



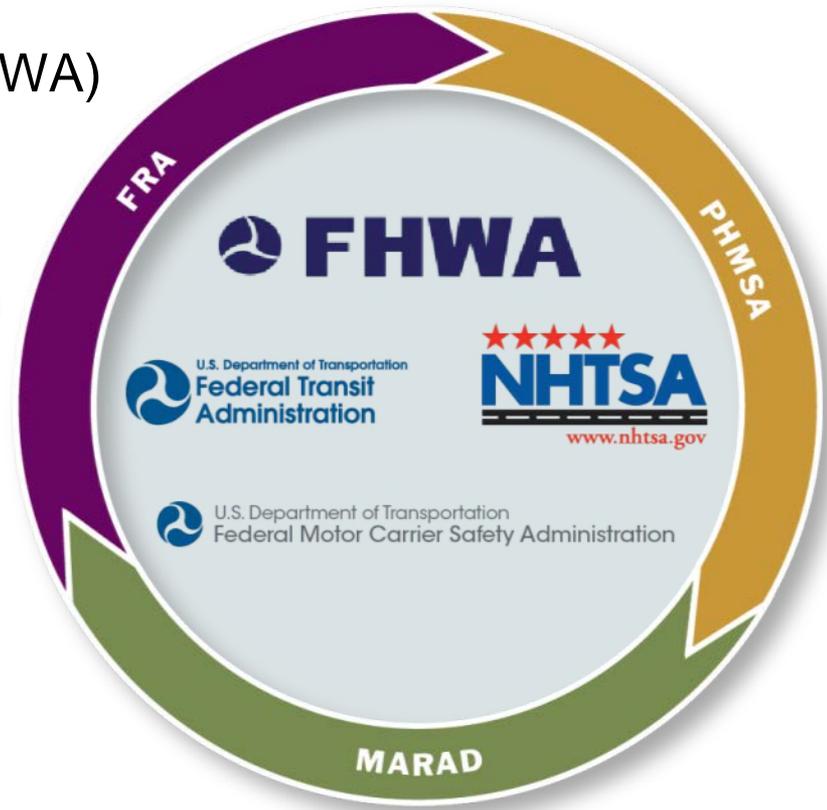
U.S. DOT Automation Program

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August 27, 2015

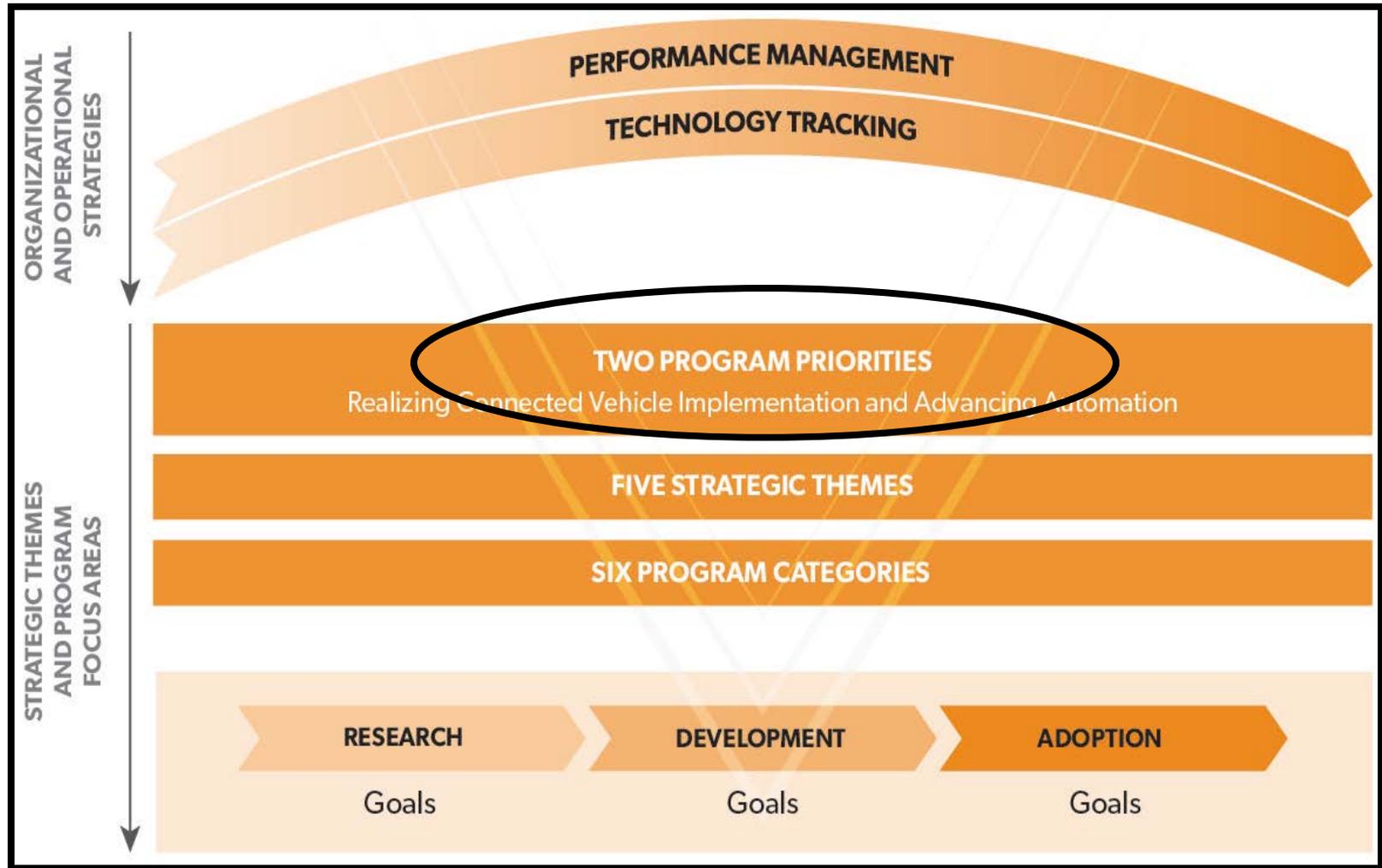
Context: ITS Joint Program Office

The ITS JPO has Department-wide authority in coordinating the ITS program and initiatives among the following DOT Offices:

- Federal Highway Administration (FHWA)
- Federal Motor Carrier Safety Administration (FMCSA)
- Federal Transit Administration (FTA)
- Federal Railroad Administration (FRA)
- National Highway Traffic Safety Administration (NHTSA)
- Maritime Administration (MARAD).



Context: ITS Strategic Plan Framework



What is an Automated Vehicle?

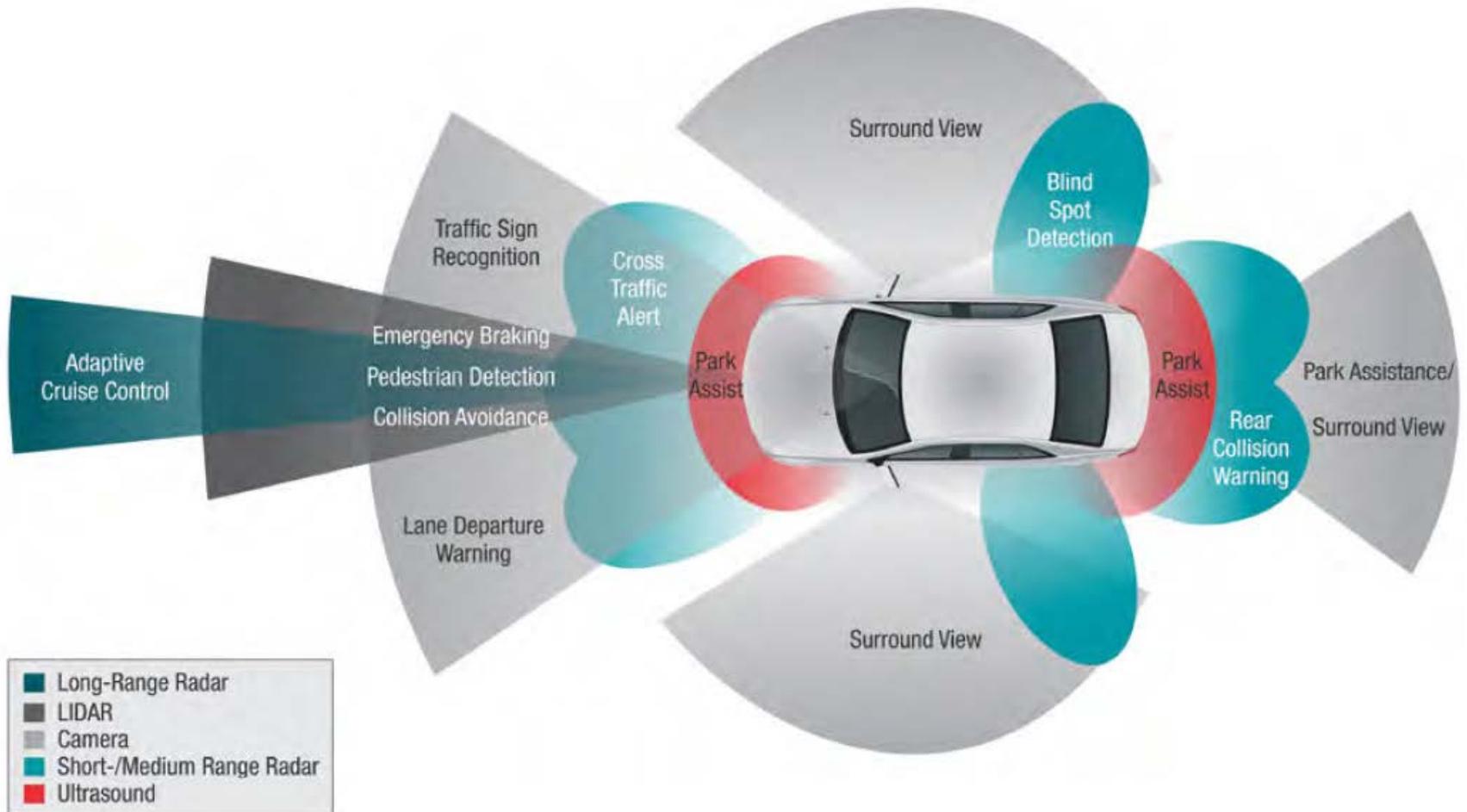


What is an Automated Vehicle?

- **Automated vehicles** are those in which at least some aspect of a safety-critical control function (e.g., steering, throttle, or braking) occurs without direct driver input.
- **Connected vehicles** are those which use wireless technology to communicate between vehicles, roadside infrastructure, and other road users.



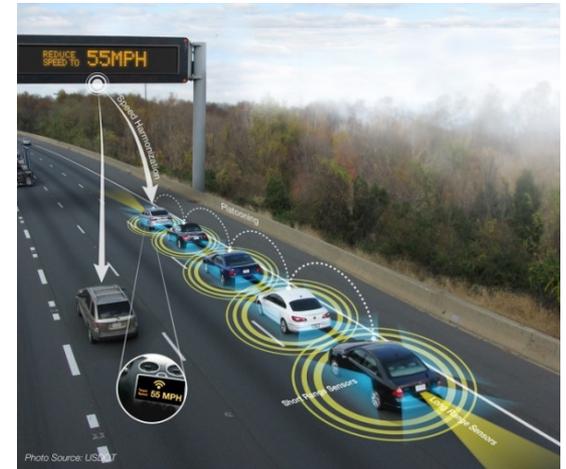
On-Vehicle Sensors



Source: Texas Instruments ADAS Solutions Guide

Automation Can Be a Tool for Solving Transportation Problems

- Improving safety
 - Reduce and mitigate crashes
- Increasing mobility and accessibility
 - Expand capacity of roadway infrastructure
 - Enhance traffic flow dynamics
 - More personal mobility options for disabled and aging population
- Reducing energy use and emissions
 - Aerodynamic “drafting”
 - Improve traffic flow dynamics



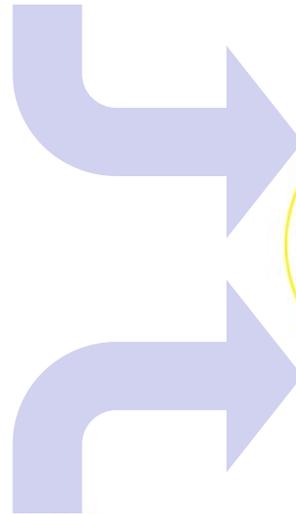
...but connectivity is critical to achieving the greatest benefits



Connected Automation for Greatest Benefits

Autonomous Vehicle

Operates in isolation from other vehicles using internal sensors



Connected Automated Vehicle

Leverages autonomous and connected vehicle capabilities

Connected Vehicle

Communicates with nearby vehicles and infrastructure



U.S. DOT Automation Program

Goal: Enable safe, efficient, and equitable integration of automation into the transportation system

Area	Example Applications	Research Emphasis
Connected Driving Assistance <i>Level 1-2</i>	Platooning, merge/weave assist, speed harmonization, and eco-approach and departure	Benefits (safety, mobility, sustainability) and Application Development
Conditional Automation <i>Level 2-3</i>	Highway autopilot, traffic jam assist, etc.	Safety Assurance (human factors, control system reliability, testing procedures, and cybersecurity)
Limited Driverless Vehicle Operations <i>Level 4</i>	Low-speed automated shuttles, first-last mile transportation	Feasibility (concept development, testing, evaluation)



Research Tracks

Enabling Technologies			
Digital Infrastructure	Communications	Technology Research	

Safety Assurance			
Electronic Control Systems	Functional Safety and Electronics Reliability	Cybersecurity	Human Factors

Transportation System Performance			
CACC, Speed Harmonization, and Platooning	Lateral Control	First/Last Mile and Transit Operations	

Testing and Evaluation			
Interoperability	Testing Methods	Benefits Assessment	

Policy and Planning			
Standards	Federal Policy Analysis	Stakeholder Engagement	Transportation Planning



Automation and Road Weather Overview

- Today
 - Poor sensor performance under degraded environmental conditions
 - Snow, fog, dust, direct sunlight, etc.
 - Wide range of capabilities: entry-level to high-end
 - Rapid evolution
 - Driver reengagement under challenging conditions
- Looking ahead
 - Road-weather information critical for operating condition assessment
 - Potential for new opportunities for real-time road surface condition information collection
 - Potential reduction in certain weather-related crash types as sensors improve



Discussion Questions

- Working Together
 - What does the weather community want to know about automation?
 - What are effective communication tools?
- Scoping Future Research
 - How do you see the weather-related research needs for automation?
 - What would help you do your job?





The screenshot shows the website for the Office of the Assistant Secretary for Research and Technology, Intelligent Transportation Systems Joint Program Office. The page features a navigation menu with categories like About, Research, Tech Transfer, Library, Press Room, ITS PCB Program, and Contact Us. A main banner highlights the 'ITS 2015-2019 STRATEGIC PLAN' with the text 'Planning for the Future of ITS'. Below this, there are sections for 'Current Research' (listing Safety, Mobility, Environment, Road Weather, Policy, Connected Vehicle Technology, Short-Term, Intermodal Research, Exploratory, ITS Cross-Cutting Support, and Success Stories) and a 'Spotlight' section with news items from December 10, 2014, and August 12, 2014. Other featured content includes 'FREE ITS TRAINING', 'Public Meetings & Webinars', 'Connected Vehicle TEST BED', 'CV Pilots Deployment Project', and an 'ITS & YOU' advertisement. Social media icons for Facebook, Twitter, Email, RSS, and YouTube are visible at the bottom of the main content area.

www.its.dot.gov

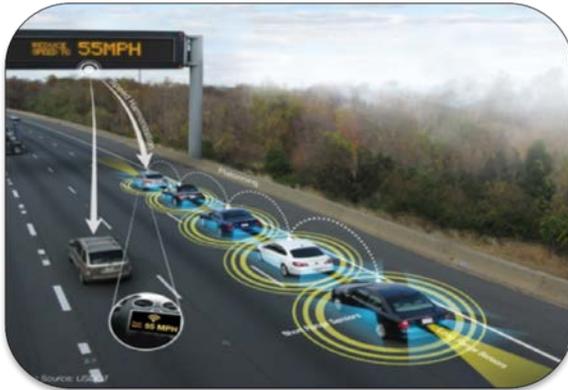
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Enabling Technologies

Sensors & Technologies			
Radar Information	Communication	Technology Research	
Safety Features			
Advanced Control	Autonomous Safety and	Collaborative	Autonomous
Co-Operative	Operational	Performance	
Transportation System Performance			
CO ₂ Emission Reduction and	Efficiency	Cost Reduction	Energy Efficiency
Improved	Operational	Performance	
Testing and Evaluation			
Interoperability	Testing Methods	Benefits Assessment	
Policy and Planning			
Standard	Federal Policy Research	Stakeholder Engagement	Transportation Planning

POSITION, NAV & TIMING



MAPPING



SENSORS



COMMUNICATIONS



HUMAN FACTORS



Safety Assurance Example: Human Factors Research

Levels & Technologies			
Light Infrastructure	Communications	Technology Research	
Safety Processes			
Business Cases	Business Models	Business Models	Business Models
Human Factors Research			
Task, Speed Management and	Label Control	Vehicle Use and Control	
Design and Evaluation			
Interoperability	Design Methods	Results Assessment	
Implementation			
Standards	Policy Analysis	Stakeholder Engagement	Implementation Planning

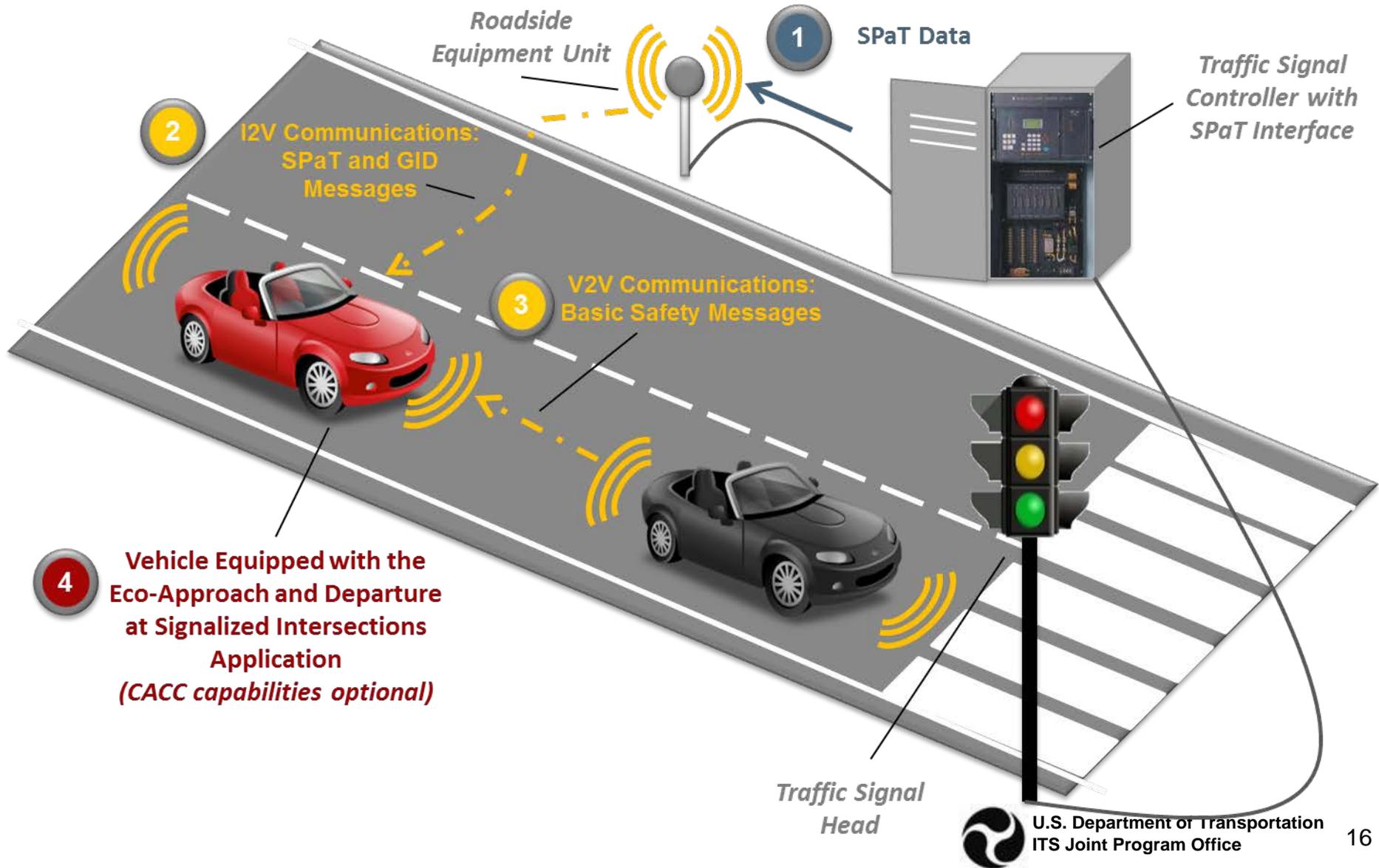
- Addresses human factors research questions focused on drivers transitioning into and out of automated driving states enabled by Level 2 (2010 Cadillac SRX) and Level 3 (Google-modified 2012 Lexus RX450h) automated driving concepts.
- Producing Driver-Vehicle Interface Design Principles



Transportation System Performance

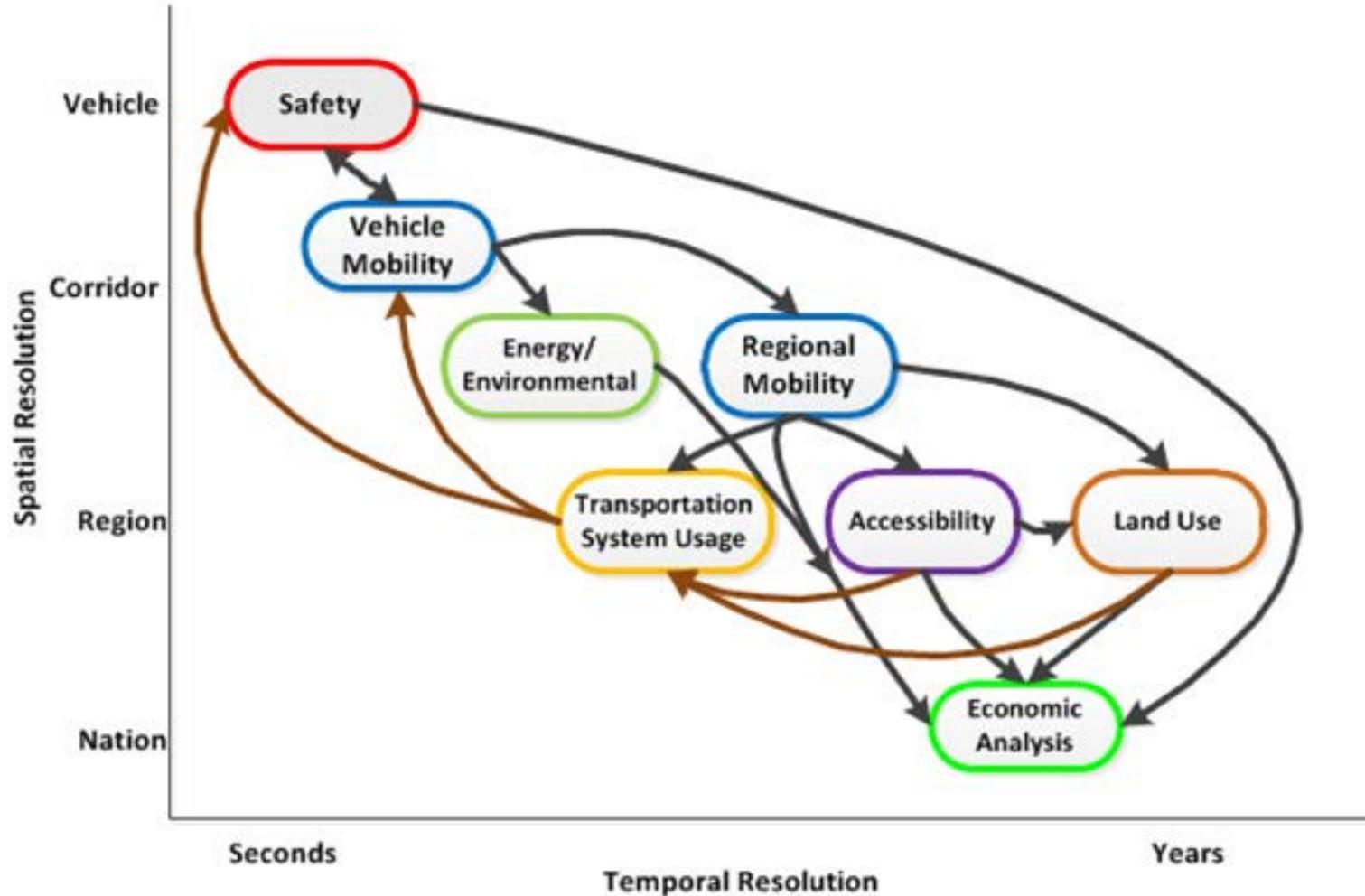
Example: Eco-Signal Operations

Building Strategies			
Signal Information	Communications	Technology Support	
Safety Features			
Advanced Lane	Advanced Safety and	Collision	Autonomous
Control	Operational	Control	Control
Transportation System Performance			
CACC, Speed Harmonization, and	Lateral Control	Brake-Like	Weld and Control
Adaptive			
Testing and Evaluation			
Interoperability	Testing Methods	Benefits Assessment	
Deployment Potential			
Hardware	Control Policy Review	Standardized Testing	Transportation Planning



Evaluation and Testing Example: Benefits Evaluation Framework

Modeling & Evaluation			
Rapid Assessment	Comprehensive	Advanced Research	
Safety Evaluation			
Advanced Level	Intermediate Safety and	Operational	Advanced Level
Transportation System Performance			
ACC, Speed Harmonization, and	Advanced Level	Advanced Level	Advanced Level
Economic and Environmental			
Intermediate	Advanced Level	Advanced Level	Advanced Level
Benefits Assessment			
Benefits	Cost-Benefit Analysis	Statistical Regression	Transportation Planning



Policy and Planning Example: Review of Federal Motor Vehicle Safety Standards

Building Bridges			
Digital Information	Communications	Technology Support	
Quality Resources			
Customer Center	Customer Service and	Customer Care	Public Affairs
Call Center	Customer Support		
Transportation System Performance			
AVL, Speed Measurement, and	Label Control	Vehicle Weigh and Class	
Operations			
Safety and Education			
Interoperability	Testing Methods	Benefits Assessment	
Data and Analytics			
Analytics	Control Policy Models	Statistical Engineering	Transportation Planning

How could highly automated vehicles impact or change the nature of existing Federal Motor Vehicle Safety Standards (FMVSS)?

- Identifying where current FMVSS pose challenges to introduction of AVs – particularly as they move into concepts of *‘human out of the loop’* or *‘driverless’*
- Ensuring that existing Federal regulations do not stifle innovation and that AVs are performing their functions safely
- NHTSA and ITS JPO coordinated research

