Connected Vehicle Research in the United States

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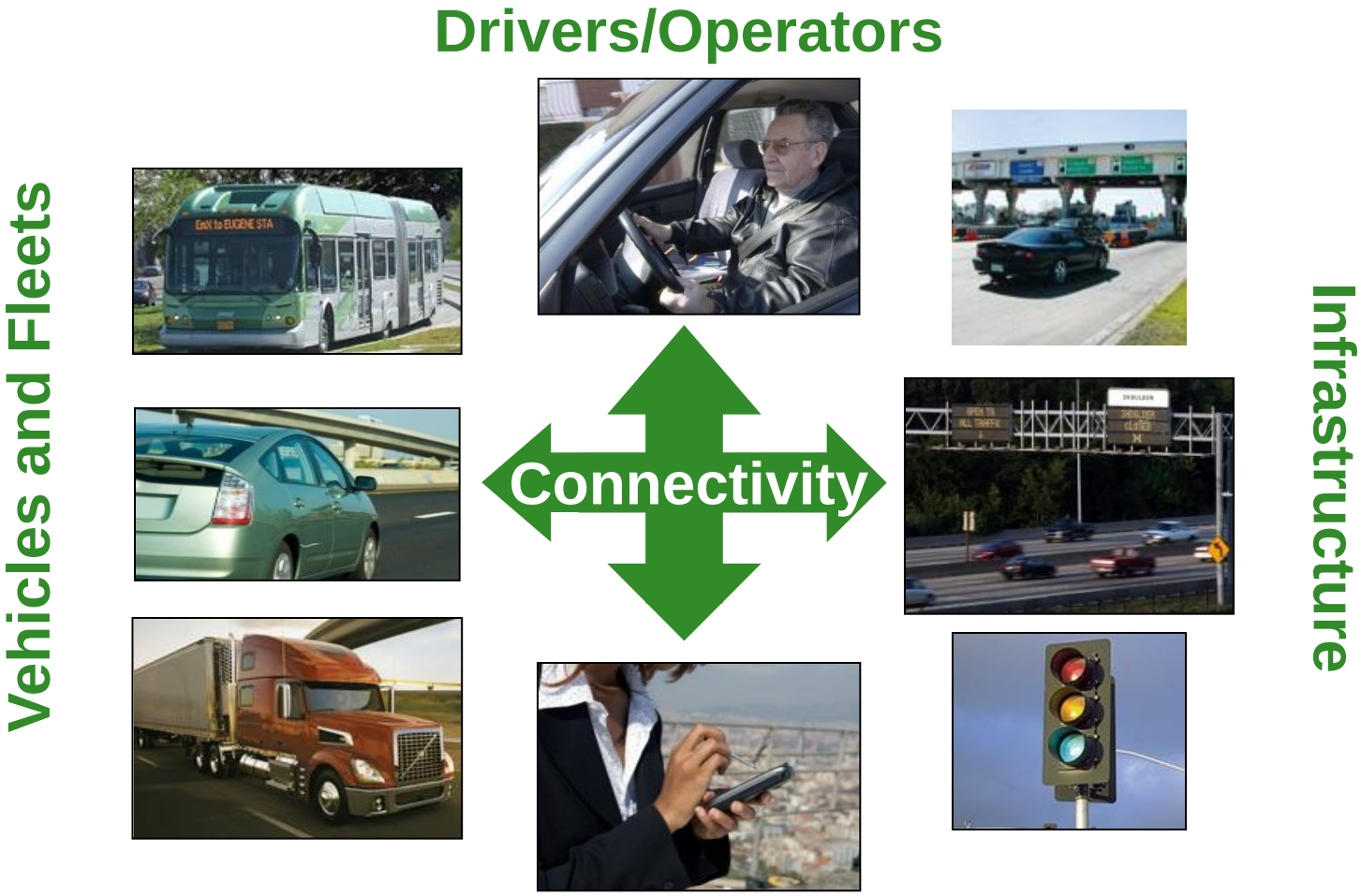
Connected Vehicle Concept



What is the Connected Vehicle Program?

- Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) wireless communications for:
  - Crash prevention
  - Improved mobility
  - Environmental sustainability

- Connected vehicle capability addresses over 80% of unimpaired crash scenarios
- Encompasses autos, buses, and trucks
  - Partnership among RITA, NHTSA, FHWA, FMCSA, and FTA

What is the Connected Vehicle Program (cont.)

- Uses Dedicated Short-range Communications (DSRC) technology
  - FCC-dedicated spectrum at 5.9 GHz
  - Low latency and high reliability essential for safety applications
  - Other communications types being considered for non-safety applications (e.g. cellular, Wi-Fi)

Key Program Objectives

- 2013 - NHTSA Decision on Vehicle Communications for Safety (light vehicles)
- 2014 - NHTSA Decision on Vehicle Communications for Safety (heavy vehicles)
- 2015 - FHWA to issue Infrastructure Implementation Guidance

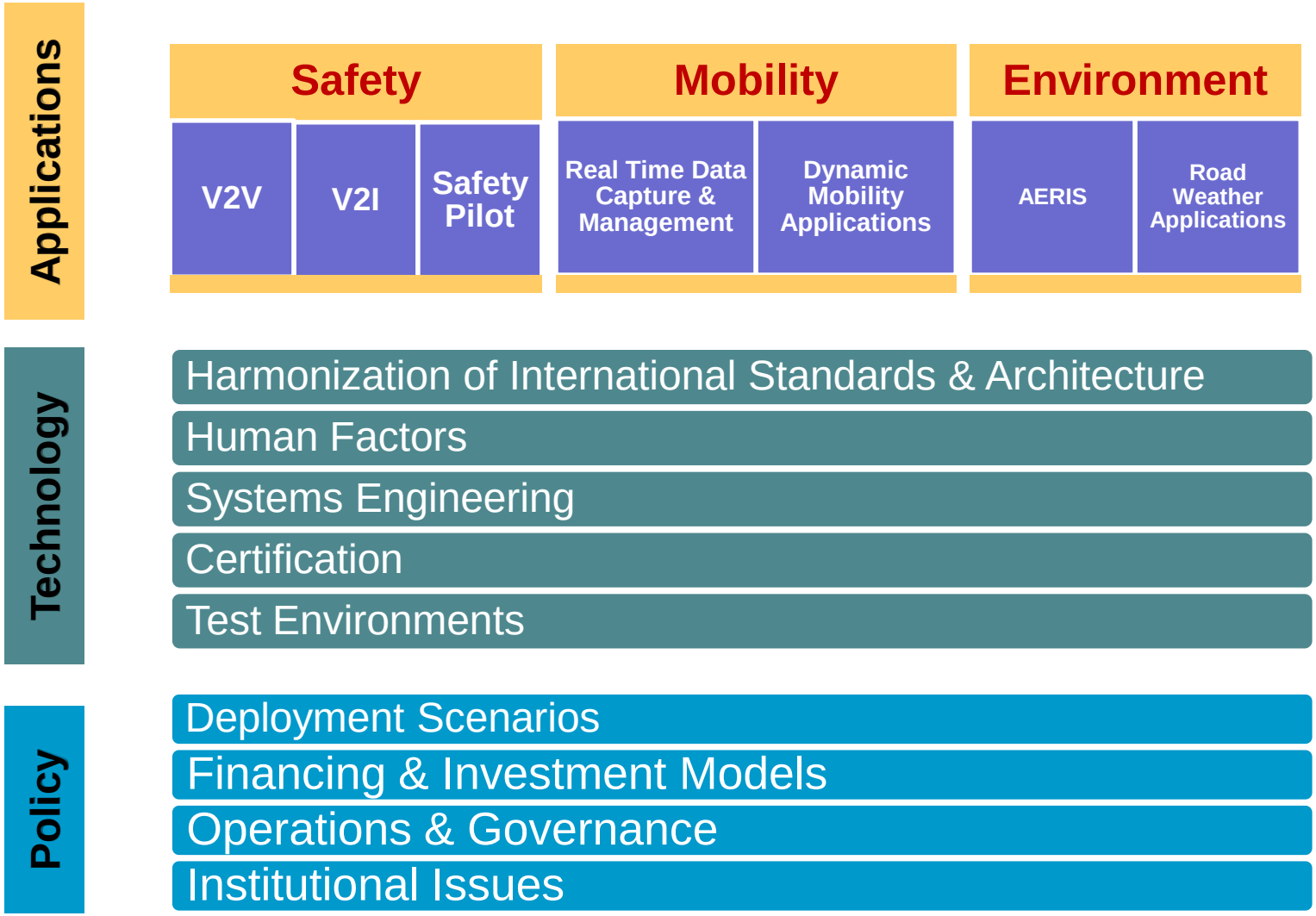
NHTSA Agency Decision

- Possible decision options include:
  - **Rulemaking** on minimum performance requirements for vehicle communications for safety on new vehicles
  - Inclusion in NHTSA's **New Car Assessment Program** to give car makers credit for voluntary inclusion of safety capability in new vehicles
  - **More research** required

NHTSA Agency Decision (cont.)

- **NHTSA's action for the 2013 decision will be based on hard data**:
  - Simulation and modeling efforts based upon previous field operational tests
  - Data collection from V2V test track testing
  - Empirical data obtained from **Safety Pilot**
    - Driver clinics (user acceptance)
    - Model deployment activities (safety effectiveness)

ITS Research Program Components



Safety Pilot Objectives

- Generate empirical data for supporting 2013 and 2014 decisions
- Show capability of V2V and V2I applications in a real-world operating environment using multiple vehicle types
- Determine driver acceptance of vehicle-based safety warning systems
- Assess options for accelerating the safety benefits through aftermarket and retrofit safety devices
- Extend the performance testing of the DSRC technology

SAFETYPILOT

Safety Pilot Sites

- **Driver clinics**
  - Assess user acceptance

Six Driver Clinic Sites

- **Large-scale model deployment**
  - Obtain empirical safety data for estimating safety benefits

One Model Deployment Site

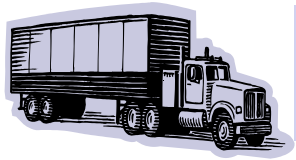
User Acceptance -- Driver Clinics

- 6 locations across the U.S. beginning in August 2011
- 100 drivers per location
- Experience crash warnings
  - Forward Crash Warning
  - Emergency Brake Light
  - Blind Spot Warning
  - Lane Change Warning
  - Intersection Assist
  - Do Not Pass Warning

Model Deployment

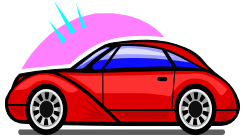
- Major road test and real-world implementation in2012-2013, involving:
  - Approximately 3,000 vehicles
  - Multiple vehicle types
  - Fully integrated systems and aftermarket devices
  - Roadside infrastructure
  - System-wide interoperability testing
- Also to test
  - Prototype security mechanisms
  - Device certification processes

Integrated Vehicles



Integrated Trucks

Aftermarket Devices

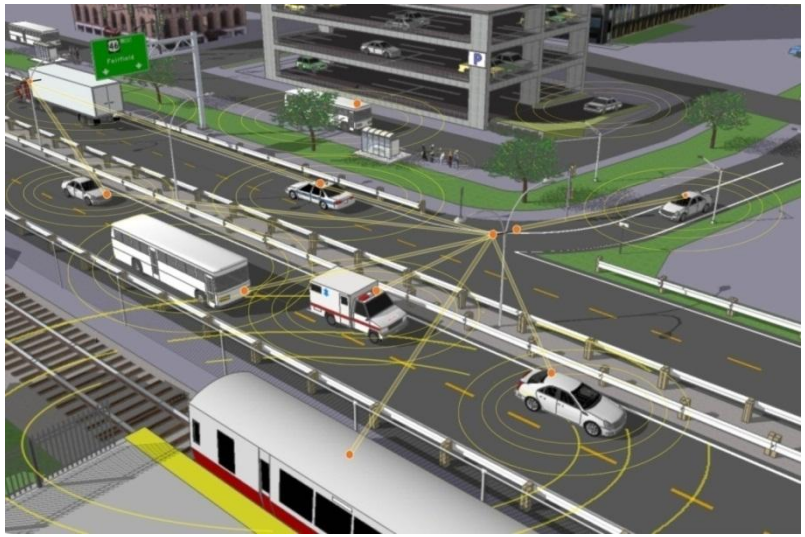


Basic Safety Devices

Roadside Infrastructure

Roadside Equipment for Safety Pilot

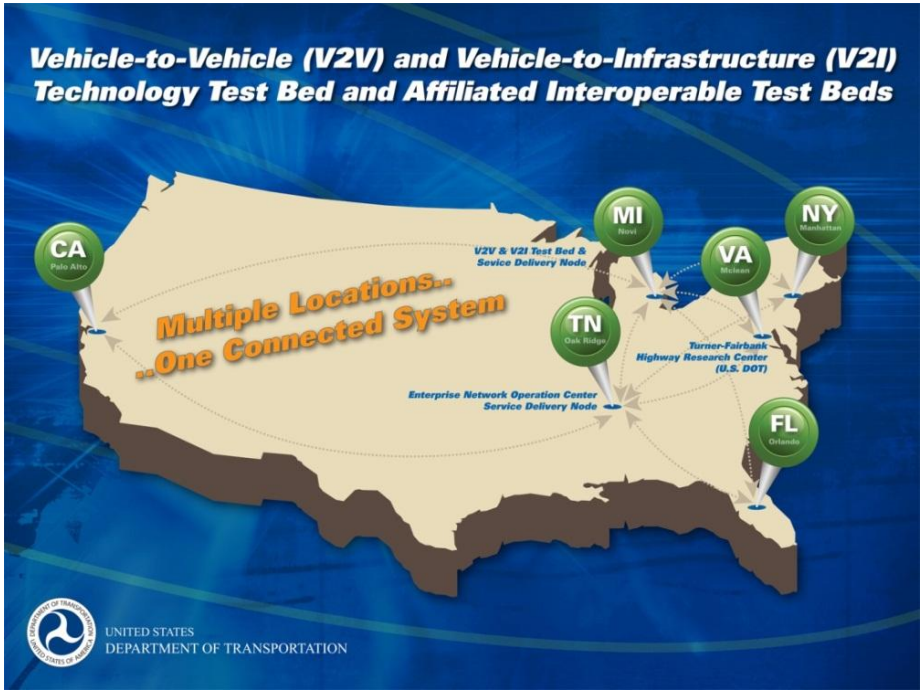
- Transmission and receipt of V2I messages
  - Interfaces with signal controller (at intersections)
  - Supports other dangerous road segment applications
- Applications supported
  - CICAS-V (red-light warning)
  - Curve overspeed warning
  - Collection of probe data transmissions
  - Other (tbd)
- 4 vendors currently developing RSE prototypes



Test Environments - Build a Reference Implementation

Status:

- Test beds with interoperable equipment in California, Florida, New York, Michigan, and Virginia, and network operations in Tennessee



2012 to 2013

- Reflect the system architecture
- Utilize harmonized international standards
- Implement a certification process
- Implement a security process

Policy Research Focus

- Security Needs and Privacy
- Deployment Scenarios/Business Models
- Governance

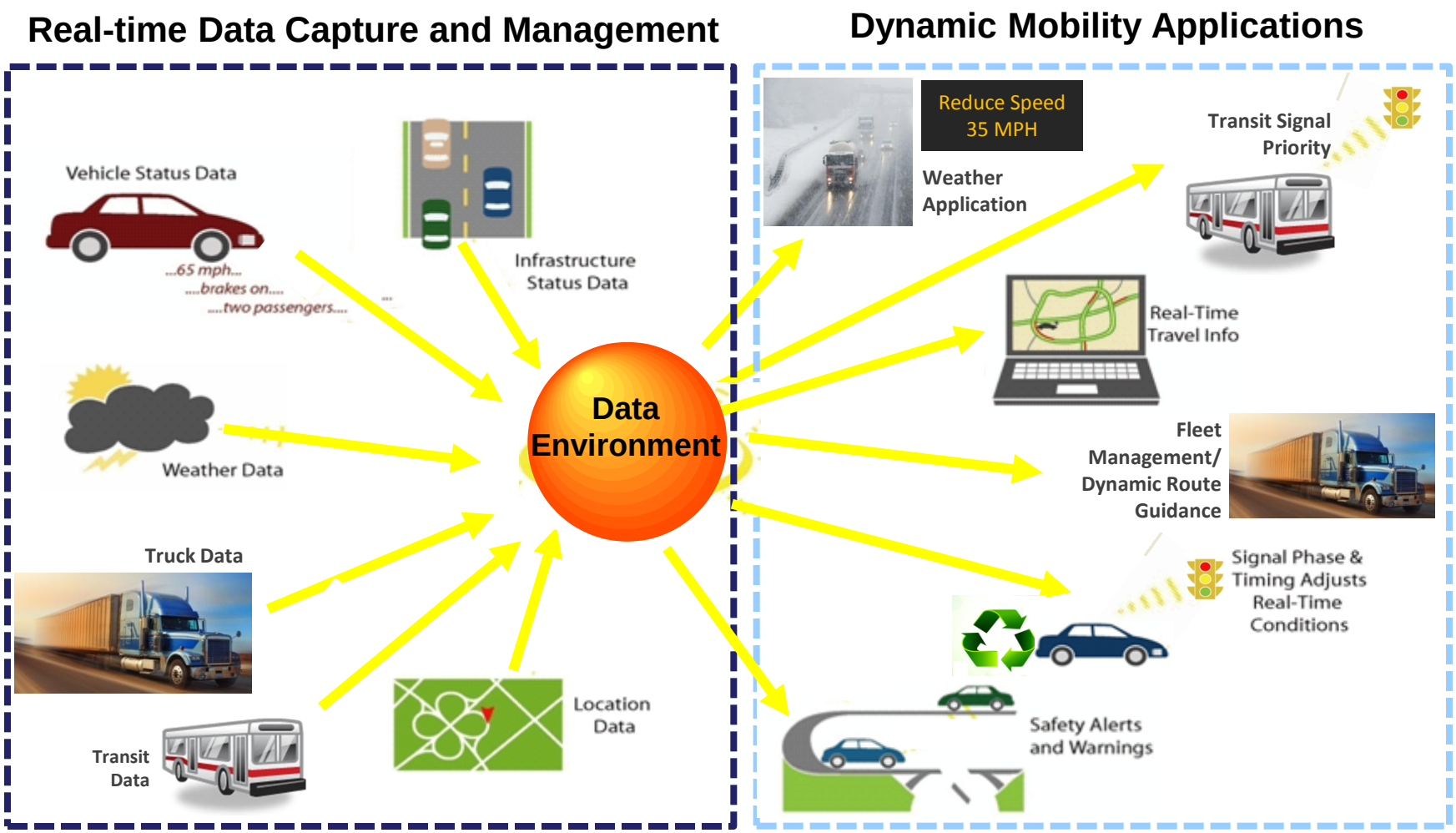
Critical Security Questions

- **Which communications media can support the needs for distributing security certificates? Choices include:**
  - Dedicated Short Range Communications (DSRC) - may require up to 40,000 RSEs
  - Existing Cellular Networks or Wi-Fi – infrastructure exists but must address privacy
  - Vehicle-Based Security Option (no infrastructure)
- **What are advantages and limitations of each?**
- **How should the organizational functions of security certificate distribution and management be structured?**
  - Who should be responsible for them
  - How should they be funded initially and over time?

V2I for Safety Program

- Requires infrastructure, could be implemented at spot locations:
  - Intersections (tied into traffic signals)
  - Curves
- Enabling Technologies
  - Signal Phase and Timing
  - Positioning
  - Communications
  - Mapping
- Applications
  - Intersection safety (e.g. red light warning)
  - Speed warnings at curves, school zones, or works zones
  - Pedestrian Safety

Mobility Program



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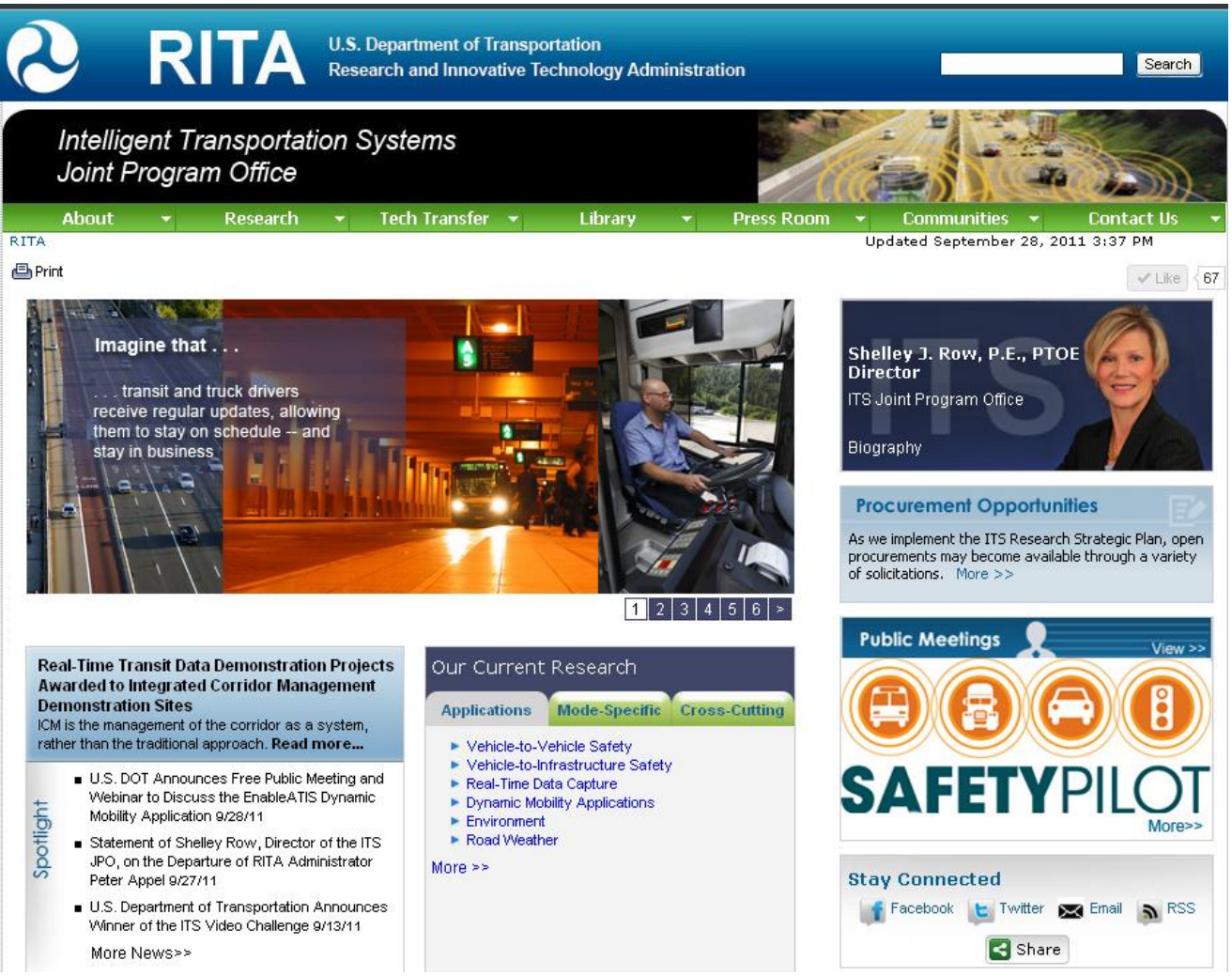
AERIS Program

- **A**pplications for the **E**nvironment: **R**eal-time **I**nformation **S**ynthesis
- Identified Transformative Applications
  - Eco-Signals
  - Eco-Lanes
  - Low Emissions Zones
  - Support for Alternative Fuel Vehicle operations
  - Eco-Traveler Information
- Planning a public workshop March 14-15 in Washington, DC to further discuss data and other requirements for Apps
  - Registration information and draft agenda to be developed and circulated soon

For More Information



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