Connected & Autonomous Vehicles on Maintenance

July 18, 2016

10:30 am - Noon

AASHTO

Connected and Autonomous Vehicles on Maintenance

Paul Pisano
Federal Highway Administration
paul.pisano@dot.gov; 202-366-1301

Overview

- Provide a national perspective on Connected and Autonomous Vehicles
- Discuss the opportunities between Connected and Autonomous Vehicles and the Maintenance Community

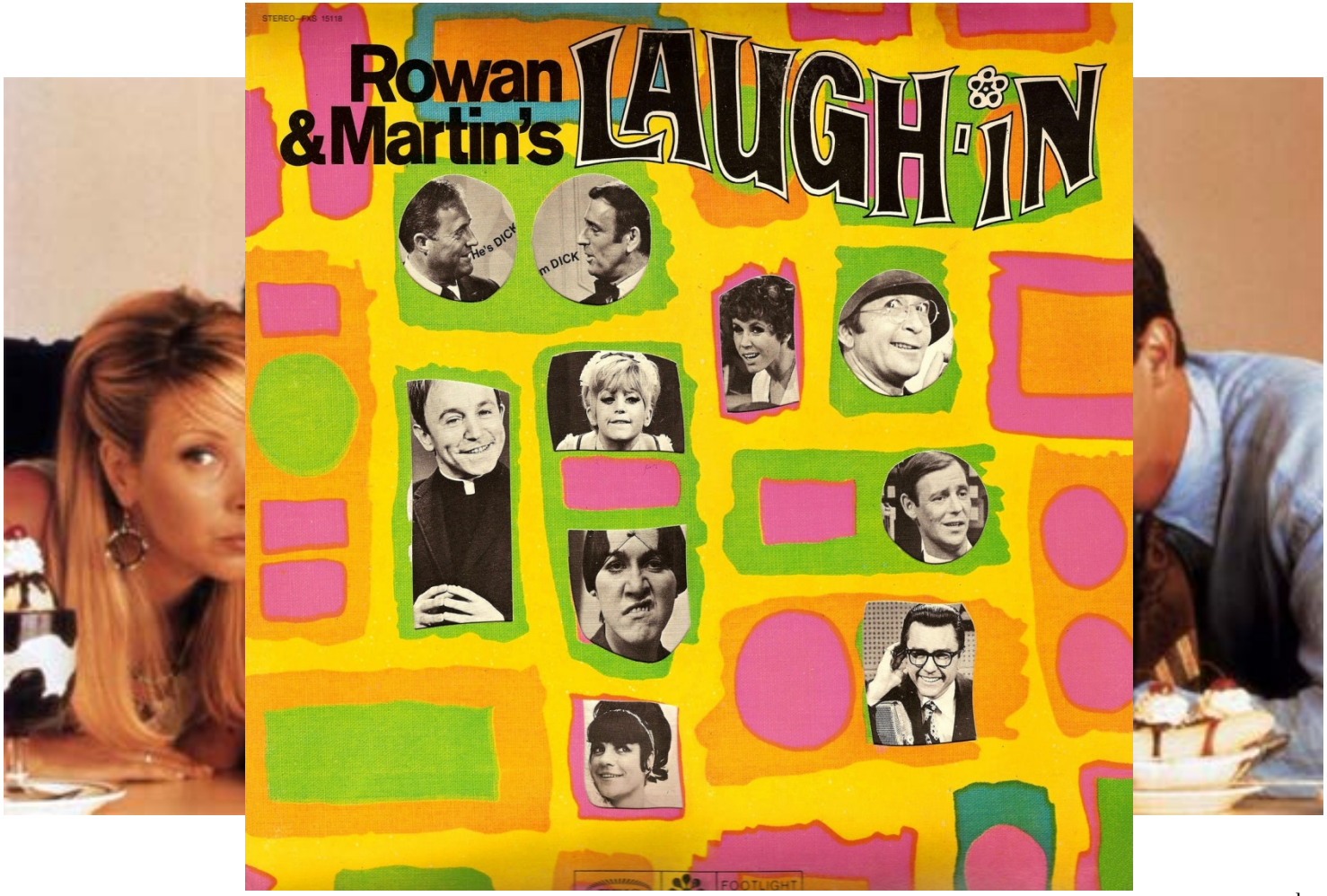
National Perspective on Connected & Autonomous Vehicles

- Conduct applied research
- Address policy items
- Issue Rulemakings
- Promote Deployment
  - 2015 FHWA Vehicle to Infrastructure Deployment Guidance and Products (Draft)
  - Vehicle-to-Infrastructure Coalition

Connected and Autonomous Vehicles and the Maintenance Community

- A little perspective
- What are the opportunities?
  - Management strategies (aka applications)
  - Data needs and sources to support the strategies
- What's been done to date? What's coming?

Flashback



www.legends1027.com
www.theodysseyonline.com

What Are the Opportunities?
Management Strategies

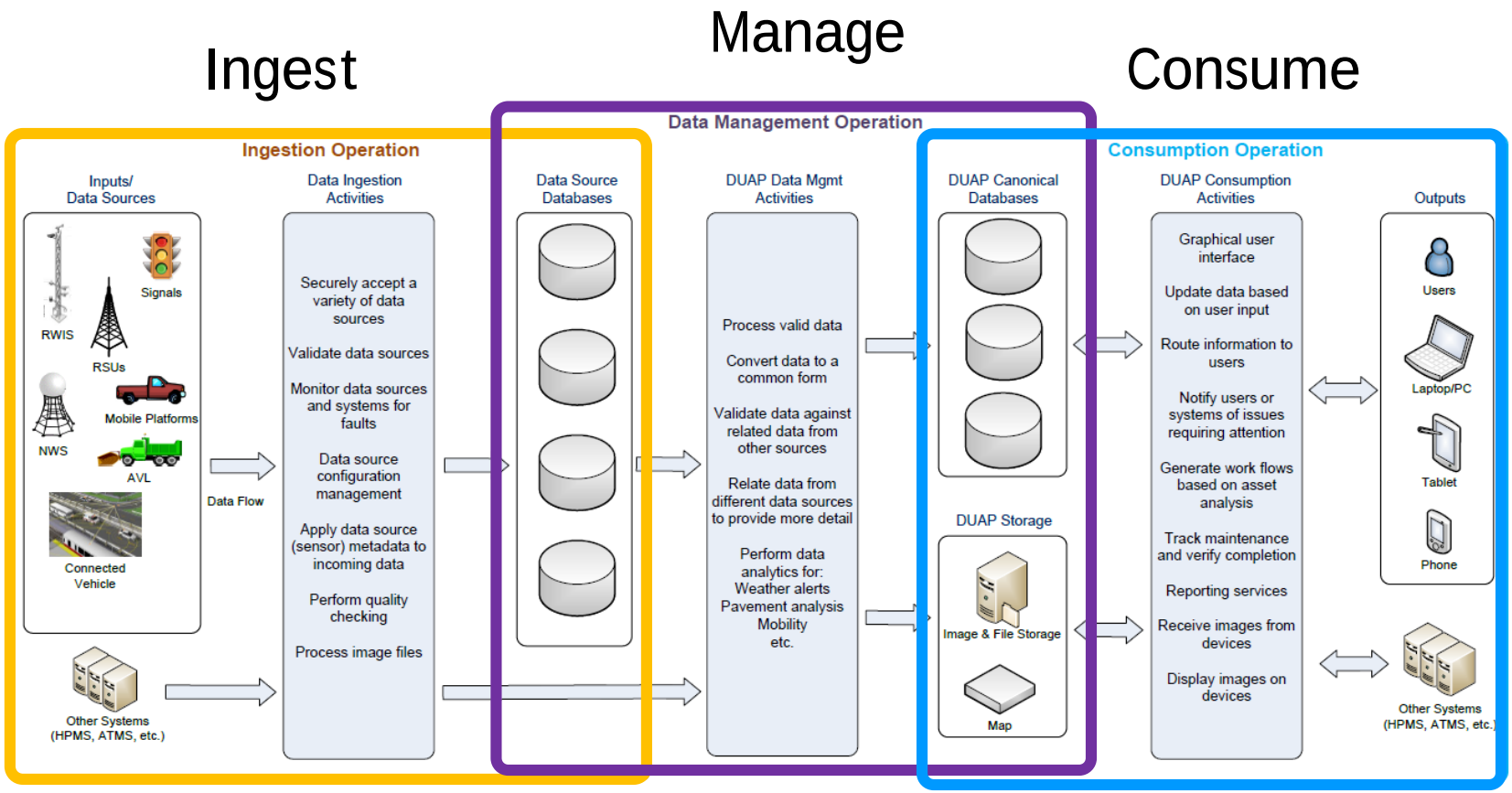
- Road Weather Management
  - Maintenance (e.g., winter maintenance)
  - Operations (e.g., motorists advisories and warnings)
  - Traffic Safety
  - Road Weather Performance Management
- Traffic Management
  - Work Zone Management
  - Congestion & Incident Management
- Pavement Management
  - Maintenance
  - Design
- Asset Management

What Are the Opportunities?
Data Needs and Sources

- Date
- Time
- Location (lat/long)
- Speed
- Altitude
- Air Temperature
- Barometric Pressure
- Humidity
- Dew Point
- Road Temperature
- Wiper Status
- Spread Rate

- Sources (current and emerging)
  - Public sector (esp. State DOT) fleets
  - Personal vehicles
  - Private sector fleets

Michigan DOT's Approach



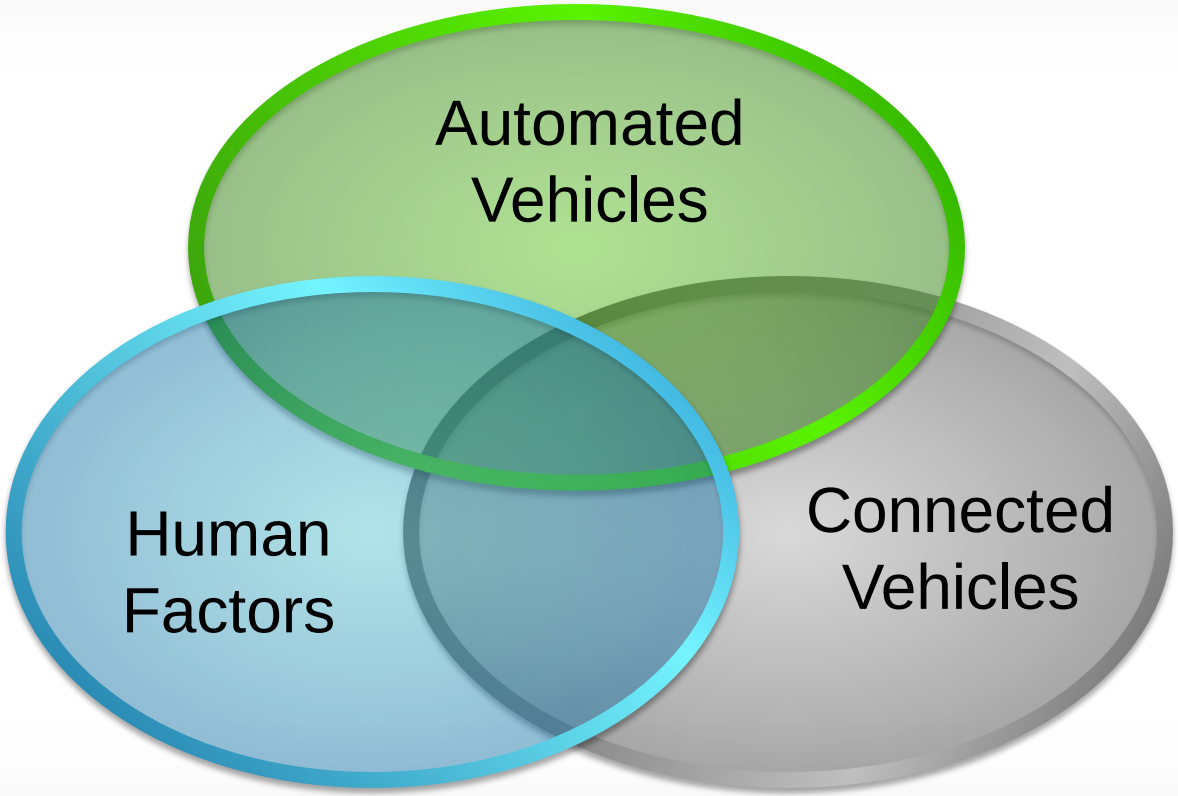
What's Been Done to Date? What's coming?

- Integrating Mobile Observations for Road Weather Management
  - Michigan, Minnesota and Nevada DOTs
  - Instrumented vehicles to collect road weather data
  - Disseminating the data via several communication paths
  - Feed the data into several applications
- Weather Data Environment (wxde.fhwa.dot.gov)
- Vehicle Data Translator (aka Pikalert) posted on the Open Source Application Development Portal (www.itsforge.net)
- **EDC-4 – WEATHER SAVVY ROADS**

Texas Connected Transportation Initiatives

John A. Barton, P.E.
Assistant Vice Chancellor

Connected Transportation Initiative



Cross-Cutting / Collaborative Research

Highway Design, Arterial Street Operation, Travel Behavior, Travel Demand Modeling, Bicycle and Pedestrian Safety, Transit Safety and Operation, Freight Planning & Operation, Pavement Performance, Vehicle-based Pricing, Economic Analysis, Roadside Safety, Vehicle Automation.

Connected Vehicles

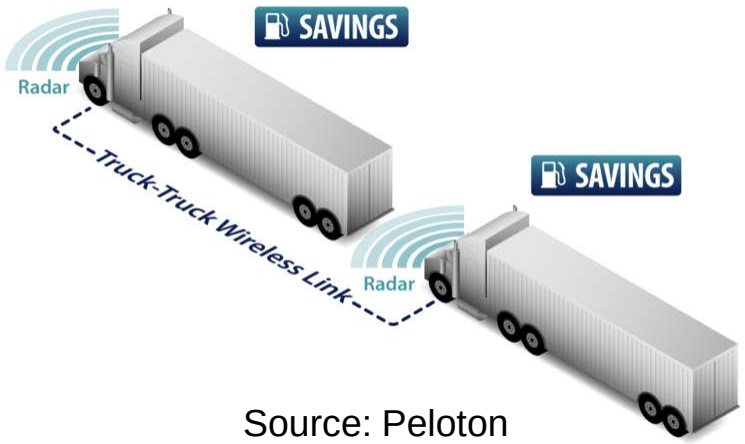
- Signal Phase and Timing (SPAT) and Related Messaging for Connected Vehicle Applications
- Integrated V2I Prototype Development
- Traffic Signal Controller Logic Enhancements
- Eco-Signal Operation

Connected Vehicles

- Speed Harmonization and Queue Warning Prototype Development and Demo
- Wrong-Way Driving Detection and Mitigation
- Sensing Highway Infrastructure
  - Safety and Operations
  - Bridge
  - Pavements

Peloton Technology

- Level 1 Automation Demonstration led by major LTL freight carrier
- Examine how infrastructure data (V2I) can enhance truck platooning operation
- Examine impacts to traffic and safety



Source: Peloton

Automated Vehicles

- Truck Automation
- Commercial Truck Platooning

AV/CV Policy Research

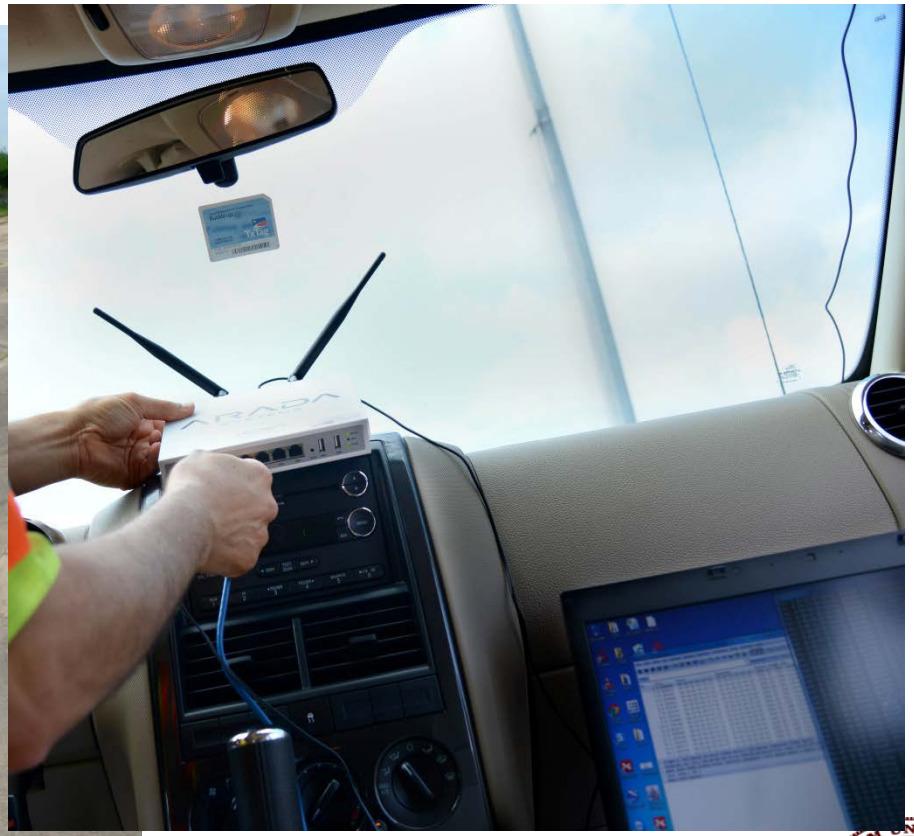
- ITS Program Legislative Research and Analysis
- Data Privacy and Liability
- Road Use Fees
- Travel Behavior Impacts
- Deploying AV/CV: Scenarios and Roadmap
- Policy Implications of Disruptive Technology and the Internet of Things
- Implications of Automated Vehicle Crashes

TAMUS RELLIS Campus

- 2,000 Acre Proving Ground

TAMUS RELLIS Campus

- Connected Vehicle Development



Test Bed to Improve Transit, Bike, and Pedestrian Safety

- Demonstrate and evaluate AV/CV technology hardware and applications in transit or paratransit vehicles to improve transit passenger, bicyclist, and pedestrian safety.

Toyota ITMS automated bus

AV/CV Test Bed Development in Texas

I-35 Field Deployments

- Bluetooth travel time detection
  - 40 segments, 2-5 miles in length
  - ~20 additional segments AUS, SAN, DAL, FTW
- 19 Wavetronix radar detector sites
- 7 CCTV cameras sites
- 21 portable changeable message signs (PCMS)
  - ~10 per direction at approximate10 mile spacing

Disseminating Travel Times

- 30 second data cycles
- 5-minute message updates
- 21 signs
- Signs procured via projects and rental
- Driven through TxDOT Lonestar® software

Connected Work Zone

- USDOT grant to expand work zone lane closure, delay, and queue information to freight logistics and trucks using CV architecture.
- Working demonstration

  in central Texas on I-35.
- PI: Bob Brydia /Christopher Poe

Future Proof

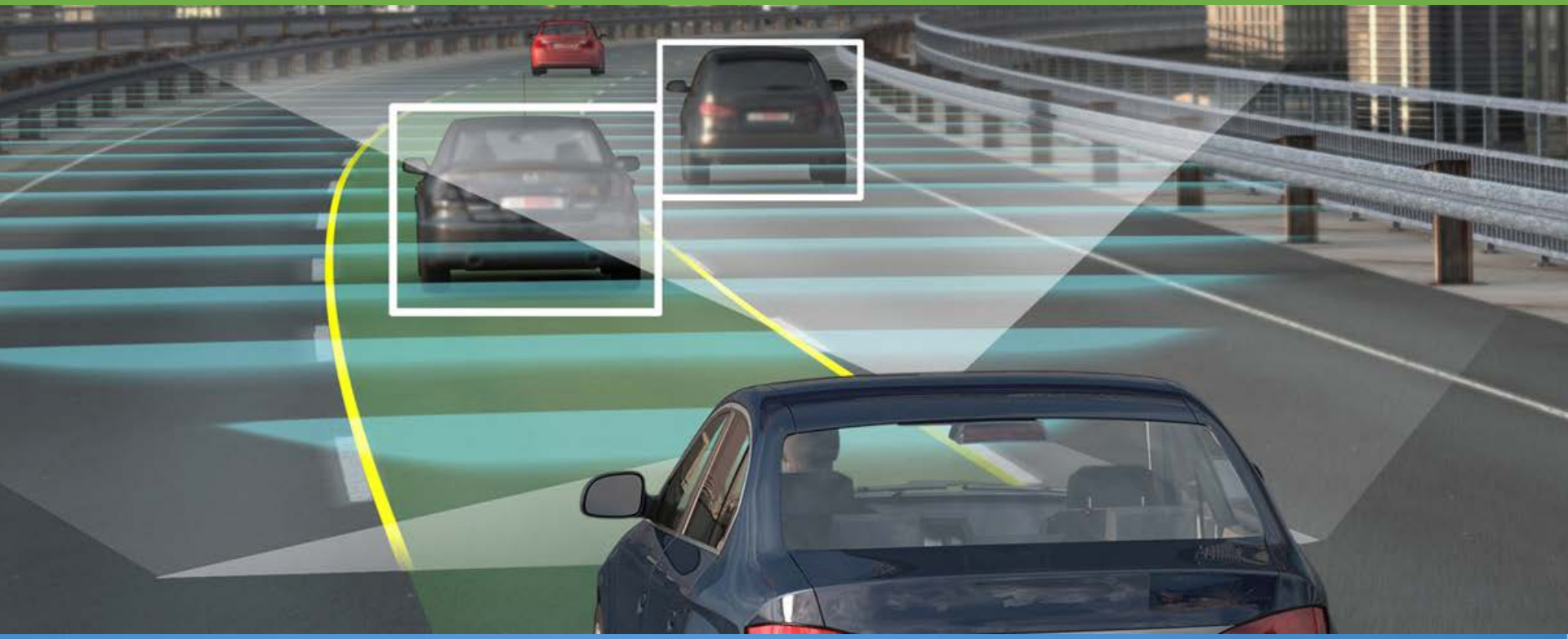
For More Information

John A. Barton, P.E.
Assistant Vice Chancellor

jbarton@tamus.edu
(979) 458-6422

Changing the Way We Travel

Mobility and Accessibility, the Autonomous/Connected Way



2016 AASHTO Subcommittee on Maintenance (SCOM)
July 18, 2016

Tracy Larkin Thomason, PE
Deputy Director, Southern Nevada
….and a "recovering" Maintenance Engineer

NEVADA DOT
SAFE AND CONNECTED

Nevada is a State of FIRSTS

- First to create AV regulations for testing and consumer deployment
- First to create an AV testing program
- First to license a company for AV testing (Google)
- First to license a commercial vehicle for testing
- One of the first 6 states identified for UAV testing

How Nevada got here…

2011

Senate Bill 511

Authorized AV ***testing & operation***.
Required DMV to create regulations

1. *Define insurance requirements*
2. *Establish minimum safety standards*
3. *Provide for vehicle testing*
4. *Restrict to specific areas*

2013

Senate Bill 313

Further defined "Autonomous technology" to not need human *active control*/monitoring

Established *$5 million* liability requirement

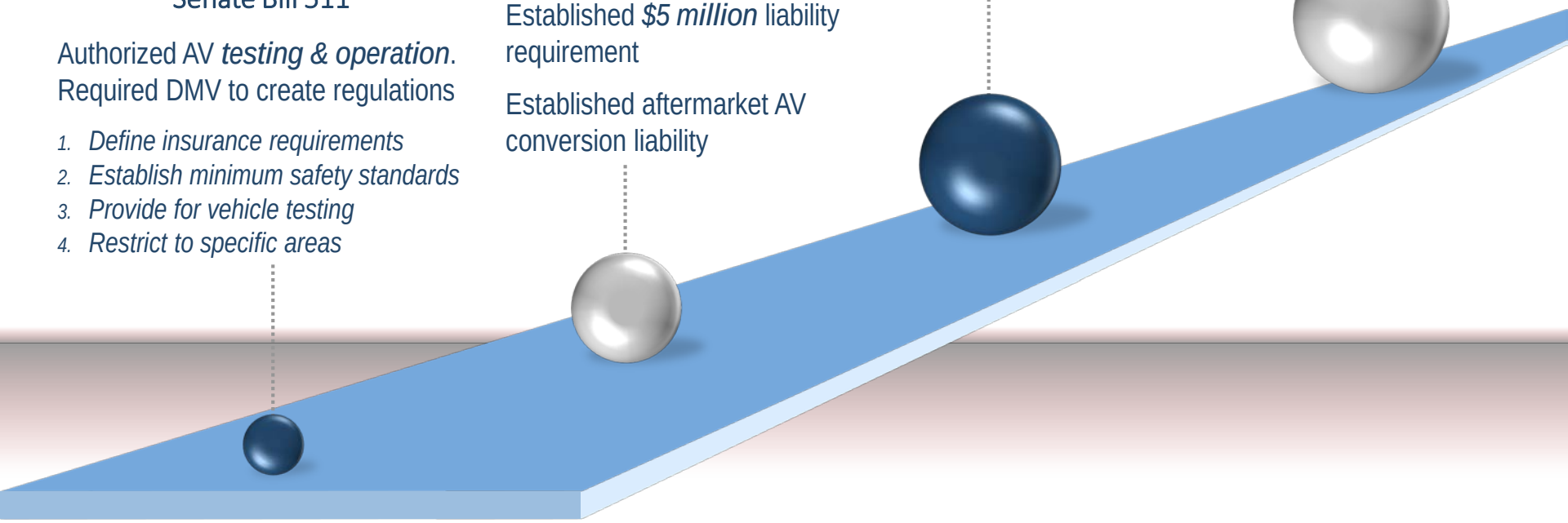
Established aftermarket AV conversion liability

2015

First AV licensed in Nevada to Daimler/Freightliner *(May 5th)*

2016

Governor established the Center for Advanced Mobility (CAM).



Establishing National Policy

AASHTO and AAMVA Workshops

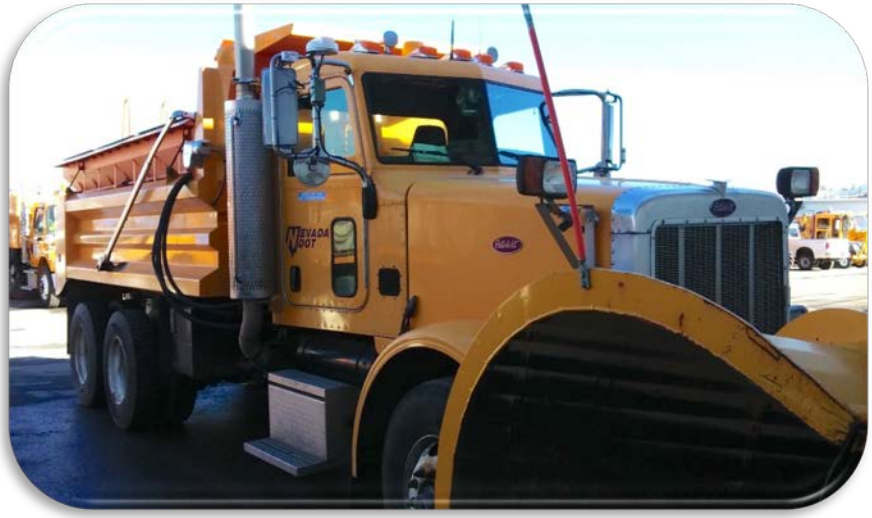
- Raise awareness of policy issues for various national, state, and local organizations and agencies.
- Gain perspectives of Insurers, Data firms, Law Enforcement & OEMs on policy and regulatory issues
- Discuss balance in policy and regulatory framework

NHTSA

- Establishing Guidelines – Part 1 of 4 will be out in July 2016

Integrated Mobile Observation Project – Connected Snowplows

- Improve safety and reduce incidents
- Outfit snowplows with GPS, LiDAR, FLIR, and DSRC/5G radios
- Lane beacons
- Integrate sensors with NDOT's RWIS
- Broadcast locations (AV HUDs, NDOT website, and travel apps)

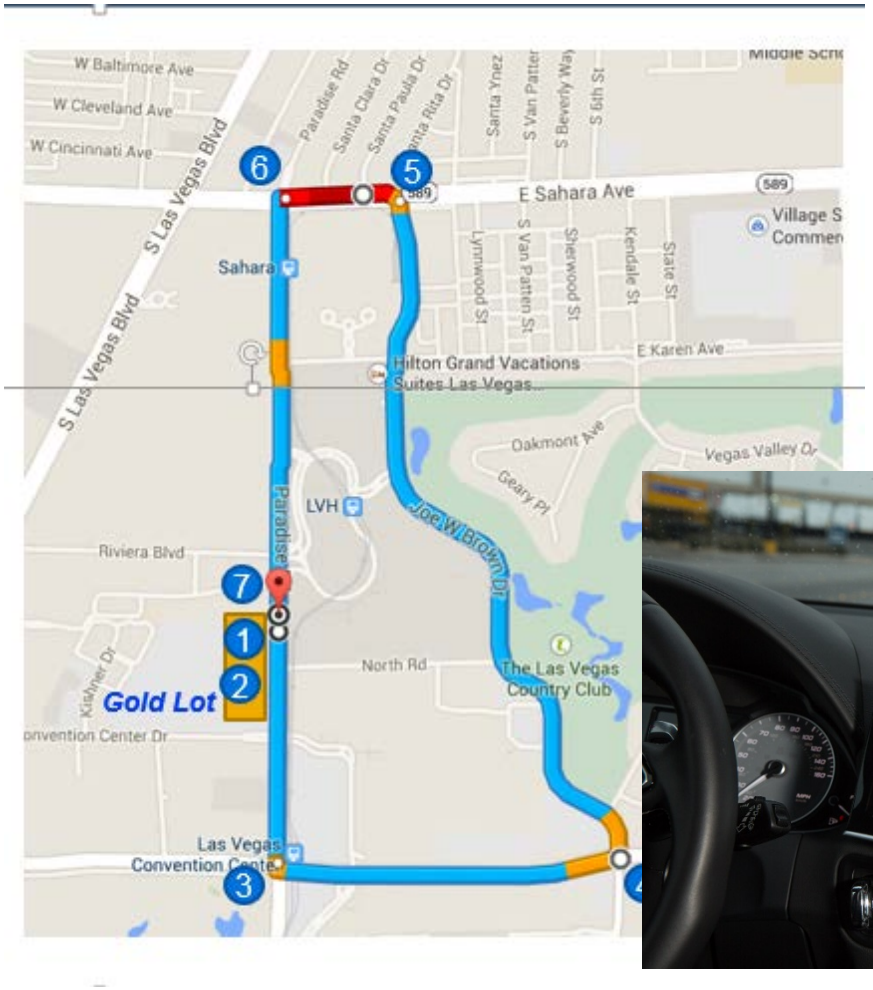


- Provide enhanced information on snowplow HUD
- Integrate with AV/CV collision avoidance

Vehicle to Infrastructure (V2I)

Daimler relied partially on pavement markings and striping for their media event

Vehicle to Infrastructure (V2I)



Integration

It’s all About the Data!!!

- DOT’s experience and understanding of the data
- Who is responsible for the data?
- Who owns the data? (Public vs. Private)
- There are varying standards for collecting and sharing data. How do you share across multiple platforms?
- Increased need for more refined data (i.e. construction zones, lane closures)

Autonomous People Movers

- Partnership with Local Motors announced June 16, 2016

- Provide “first-mile/last-mile” autonomous transit

Mobility for Disabled Residents

- Collaborate with OEMs and aftermarket AV technology companies
- Outfit passenger vehicles with aftermarket AV technologies
- Integrate with corridor ITS, DSRC/5G/WiFi, other ICT, and data centers
- Statewide multimodal testing of AVs

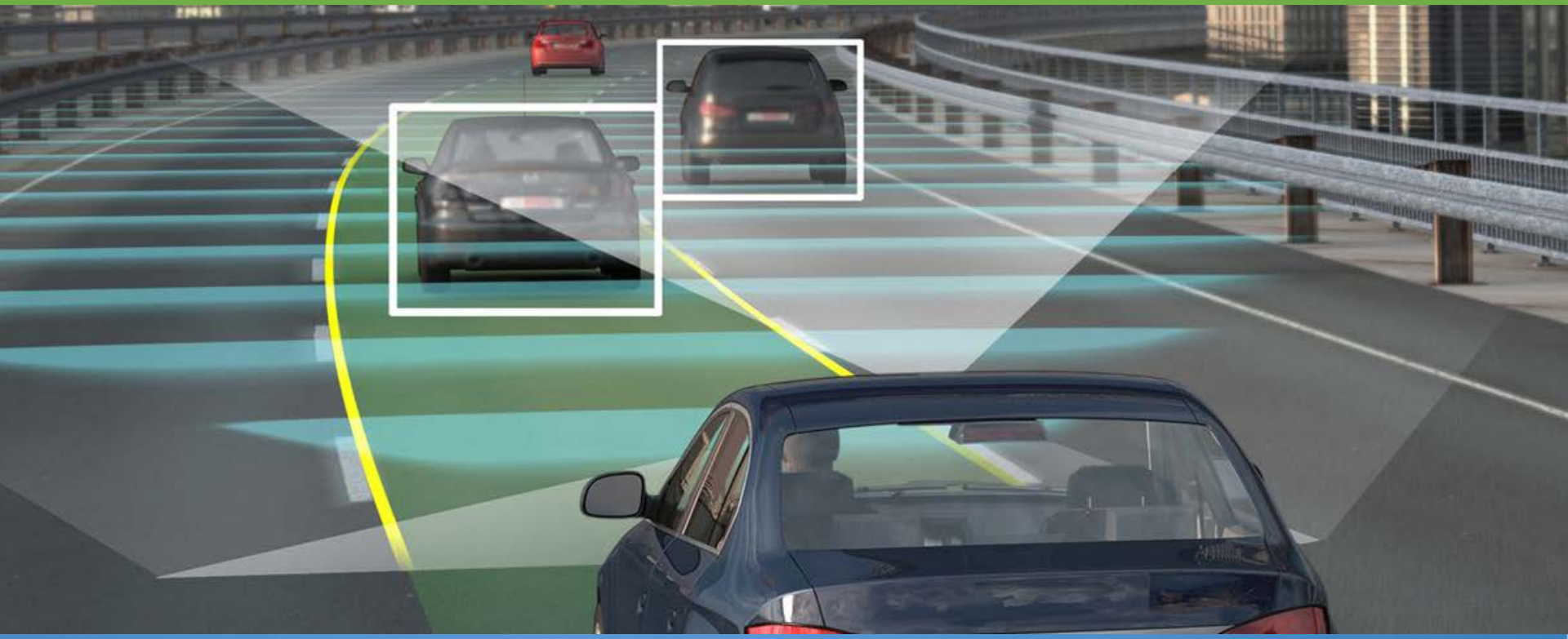
- Connected car adoption
- More autonomous cars
- Smart City integration
- V2I and V2V connections
- Reliance on real-time data

Top Policy Issues

- Need for National Standards – challenge of 50 different sets of standards
- Data governance
- Cybersecurity issues (AV and traffic management systems)
- Liability clarification
- Infrastructure clarification
- Process for approving AV for public use

Changing the Way We Travel

Mobility and Accessibility, the Autonomous/Connected Way



Tracy Larkin Thomason, PE
Deputy Director, Southern Nevada
702.730.3300
tlarkin@dot.state.nv.us

NEVADA DOT
SAFE AND CONNECTED

Royal TRUCK & EQUIPMENT, INC.

INTRODUCES

THE ATMA™ (THE AUTONOMOUS TMA)

POWERED BY

MICRO SYSTEMS, INC.

KRATOS UNMANNED SYSTEMS DIVISION

AASHTO

SUBCOMMITTEE ON MAINTENANCE

NO DRIVER NEEDED!

AS SEEN IN:

FOX NEWS .com · NBC · FOR Construction PROS.com · EQUIPMENT EJ JOURNAL · BUSINESS INSIDER · THE HUFFINGTON POST · EQUIPMENT WORLD · übergizmo · YAHOO! NEWS · MarketWatch THE WALL STREET JOURNAL

Nasdaq · CBS NEWS · ATSSA SAFER ROADS SAVE LIVES · ROADS&BRIDGES · msn · POPULAR SCIENCE · U.S.News & WORLD REPORT · Discovery CHANNEL · abc NEWS

INTRODUCING THE NEXT GENERATION OF SAFETY

A SELF-DRIVING (AUTONOMOUS) TMA

THE ATMA

- GPS WAYPOINT NAVIGATION
- REMOTE CONTROL DRIVING
- LEADER/FOLLOWER

NO DRIVER NEEDED!

HOW DOES IT WORK? THE VEHICLE KIT

1. THE VEHICLE CONTROL MODULE

- ✓ CONVERTS MANNED VEHICLE INTO UNMANNED SYSTEM

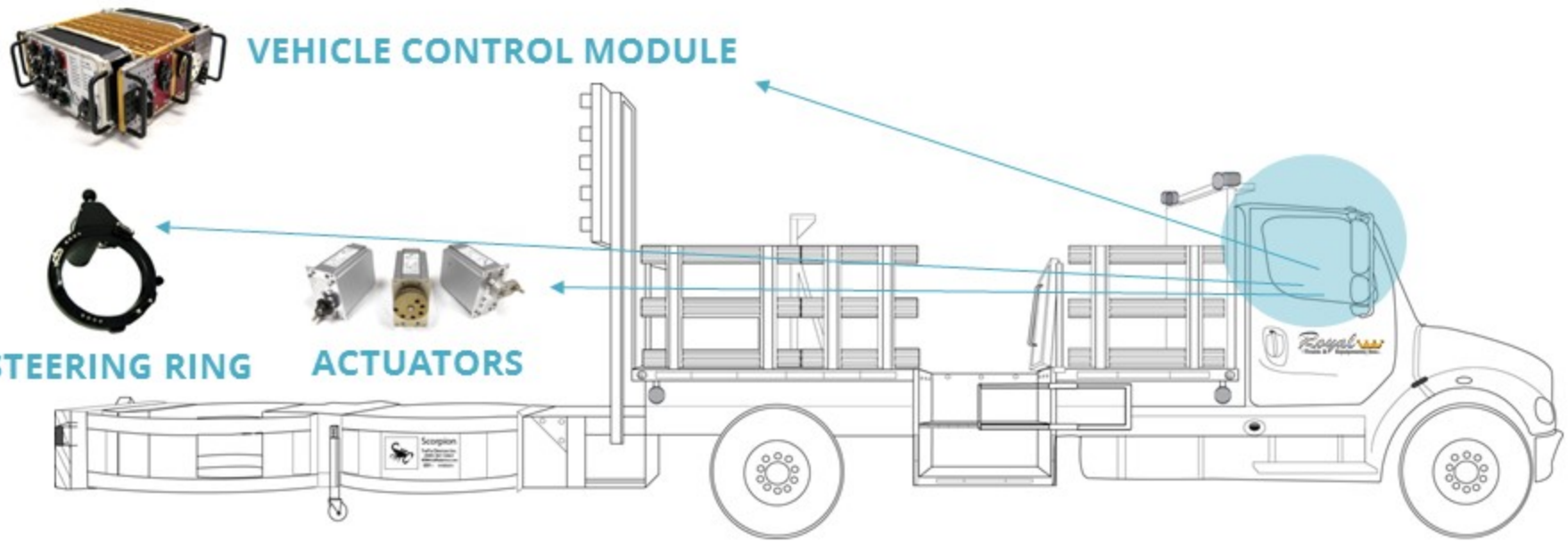
2. THE STEERING RING

- ✓ SHORT INSTALLATION TIMES

3. THE ACTUATORS

- ✓ MODULAR DESIGN

MARKET INTRODUCTION



- ✓ DEMONSTRATED A WORKING PROTOTYPE TO FLORIDA DOT OFFICIALS
- ✓ JUNE 2015 - MADE A PRESENTATION ABOUT THIS REVOLUTIONARY PRODUCT TO FEDERAL DOT OFFICIALS AT THE AASHTO INTERMODAL CONFERENCE IN CHEYENNE, WYOMING
- ✓ APRIL 2016 – DEMONSTRATED FIRST ATMA DEMO TO INTERNATIONAL COMPANY OUT OF EUROPE

WHY IS AUTONOMOUS OUR INDUSTRY'S FUTURE?

- TMA PURCHASE & RENTAL DEMAND IS **RAPIDLY GROWING** IN THE US
- THE NATIONAL MOTOR VEHICLE **FATALITY COUNT** IS NOT ZERO, IT'S OVER 30,000/YR
- THE CONVERSATION IS GROWING – **WHY PUT A SITTING DUCK IN A CRASH TRUCK?**
- AUTOMATED VEHICLE TECHNOLOGIES HOLD **UNPRECEDENTED OPPORTUNITIES** IN HELPING IMPROVE WORK ZONE SAFETY

* 2015 map of TMA purchases/rentals

THE INTEREST IS REAL

OFFICIALS HAVE INDICATED **STRONG INTEREST** IN USING THE AUTONOMOUS TMA TRUCK AS AN "INTERMEDIATE" APPLICATION FOR TESTING AUTONOMOUS TECHNOLOGY ON OUR NATIONAL HIGHWAY SYSTEM.

WHAT WE BELIEVE

*DRIVERLESS STEERING WHEEL CONFIGURATION

"WE BELIEVE THE ANSWER IS REMOVING WORKERS FROM THE LINE OF FIRE WHERE EVER AND WHENEVER POSSIBLE. THE AUTONOMOUS TMA TRUCK ACHIEVES THAT LIKE NO OTHER TECHNOLOGY IN THE FIELD TODAY."

ROBERT ROY, PRESIDENT, ROYAL TRUCK & EQUIPMENT

THE WORLD'S 1ST DRIVERLESS WORK ZONE TRUCK

FUTURE DEVELOPMENT

1. COLLISION AVOIDANCE SENSORS

2. AUTOMATIC BREAKING SYSTEM WHEN IMPACTED

THE TECHNOLOGY PACKAGE

CAMERA/DVR SYSTEM

BACKUP CAMERA

- DID YOU KNOW? **48%** OF ACCIDENTS FROM BACKING UP

INTERCOM SYSTEM

- WE PROVIDE THE NECESSARY TRAINING VIDEOS!

"BLACK BOX" RECORDING SYSTEM

- LIABILITY PROTECTION

MOBILE RADAR / MESSAGE & ALERT CENTER

- PROVIDES REAL-TIME INFORMATION
- CUSTOMIZABLE MESSAGES

THE BRUTAL FACTS

NO DRIVER NEEDED!

ROYAL HAS MADE A PUSH FOR THESE INNOVATIONS AS A RESULT OF A NUMBER OF BRUTAL NATIONAL STATISTICS

32,675 - # OF MOTOR VEHICLE FATALITIES FROM 2015 *FARS ANNUAL REPORT FILE

87,696 - # OF CRASHES IN WORK ZONES IN 2012 *US DOT FHA FACTS & STATISTICS

41% - OF CRASHES WERE REAR-END COLLISIONS IN WORK ZONES * "IDENTIFICATION OF WORK ZONE CRASH CHARACTERISTICS"

90% - OF TRAFFIC CRASHES IN FLORIDA ARE DUE TO HUMAN ERROR *2015 FL DEPT. OF TRANSPORTATION

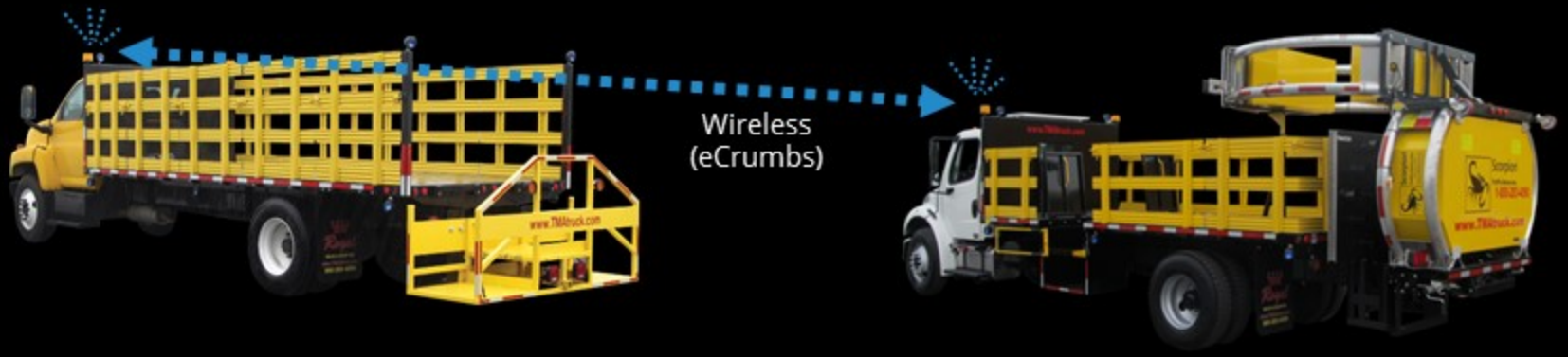
AASHTO
SUBCOMMITTEE ON MAINTENANCE

Royal TRUCK & EQUIPMENT, INC.

THANK YOU!

QUESTIONS?

ANDREW ROBERTS | STRATEGIC ACCOUNTS MANAGER, ROYAL TRUCK & EQUIPMENT, INC.
andrew@royaltruckequip.com
6910 N. Route 309 | Coopersburg, PA 18036
Main: 855-202-7129 | **www.royaltruckandequipment.com/atma**



V2I Deployment Coalition
V2I DC

Overview and Early Findings

Dean Deeter

Athey Creek Consultants

AASHTO ITS AMERICA ite

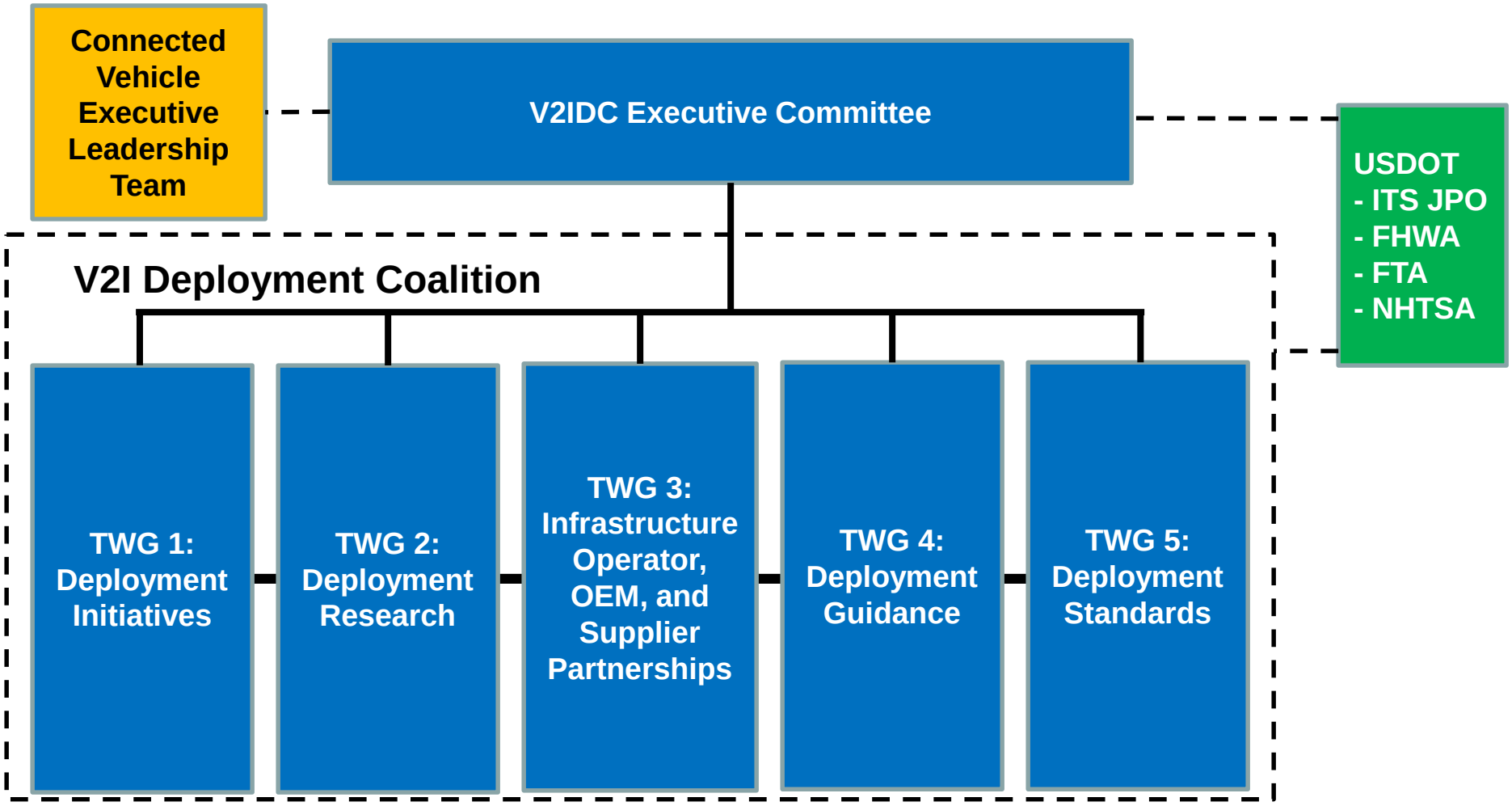
Topics

- Introduce the V2I Deployment Coalition
- Describe the Initial 18 Month Focus
- Share Early Findings
- Invite Your Participation

What is the V2I Deployment Coalition?

- V2I DC Concept
  - A single point of reference for stakeholders to meet and discuss V2I deployment related issues
- V2I DC Approach
  - USDOT asked AASHTO, ITS America and ITE to collaborate on organizing and managing the coalition

V2I Deployment Coalition Structure



TWG Chairs & Co-Chairs

TWG	Chair	Co-Chair
TWG 1: Initiatives	Bill Legg, WSDOT	Joe Averkamp, Xerox
TWG 2: Research	Greg Larson, Caltrans	Rob Bertini, Cal Poly
TWG 3: Partners	Matt Smith, MDOT	Roger Berg, Denso
TWG 4: Guidance	Faisal Saleem, MCDOT	Navin Katta, Savari
TWG 5: Standards	Ed Seymour, Texas A&M	Gary Duncan, Econolite

16 Deployment Issues Identified

Issue	TWG 1 Initiatives	TWG 2 Research	TWG 3 Partners	TWG 4 Guidance	TWG 5 Standards
Issue 1: V2X Applications	P	S	S	S	S
Issue 2: Complementary Communications to DSRC	N	P	N	N	N
Issue 3: V2I Data	N	S	P	N	S
Issue 4: Patents-Intellectual Property	N	P	N	N	N
Issue 5: Security	No action planned at this time				
Issue 6: V2I Outreach	N	S	N	P	S
Issue 7: Understanding the Benefits and Costs of V2I Deployment and Operation	S	S	P	S	N
Issue 8: V2I Standards	N	N	N	N	P
Issue 9: Understanding V2I Liability Assignment	N	P	N	S	N
Issue 10: V2I Synergies with Other Emerging Technologies	No action planned at this time				
Issue 11: V2I Consumer Messaging	N	N	N	P	N
Issue 12: V2I Multimodal Applications	No action planned at this time				
Issue 13: Infrastructure Processes as V2I Obstacles	P	N	N	S	N
Issue 14: Federal V2I Policy Statement	P	N	N	S	N
Issue 15: Maintaining V2I Infrastructure	P	N	N	N	N
Issue 16: Operator and OEM Goals for V2I	N	N	P	N	N

V2I DC Overview

Initial Goals of the V2I DC:

To help accelerate V2I deployments related to:

1. **Intersections (signalized & non-signalized)**
2. **End of queue warnings**
3. **Work zone management**
4. **Curve warning systems**

V2I DC Efforts

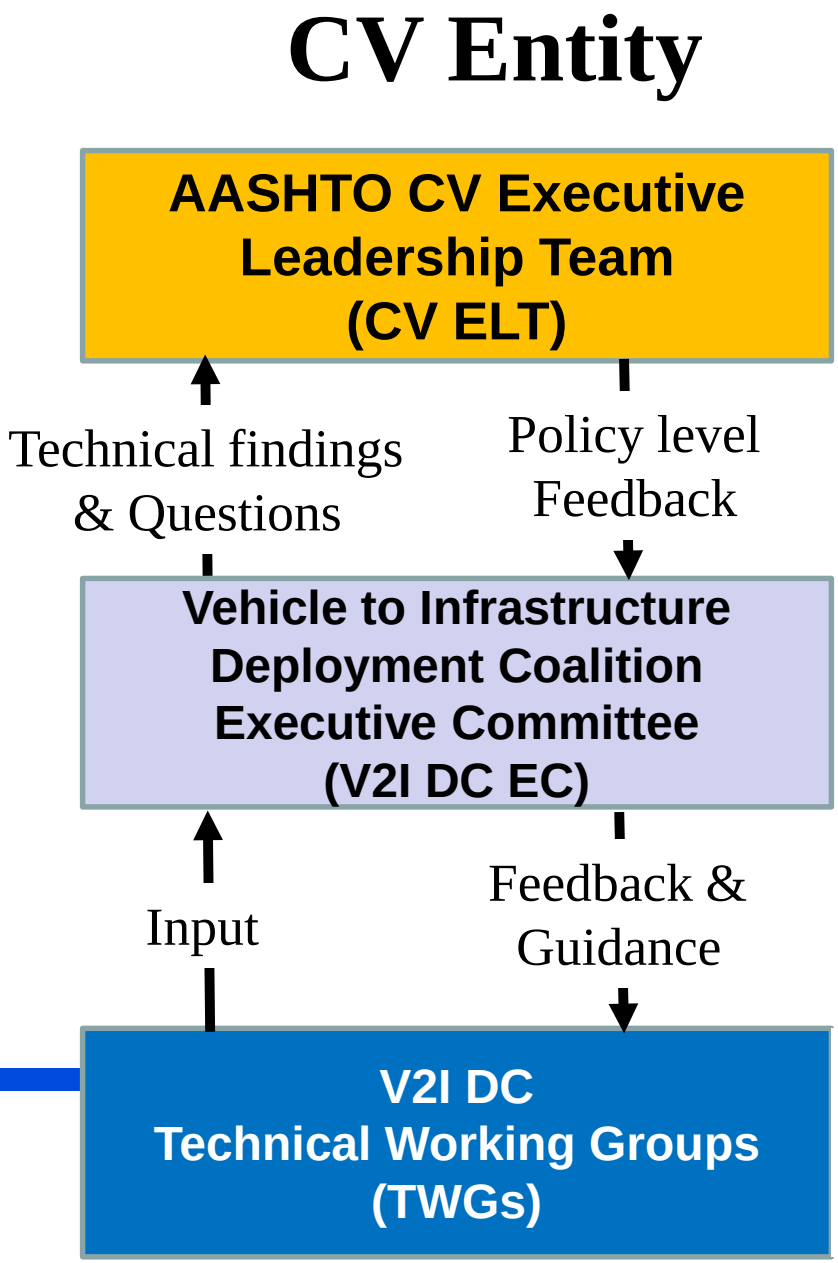
TWGs approach to the 4 Focus Areas:

- Addressing the key issues impacting V2I deployment
- Each TWG has a Work Plan of activities
- 'Fishbone Diagrams' helped coordinate activities of TWGs
- Monthly TWG webinars
- Coalition wide meetings/calls

Four Focus Areas

1. Intersections
2. Queue Warnings
3. Work Zone Management
4. Curve Warnings

CV Institutional Framework



Early Findings / Results

- V2I Standards Context Drawing
- V2I Deployment Guidance Feedback / Input
- Definition of Research Activities for 4 Issues
- Increased Interaction with Automobile Manufacturers re: Data Exchanges – Planned Upcoming Meetings
- Survey of Planned & Most Beneficial V2I Deployments

To Become Involved

Gummada Murthy, AASHTO gmurthy@aashto.org

Siva Narla , ITE - Snarla@ite.org

Adrian Guan, ITS America – aguan@itsa.org

Dean Deeter, Athey Creek – deeter@acconsultants.org