



FEDERAL TRANSIT ADMINISTRATION

FTA's Strategic Transit Automation Research (STAR) Plan

April, 2018

Vincent Valdes
Associate Administrator

Office of Research, Demonstration and Innovation



U.S. Department of Transportation
Federal Transit Administration

Automation Benefits in Public Transportation

- Improve safety
- Increase efficiency and productivity
- Potentially reduce costs
- Increase traveler convenience and comfort through improved service frequency, flexibility and reliability
- Expand service hours and area
- Increase overall customer satisfaction
- Adapt to change – embrace innovation

Transit Automation Research Goals

- **Conduct enabling research** to achieve safe and effective transit automation deployments
- **Identify and resolve barriers** to deployment of transit automation
- **Build awareness** to socialize automation for transit stakeholder community
- **Demonstrate market-ready technologies** in real-world settings
- **Leverage technologies** from other sectors to move transit automation industry forward

STAR Plan Scope

- Transit bus operations
 - “Bus” is defined broadly
 - Passenger capacities
 - Traditional and novel vehicle designs
 - Lessons learned from automation in rail, light-duty vehicles, commercial vehicles, and aviation considered
- Full range of automation (SAE Levels 1-5)
 - Does not include driver assistance systems without an automation aspect (e.g., driver warnings and alerts)



STAR Plan

TABLE OF CONTENTS

1	Executive Summary
3	Part I: Research Plan
3	Introduction
3	Scope
4	Approach
5	Relationship to Other USDOT Initiatives
7	Related FTA Research
7	Summary of Key Findings
9	Strategic Transit Automation Research Roadmap
19	Part II: Input and Analysis
19	Methodology
19	Inputs to Research Plan: Interim Products
30	Knowledge Transfer Activity Plan
30	Research Needs and Gaps
31	Conclusion
33	Appendix A: SAE Levels of Automation
35	Appendix B: Automation Risk/Barrier and Mitigation Assessment
52	Appendix C: Analysis of Non-Driving Operator Responsibilities
81	Appendix D: Transit Automation Benefit-Cost Analysis Report
128	Appendix E: Stakeholders Consulted
131	Appendix F: Technology Literature Review and Analysis



STAR Plan Development Process

Engage stakeholders

- Interviews, workshops, and presentations

Identify potential scenarios (use cases)

- Identify, analyze, and prioritize use case scenarios for automating transit bus operations

Develop a plan

- For future transit automation development and demonstration projects

Major Project Tasks

- Literature Review
- Risk/Barrier Assessment
- Stakeholder Engagement
- Benefit-Cost Analysis
- **Research Plan**

Transit Automation Scenarios (Use Cases)

- Smooth Acceleration and Deceleration
- Automatic Emergency Braking and Pedestrian Collision Avoidance
- Curb Avoidance
- Precision Docking
- Narrow Lane/Shoulder Operations
- Platooning

- Circulator Bus Service
- Feeder Bus Service

- Precision Movement for Fueling, Service Bays, and Bus Wash
- Automated Parking and Recall

- Automated First/Last-mile
- Automated ADA Paratransit
- On-Demand Shared Ride

- Automated Bus Rapid Transit

Transit Bus Advanced Driver Assistance System (ADAS)

Technology Package 1

Automated Shuttle

Technology Package 2

Maintenance, Yard, Parking Operations

Technology Package 3

Mobility-on- Demand (MOD) Service

Technology Package 4

Automated Bus Rapid Transit

Technology Package 5

FY2018 Activities

Enabling Research

- *Automation Policy Review*
- *Applications of Light and Commercial Vehicle Automation Technology*
- *User Acceptance Study and Human Factors Research*
- *Market Analysis for Transit Bus Automation*
- *Hazard and Safety Analysis of Automated Transit Bus Applications (ITS JPO-funded)*

Integrated Demonstrations

- *Test Facility Requirements*
- *Solicitation for Demo 1: Automated ADAS*
- *Solicitation for Demo 2: Automated Shuttles*
- *Demonstration Evaluation Guidance*
- *Transit Industry Automation R&D Solicitation*

Strategic Partnerships

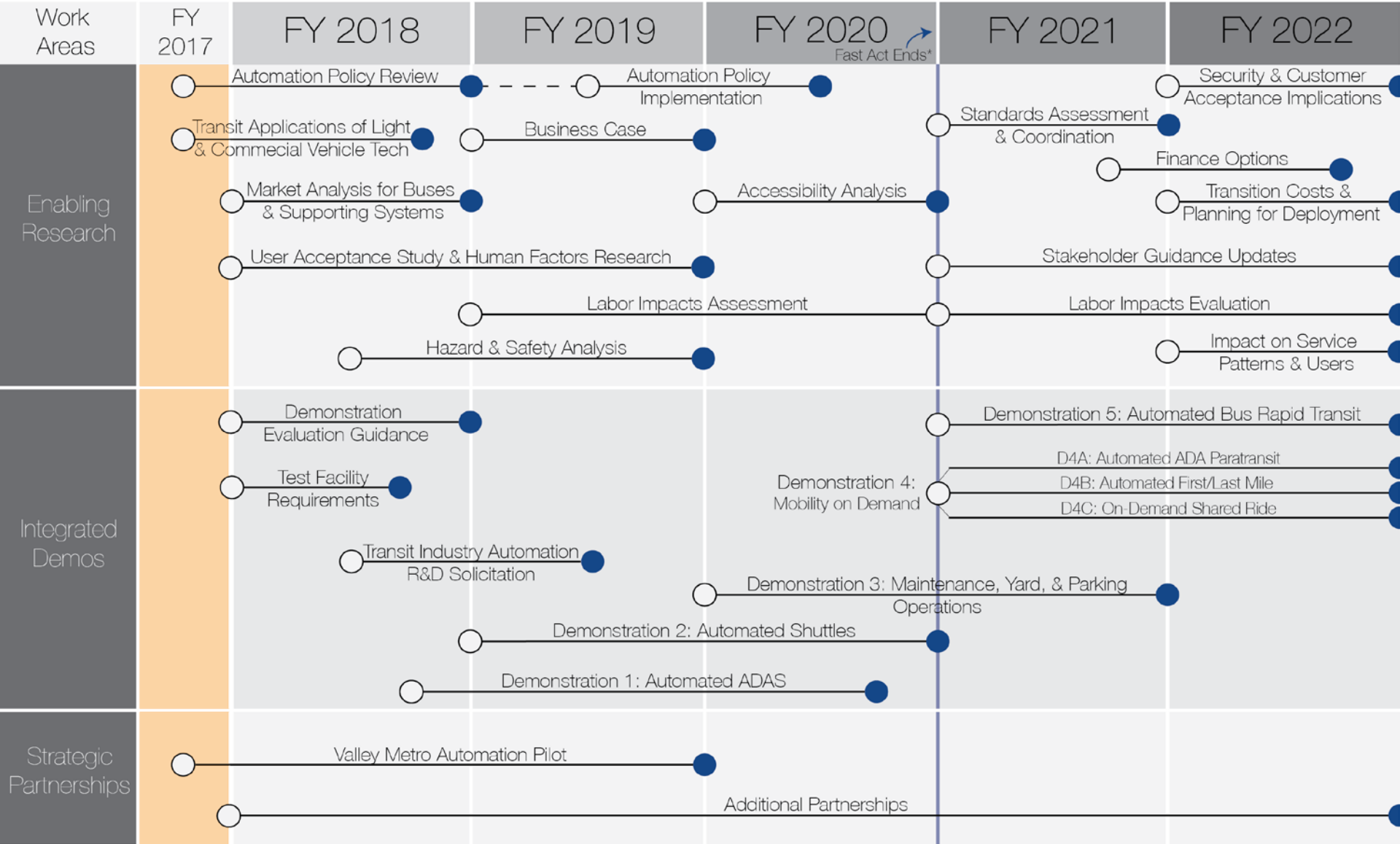
- *Valley Metro Automation Pilot*
 - *Access Services LA (potential)*
 - *Las Vegas (potential)*
 - *Jacksonville (potential)*
- These projects will leverage pilots and demonstrations initiated by external actors (manufacturers, suppliers, transit agencies, cities) and are opportunistic in nature.*



Stakeholder Engagement, Knowledge Transfer, and Technical Assistance

Strategic Transit Automation Research Roadmap

Federal Transit Administration
U.S. Department of Transportation



Knowledge Transfer, Stakeholder Engagement, & Technical Assistance

