U.S. DOT Automated Vehicle Research Activities

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Kevin Dopart, ITS Joint Program Office
July 12, 2018
Automated Vehicles Symposium
U.S. DOT and Automation
Facilitating a new era of transportation innovation and safety
Preparing for the Future of Transportation
• **Automated Driving Systems (ADS) 2.0: A Vision for Safety (September 2017)**
  – Clarifies Voluntary Safety Self-Assessment process
  – Emphasis on motor vehicle safety

• **2018 Update**
  – Multimodal, surface transportation
  – Broadens considerations to reflect multimodal responsibilities (e.g. operations)

More information on ADS 2.0 is available on the NHTSA website: https://www.nhtsa.gov/technology-innovation/automated-vehicles
Stakeholder Engagement
Informing action through dialogue
2018 Requests for Comment and Information Related to Automation

• FHWA, FTA, FMCSA, NHTSA, FRA, PHMSA each released RFIs/RFCs in early 2018

• Nearly 4,000 comments submitted

• Topics included:
  – Technology availability
  – Mode-specific barriers to integration of automation
  – Mode-specific considerations
• **Uniformity and Quality**
  – Greater uniformity and quality in road markings and traffic control devices would enable automation.

• **Leadership**
  – FHWA should take a leadership role in convening stakeholders to encourage collaboration.

• **Data**
  – Certain data elements around the roadway environment are useful for industry, State, and local DOTs to share and could improve automation operations.

• **Pilots**
  – Conducting pilots and supporting pilot testing are important for facilitating learning, collaboration, and information sharing.

• **Uncertainty**
  – Uncertainty in infrastructure investment and allocation of limited resources are key concerns for State and local agencies.
RFI/RFC Key Themes – FTA

• **ADA and Accessibility**
  – Non-driving functions must be addressed
  – Automation could improve access for seniors and persons with disabilities
  – Incorporate universal design into research and development

• **Workforce and Labor**
  – Consideration for job loss and retraining
  – Could increase labor costs due to need for specialized skills

• **Funding and Procurement**
  – Buy America concerns
  – Useful life and spare ratio requirements questions
• **Consistency**
  – Consistent, performance-based standards and regulation are needed across states

• **Research**
  – Further research is needed on distracted driving, medical qualifications, and hours of service requirements

• **Cybersecurity**
  – A few organizations mentioned cybersecurity issues
• **Research**
  – Further research is needed to establish a baseline for safety before permitting AV transport of hazardous materials.

• **Education and Training**
  – Continued education and training are vital as automation technology evolves.

• **Regulatory Review**
  – PHMSA should maintain its current regulations, while it conducts a review to identify those that may require updating to address risks and opportunities presented by a future AV environment.
Public Listening Summit on Automated Vehicle Policy

• Stakeholder Discussion
  – 117 participants

• Public Listening Session
  – 1,111 participants (in-person and livestream)

• Themes
  – Public safety and first responders
  – Disability and accessibility
  – Consumer and public education
  – Insurance and liability
  – Employment issues
  – Cybersecurity
The Federal Highway Administration is initiating a national conversation with partners and stakeholders to better understand the implications of highway automation to facilitate innovation and inform the Agency’s role in this area.

FHWA will use inputs from the National Dialogue to...

- **ASSESS** National issues and priorities
- **DEVELOP** technical guidance, best practices and standards
- **SUPPORT** necessary research
- **ADAPT** programs and policies
- **CREATE** a National community or coalition

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<td>June 7</td>
<td>National Dialogue Launch Workshop</td>
<td>Detroit, MI</td>
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<td>June 26-27</td>
<td>National Workshop 1 Planning and Policy Considerations for Highway Automation</td>
<td>Philadelphia, PA</td>
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<td>July 12</td>
<td>Automated Vehicle Symposium FMCSA-FHWATruck Automation Listening Session</td>
<td>San Francisco, CA</td>
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<td>August 1-2</td>
<td>National Workshop 2 Digital Infrastructure and Data Considerations for Highway Automation</td>
<td>Seattle, WA</td>
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<td>Early September</td>
<td>National Workshop 3 Freight Considerations for Highway Automation</td>
<td>Chicago, IL</td>
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<td>October 24-25</td>
<td>National Workshop 4 Operations Considerations for Highway Automation</td>
<td>Phoenix, AZ</td>
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<td>Week of Nov. 12</td>
<td>National Workshop 5 Infrastructure Design and Safety Considerations for Highway Automation</td>
<td>Austin, TX</td>
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Additional Information: [https://ops.fhwa.dot.gov/automationdialogue/](https://ops.fhwa.dot.gov/automationdialogue/)
FMCSA Listening Sessions/Open Meetings on Vehicle Automation

• Public Listening Session on Automation Technologies: Held June 19 at University of Michigan
  – Participants included representatives from industry, law enforcement, commercial motor vehicle operators, academia, and technology providers

• FMCSA-FHWA Truck Automation Listening Session: Thursday, July 12 at 1:30, Grand Ballroom, Hilton Union Square

• Motor Carrier Safety Advisory Committee (MCSAC) Meeting: July 30-31 at USDOT Headquarters

• FMCSA Truck Automation Listening Session, August 24, 2018 at the Great American Trucking Show, Dallas, Texas
NHTSA Public Meetings and Listening Sessions

• Public Meeting On Removing Regulatory Barriers For Vehicles With Automated Driving Systems March 2018

• Public Listening Session on Automated Driving Systems 2.0: A Vision for Safety November 2017

• Public Meeting on Automated Driving Systems: Voluntary Safety Self-Assessments October 2017
Research Approach and Highlights

Exploring how to ensure safe, accessible, and efficient integration of automation
Consolidated Appropriations Act, 2018

• Signed into law on March 23, 2018
• Funds highly automated vehicle research and development
• Reallocates a total of $100 million for automation activities, including:
  – Up to $38 million for direct research
  – Up to $60 million for demonstration grants
  – Up to $1.5 million for analysis of impacts on drivers and operators of commercial motor vehicles, in consultation with Department of Labor
• Additional funding for NHTSA and OST
Enabling the Complete Trip

1. Plan and Book a Trip
   Andy uses a pre-trip concierge application.

2. Travel to Transit Station
   An automated shuttle (rideshare service) is dispatched.

3. Ride the Bus/Take a TNC
   While on the bus, Andy receives direction on when to pull the Stop Request cord from his wayfinding and navigation application.

4. Cross the Street
   As Andy approaches an intersection, his safe intersection crossing application communicates with the traffic signal.

5. Arrival at Destination
   Andy safely arrives at his destination, while the pre-trip concierge application plans his return trip home.

Current ATTRI Applications in Development

Wayfinding and Navigation:

Pre-Trip Concierge and Virtualization:

Safe Intersection Crossing:

Robotics and Automation:

http://www.its.dot.gov/research_areas/attri/index.htm
Voluntary data exchanges to accelerate the safe integration of AVs

WORK ZONE DATA EXCHANGE

• **Purpose**
  – Voluntary adoption of a basic work zone data spec

• **Near-Term Outcomes**
  – Active work zone data feed
  – Feed is used in a meaningful way

• **Big Picture Outcome**
  – Repeatable approach to harmonize local data

[transportation.gov/av/data]
Automated Low-Speed Shuttles

- **Monitor** development and deployment activity
- **Convene** working group of early deployer communities and other organizations interested in small, automated shuttles.
- **Document Emerging Findings** – including best practices, barriers, and lessons learned from early deployers and technology suppliers.
Impact Assessment

• Framework for AV Impacts
  – Mobility/energy/emissions modeling on a freeway
  – Safety baseline development
  – System dynamics of broader impacts
  – International collaboration on Key Performance Indicators

• Economic and Workforce Impacts from Automation
  – New project to analyze potential impacts from vehicle automation
    the macro economy including: GDP growth, employment/jobs, wages, consumption, exports, etc.
Cooperative Automated Vehicle Testing with VDOT and Transurban

Objective: Investigate the combination of speed harmonization, vehicle platooning, and cooperative merging at an entrance ramp for a single-lane, managed facility with access limited to cooperative automated vehicles.

Findings: Completed 21 runs with 5 FHWA test vehicles that confirm earlier simulation results that throughput can realistically be increased by more than 50 percent with greater stability and reliability.
**Purpose:** To equip agencies with information and tools to consider the uncertainties of CV/AV deployment

- Created scenarios of potential CV/AV deployment
- Conducted workshops to refine test scenarios
- Assessed overarching scenario impacts and implications

**Outputs:** Practitioner guidance/guidebook, qualitative assessment of impacts and policy implications arising from future described in scenarios

**Drivers**
- Environment...
- Economy...
- Society...
- Technology...

**Levers**
- Infrastructure conditions...
- Travel choices...

**Outcomes**
- Congestion...
- Reliability...
- Safety...
- Quality of life...

**Scenario Building Blocks**
• **Overview:** Create baseline safety performance measures to evaluate automated commercial motor vehicle (CMV) safety systems through analysis of data from CMV naturalistic driving and driver/fleet management systems (100m hours, 33,000 collision events).

• **Goal:** Establish a baseline against which the safety performance of automated CMV functions can be evaluated.
FMCSA: Sensor Guidelines for Automated CMV Applications

• **Overview:**
  – Document input from vehicle automation companies and sensor manufacturers regarding best practices for adequate safe performance of relevant sensors (upkeep, optimum conditions).
  – Review and report on current sensor technologies that support automation and current calibration processes.

• **Goal:**
  – To conduct performance and maintenance research for add-on sensors that support various levels of automation on CMVs.
The Federal Railroad Administration is researching the interaction between Automated Vehicles (AV) and rail crossings.

The objective of this project is to explore what information AVs will need to negotiate Highway-Rail Intersections (HRI).

Deliverables
- Literature Review
- Stakeholder Engagement
- System Requirements
FTA: Strategic Transit Automation Research Plan

7 demonstrations planned through 2022

Research in progress:

• Transit Bus Applications of Light and Commercial Vehicle Automation Technology
• Automation Policy Review
• Test Facility Requirements for Automated Transit Buses
• User Acceptance and Human Factors for Automated Transit Buses

https://www.transit.dot.gov/automation-research
MARAD/FMCSA: Feasibility Study: Low-Speed Automated Truck Queue at Ports and Warehouses

- Exploring application of automation to low-speed commercial vehicle operations at port terminals and warehouses
- Review of related studies and papers
- Surveys of industry and technology stakeholders (currently underway)
- Technology scan of existing or near-term enabling technologies
- Regulatory changes, cost estimation and safety benefits
- Report expected in Fall 2018
NHTSA: Driving Automation Communication of Intent with Shared Road Users

• **Project Summary**: Drivers communicate with other road users using gestures, eye contact and other complex means. A similar need will likely emerge to communicate Automated Driving Systems’ intentions to shared road users.
  – Describe social interaction strategies used by drivers when communicating to other road users
  – Conduct initial studies to test potential strategies for driving automation systems

• **Project Start**: 2017

• **End Products**: Report on types of communication needs and potential strategies for effectively communicating automated systems’ intention to other road users

• **Status**: Data collection in process and will be completed in 2018
NHTSA: FMVSS Considerations for Vehicles with Automated Driving Systems

- **Goal**: Research and identify potential barriers for self-certification and compliance verification of innovative new vehicle designs precipitated by Automated Driving Systems (ADSs)
- Developed four conceptual vehicle designs using generic features and characteristics expected in ADS-equipped vehicles with no human-operated controls
- Significant progress in translation of regulatory text has been made
- **Next step** is testing FMVSS test procedures for vehicles without traditional human-operated controls to assess objectivity and repeatability
- **Contractor**: VTTI
Overview:
The Pipeline and Hazardous Materials Safety Administration is researching the potential for applying automation for hazardous materials transportation.

Objective:
To identify, characterize, and quantify risks associated with pairing automation technologies and hazardous materials transport.
transportation.gov/av