United States Department of Transportation

Annual Modal Research Plans
Intelligent Transportations Systems (ITS)
Joint Program Office (JPO)
Fiscal Year 2017-18

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Federal Highway Administration
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NOTE: This research plan is included in the Federal Highway Administration (FHWA) Research program, and is provided also as a standalone Annual Modal Research Plan to reflect the unique cross modal mission of the USDOT ITS Joint Program Office and to comply with the requirements of the Fixing America's Surface Transportation (FAST) Act.

Section 1: The Intelligent Transportations Systems Joint Program Office, US Department of Transportation

The Intelligent Transportation Systems/Joint Program Office (ITS JPO) was created in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) Public Law 102-240 (December 18, 1991). ISTEA established a federal program to research, develop and operationally test Intelligent Transportation Systems (ITS) and to promote ITS implementation. The program is designed to facilitate deployment of technology to enhance the efficiency, safety, and convenience of surface transportation, resulting in improved access, saved lives and time, and increased productivity.

MISSION: *The ITS Strategic Plan 2015-2019* states its mission as "Conduct research, development, and education activities to facilitate the adoption of information and communication technology to enable society to move more safely and efficiently."

The ITS JPO conducts and coordinates research on behalf of the Department and all major modes to advance transportation safety, mobility, and environmental sustainability through electronic and information technology applications. The ITS JPO supports the Deputy Secretary in his/her role as chair of the ITS Management Council and executes the policy guidance developed by that body. The ITS JPO maintains relationships with the ITS industry and public interest groups, and represents ITS interests throughout the surface transportation community. The ITS JPO fosters the development and future deployment of intelligent transportation technologies to make surface transportation safer, smarter, and greener.

The ITS Program includes a large portfolio of research and technology deployment support programs focused on diverse systems and technologies with the potential for greatest public benefit from transportation transformation. Intelligent Transportation System program categories currently coordinated by the JPO across USDOT include:

Connected Vehicles: The USDOT CV research program focuses on adoption and eventual deployment of connected vehicle systems. Advancements in communication technologies enable Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communications to create a "connected transportation network" in a private and secure way. This technology will improve safety by allowing vehicles to "talk" to each other and ultimately avoid many crashes altogether by exchanging basic safety data. Drivers, pedestrians, transit passengers, freight operators, and transportation management personnel will interact with each other generating information and advisories on the prevailing conditions of the transportation network in real-time. In addition to enhancing safety, this continual exchange of real-time data will permit more efficient management of the transportation network, enhancing mobility while reducing environmental impact.

Automation: The automation program conducts research on automated road-vehicle systems and related technologies that transfer some amount of vehicle control from the driver to the vehicle. The automation program focuses on the development of a technology

and systems environment to enable smooth and safe introduction of connected automated features into the nation's vehicles and transportation systems.

Emerging Capabilities: The USDOT emerging capabilities program initiatives focus on future generations of transportation systems. The USDOT tracks technological, market, and demographic trends throughout the globe and across industries to seek and evaluate emerging capabilities that demonstrate the potential to transform transportation such as advanced information and communication technologies and the Internet of Things. An excellent example of a recent emerging capability is the recent Smart Cities Challenge initiative from the ITS JPO.

Enterprise Data: With increased connectivity and automation among vehicles, organizations, systems, and people, unprecedented amounts of data are being generated. New methods to collect, transmit/transport, sort, store, share, aggregate, fuse, analyze, and apply these data will be needed for management and operations of transportation systems.

Interoperability: Interoperability is essential for the safe, secure and efficient operation of the transportation system. As ITS are focused on the application of Information Technology (IT) to manage and operate the surface transportation network, interoperability and cybersecurity needs are partially analogous to those of the Internet with the added dimension of ITS supporting operation of physical systems which move people and goods -- where failures can have severe consequences.

Accelerating Deployment: As new ITS technologies and systems evolve into market-ready products, the ITS Program addresses questions associated with adoption and deployment. Adoption includes the phase after testing, when technologies are ready for initial implementation in the "real world." The ITS JPO seeks to spur adoption of technology, and help stakeholders and localities deploy maturing ITS systems. The program provides knowledge transfer, and supports technical assistance, training, outreach, program evaluation, and other stakeholder engagement. ITS JPO seeks to advance ITS work from research, to initial adoption, and subsequently on to wider scale deployment in coordination with other stakeholders at the federal, state, regional and local levels.

Section 2: FY 2017 RD&T Program Funding Details

RD&T Program Name	FY 2017 Pres. Budget ($000)	FY 2017 Basic	FY 2017 Applied	FY 2017 Development	FY 2017 Technology
Intelligent Transportation Systems (ITS)					
Connected Vehicles	30,275		30,275		
Automated Vehicles	3,950		3,950		
Emerging Technology	18,025		18,025		
Enterprise Data	3,400		3,400		
Interoperability	6,050		6,050		
Accelerating Deployment	15,300		14,300		1,000
Advanced Transp. and Congestion Management Technology Deployment (ATCMTD) (1)	21,000				21,000
Small Business Innovation Research (SBIR)	2,000		2,000		
TOTAL	**100,000**		**78,000**		**22,000**

These funds are included in the FHWA budget and Modal Research Plan accounting. These funds are not in addition to those funds.

Section 3: FY 2017 RD&T Program Budget Request by DOT Goal(s)

RD&T Program Name	FY 2017 Pres. Budget ($000)	Safety	State of Good Repair	Economic Competitiveness	Quality of Life in Communities	Environmental Sustainability
Intelligent Transportation Systems						
Connected Vehicles	30,275	18,165	3,028	4,541	3,025	1,516
Automated Vehicles	3,950	1,975	395	790	395	395
Emerging Technologies	18,025	7,011	2,003	2,003	5,006	2,002
Enterprise Data	3,400	680	680	1,360	340	340
Interoperability	6,050	1,815	1,210	1,210	1,210	605
Accelerating Deployment	15,300	4,590	1,530	3,060	3,060	3,060
ATCMTD (1)	21,000	6,300	2,100	4,200	4,200	4,200
SBIR	2,000	1,000		1,000		
TOTAL	**100,000**	**41,536**	**10,946**	**18,164**	**17,236**	**12,118**

Note: amounts are estimates only, subject to changing priorities, and do not reflect reductions due to annual obligation limitation, which is typically around 5%.

(1) Per the FAST Act, the ATCMTD program is funded out of three programs: Highway Research and Development (HRD), Technology and Innovation Deployment program (TIDP), and ITS.

These funds are included in the FHWA budget and Modal Research Plan accounting. These funds are not in addition to those funds.

Section 4: Program Details for FY 2017

Connected Vehicles

($30,275)
($000)

Program Description:

The connected vehicle program, like all ITS research, benefits from a multimodal planning and coordination process utilized by the ITS Joint Program Office. All surface transportation modes participate in the modal Strategic Planning Group (modal associate administrators), with concurrence by the Management Council (comprised of all surface mode administrators, chaired by the Deputy Secretary) to coordinate ITS project funding. Examples of integrated ITS research include the FHWA/FTA joint effort "Accessible Transportation Technologies Research Initiative (ATTRI)", FHWA's "Integrated Corridor Management" and "Deployment Readiness" efforts, and MARAD's "ITS Assessment."

The CV program plans to advance the Department's goal of transferring research results into real world application. Building on over a decade and nearly $600 million in ITS investments, this program will continue to support: the issuance of the NHTSA Vehicle to Vehicle (V2V) rule; the FHWA Vehicle to Infrastructure (V2I) guidance; the development of a scalable operational Security Certification Management System (SCMS) to accommodate tens of millions of vehicles; and expand the deployment of both vehicles and infrastructure through the continued support of the connected vehicle pilots. The primary focus is to spur widespread adoption and deployment of the system nationwide reducing collisions, injuries, and fatalities.

The program will promote technology transfer of over 60 connected vehicle applications, that in addition to promoting safety, also enhance traveler and freight efficiency, address impacts of weather on road transportation, reduce fuel consumption and reduce greenhouse gas and other pollutants. Connected vehicle technology research and development is being leveraged in the USDOT CV pilots in New York City, Tampa, FL and Wyoming. This technology is also being leveraged in the agency's Smart City Challenge efforts and FAST Act Advanced Transportation and Congestion Management Technologies Deployment Program grants.

In addition, this program will commit resources to conduct research to respond to congressional interest in the use of Wi-Fi and Dedicated Short Range Communications spectrum (DSRC) for this collision avoidance technology.

Program Objectives:

To advance knowledge of Connected Vehicle (CV) systems (Research); to collect benefits and costs and implementation lessons learned information from high priority CV applications (Development); and to support State and local, and transit agency integrating CV environment deployments (Adoption).

Anticipated Program Activities:

1. Design and test Connected Vehicle Pilot concepts in NYC, Tampa, FL and Wyoming.
2. Develop program plan and roadmap for Cyber Security.
3. Summarize findings and prepare project report for Southeast Michigan Advanced Data Capture Field Testing.
4. Deliver test results and documentation of the Systems Engineering Management Plan (SEMP) and testing plans for V2V systems engineering and vehicle integration research for deployment project.
5. Continue development of On-Board Equipment Minimum Performance Requirements and Test Procedures.
6. Conduct SCMS end-to-end testing for V2V system engineering and vehicle integration research for deployment project.
7. Conduct spectrum sharing testing with other modes and the Federal Communications Commission (FCC).
8. Evaluate improvements with ITS technology to reduce truck involved work zone crashes.
9. Develop and demonstrate a prototype system for Heavy Vehicles V2V basic safety message (BSM) and implementation issues for deployment.

Expected Program Outcomes:

- Demonstrations of CV environments that fit into real-world environments of today.
- Real-time and real-world data to help with transportation planning and transportation system operations.
- Increase in safety, mobility, system efficiency and access to resources for disadvantaged groups, and decreases in negative environmental impacts such as vehicle emissions, the need for physical expansion and noise.
- Increased opportunities to partner with non-government groups, such as private industry and universities.
- Decreases in undesirable transportation impacts to the environment and society.
- Reduction of fatalities through weather-related safety, infrastructure-based, and other applications.

FY 2017 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
CV Pilots	FHWA, FTA, FMCSA, NHTSA and Volpe work with the JPO to conduct evaluations of the safety, mobility, environmental and public agency efficiency impacts from the CV Pilot sites.
CV Pilots	FHWA, FTA, FMCSA, NHTSA and Volpe work with the JPO on the CV Pilots Phase 2 which is the Design/Build/Test Phase for CV technologies.
Connected Vehicle Policy	NHTSA, FHWA, FTA and OST-R work with the JPO to understand the impacts of spectrum use.
Connected Vehicle Policy	FHWA works with the JPO to foster a deployment community

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
	that moves forward in a consistent manner, which is a significant basis for interoperability.
Connected Vehicle Policy	FHWA, FTA and NHTSA work with the JPO to better understand the relationships between connected and automated vehicle systems.
Connected Vehicle Policy	FHWA, FTA and NHTSA work with the JPO to develop a connected vehicle certification governance structure.
Mobility on Demand (MOD)	FTA and FHWA will work with the JPO to evaluate and analyze Mobility on Demand (MOD) approaches and demonstrations.
Model Deployment Follow-up Ann Arbor	NHTSA works with the JPO to support continuing research and development of technologies and applications using Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) technology.
Connected Vehicle	NHTSA, FHWA, FTA and OST-R work with the JPO to evaluate the as-built Security Credential Management System (SCMS) and to provide continuing security credential management services to early connected vehicle deployments.
Road Weather Management	FHWA works with the JPO to analyze the effects of weather and road conditions on connected and automated vehicles.
V2X	FTA and FHWA work with the JPO to test market ready Vehicle-to-Pedestrian (V2P) technologies.
Vehicle-to-Infrastructure	FHWA, FTA, FRA and NHTSA work with the JPO to enable the V2I Deployment Coalition to work collaboratively with industry, state and local governments, academia and USDOT to achieve the goal of deploying and operating a functioning CV environment.
Vehicle-to-Infrastructure	FHWA, FTA and FRA work with the JPO on the Multi-Modal Intelligent Traffic Signal System (MMITSS) which focuses on the interaction of traffic as it moves between arterials and freeways.
Vehicle-to-Infrastructure	FHWA, FTA and FRA work with the JPO on multimodal V2I safety applications including enhanced transit bus stop pedestrian warnings (TSPW) and at-grade rail crossing violation warnings (RCVW).
Connected Vehicles	FTA, NHTSA and FMCSA work with the JPO to integrate unequipped vehicles and vulnerable road users into the CV environment.
Vehicle-to-Infrastructure	FHWA works with the JPO to develop Connected Vehicle Road Side Unit Specification, RSU v4.1 and updated procure devices compliant with RSU v4.1 specification to update test beds used for USDOT research.
Vehicle-to-Infrastructure	FHWA works with the JPO to ensure the V2I infrastructure components are accurately addressed in the Connected Vehicle Reference Implementation Architecture (CVRIA).

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 ITS Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published online in 2014.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Connected Vehicle Pilots: In 2015 and 2016, the ITS JPO held 12 public webinars and four webinars that were open only to the 3 pilot sites. Since 2014, the ITS JPO has held more than 18 webinars on CV Pilots.

Automated Vehicles

($3,950)
($000)

Program Description:

The development of Automated Vehicles (AV) technology is occurring at a rapid pace, with industry investing billions of dollars a year. Several states have enacted legislation regarding AV and testing is currently occurring on public roads. Partially automated vehicles are already available in the market today and heavy vehicle automation technologies are approaching commercialization. The speeds of these developments are challenging our existing regulatory frameworks and significant Federal investment is required to ensure the safe development and deployment of this technology.

Recognizing the importance of these advancements, the USDOT is playing a significant role in addressing the key technological and institutional barriers that have emerged. In early 2016, the National Highway Traffic Safety Administration (NHTSA) announced its intention to develop operational guidance, model state policy, and identify potential new authorities needed for automation. In addition, the topic of urban automation was the highest of twelve priority areas for the 2016 Smart City Challenge. The development and adoption of safe vehicle automation through real-world pilot projects like the Smart City Challenge and the FAST Act ATCMTD Program grants would enable the USDOT to engage and catch up with other international activities. A key component of our Smart City Challenge includes investigating the impact of automated vehicle technology on mobility, safety and sustainability.

Program Objectives:

To define the core elements and the performance criteria for automation (Research); to test automation components in the Smart City Challenge and FAST Act Advanced Transportation and Congestion Management Technologies Deployment Program grants, as well as in other test situations (Development); and to define the Federal role in facilitating and encouraging deployment of automated systems (Adoption).

Anticipated Program Activities:

1. Prepare final report for Automated Speed Harmonization – Testing and Evaluation.
2. Develop White Paper: Standards Applicable to Automated Vehicles: Currently Existing and Those Being Developed.
3. Prepare roadmap for development of automated vehicle standards.
4. Prepare technical finding briefs and reports of simulator experiments of driver acceptance of level 1 automation.
5. Develop safety requirements for conventional braking and automated lane centering for functional safety of automated lane centering controls.
6. Prepare technical memorandum: Multimodal Shared-Use Operational Strategies for Universal Automated Community Transport.

7. Prepare final report and briefing: Operational Concept for Universal Automated Community Transport.
8. Develop and select algorithms for CACC vehicle control.
9. Develop specification for CACC implementation and perform hazard analysis
10. Report for extension of technical and operations cyber security requirements to automated vehicles.
11. Complete test track and over the road functional testing of varying levels of automated vehicles.
12. Conduct naturalistic study of L2 automated vehicle functions over-the-road and report results.
13. Develop and validate vehicle automation benefits model.

Expected Program Outcomes:

- Provide guidance to state and local agencies to help the understanding of impacts of automated vehicles on the assets they manage.
- Expand the reach of transportation modes to disabled and older users and provide "last mile" connectivity services for all users.
- Increasing the efficiency and effectiveness of existing transportation systems.
- Reduce the number and severity of crashes caused by drivers or by other conditions (e.g. weather, pedestrians, and roadway conditions).
- Reduce incidence of aggressive driving.

FY 2017 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Automated Vehicles (AV)	NHTSA conducts research for JPO on AV human factors, functional safety, test procedures, and cybersecurity.
Automated Vehicles	FHWA conducts research for JPO on AV human factors, technology and applications for connected automation, weather impacts, and accessibility.
Automated Vehicles	FMCSA provides requirements and oversight to JPO research on AV implications for Federal Motor Carrier Safety Regulations and prototype port applications.
Automated Vehicles	FTA provides requirements and oversight to JPO on first mile/last mile service and other Smart City AV applications.
Automated Vehicles	Volpe Center conducts AV policy and benefits research for JPO and also provides program management and internal collaboration support.

How does the Program meet statutory requirements?

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How does the Program incorporate public and stakeholder input?

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Emerging Technology

($18,025)
($000)

Program Description:

The United States Department of Transportation (USDOT) emerging capabilities program focuses on cultivating the next generation of transportation systems. As the scale of intelligent transportation systems (ITS) increases, vehicle manufacturers, infrastructure providers, innovators, and entrepreneurs discover new opportunities to use technology and the data that will be generated. Technological advances, new functionality, new applications, new operational concepts, and disruptive innovations result. The USDOT needs to track technological, market, and demographic trends throughout the globe and across industries to seek, evaluate, and sometimes incubate emerging capabilities that demonstrate the potential to transform transportation. As this happens, the USDOT will be positioned and engaged as a partner to guide research, development, and technology adoption in a systematic manner.

An example of a major initiative in Emerging Capabilities is the USDOT's Beyond Traffic: Smart City Challenge. The Smart City Challenge was launched in December 2015 by USDOT Secretary Anthony Foxx as an innovative competition for cities to reshape their transportation systems, harnessing the power of technology, data, and creativity to reimagine how people and goods move throughout cities. The Challenge called on cities to do more than merely introduce new technologies onto city streets, requiring them to boldly envision new solutions that would change the face of transportation in our cities by closing the gap between rich and poor; capturing the needs of both young and old; and bridging the digital divide through smart design so that the future of transportation meets the needs of all city residents.

The USDOT sought bold and innovative ideas for proposed demonstrations to effectively test, evaluate, and demonstrate the significant benefits of smart city concepts. Seventy-eight cities submitted entries to the competition, and in March 2016, seven finalists were selected. The finalists were Austin, Columbus, Denver, Kansas City, Pittsburgh, Portland, and San Francisco. In June 2016, Columbus was selected and the ITS JPO will work with the City of Columbus to implement its Smart Columbus program.

Program Objectives:

To establish ways to use new technologies and decision support tools for real-time needs, and to meet longer-term public policy objectives (Research); and to integrate the operational characteristics of new technologies into CV, AV, and legacy systems and applications (Development).

Anticipated Program Activities:

1. The Smart City Challenge will follow a systems engineering process for project development, then move to the build phase, followed by operations and evaluation.

FY2017 will include development of a concept of operations, system requirements and design for 12 vision elements focusing on connected vehicles, automated vehicles, mobility on demand, electrification, and infrastructure communications.
2. Deliver presentations for Accessible Transportation Technologies Research Initiative (ATTRI) Socio-Economic Impact.
3. Deliver final report, potential impacts of ATTRI Socio-Economic Impact.

Expected Program Outcomes:

- Forge stronger relationships and partnerships with private industry and universities.
- Increase ability to adapt existing or upcoming program to accommodate new ITS technologies.
- Stimulate economic growth through innovation and technological leadership.

FY 2017 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Accessible Transportation Technologies Research Initiative (ATTRI)	Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) work with the JPO on supporting the development of Concept of Operations document and Functional Requirements for two ATTRI applications.
Smart City Challenge	OST, FHWA, FTA, FMCSA, NHTSA, MARAD, FRA work with the JPO to conduct the demonstration and evaluation of the Smart City winner to test, evaluate and demonstrate the benefits of connected city concepts.
ITS MARAD	MARAD, FHWA and FMCSA works with the JPO in a three-phased effort to incorporate maritime port ITS needs into current and existing ITS JPO research, including a project related to low speed automated truck queuing at ports and warehouses.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

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Enterprise Data

($3,400)
($000)

Program Description:

The ITS Joint Program Office (JPO)'s Enterprise Data program focuses on enabling effective data capture from ITS-enabled technologies, including Connected Vehicles (CV) (automobiles, transit, and commercial vehicles), Automated Vehicles, Smart Cities, mobile devices, and infrastructure in ways that protect the privacy of users while exchanging and utilizing real-time data. In addition, these activities focus on the creation of open source data environments that enable integration and sharing of open and protected data from multiple sources for use in transportation research, management, and performance measurement.

These efforts aim to establish a data system foundation for agility, data sharing, and privacy protection for future ITS, Internet of Things, and Smart City developments. This includes demonstrating how sharing streaming and archived data from connected and automated vehicles and combining it with other data sources can fuel innovative public and private transportation services, such as mobility on demand and urban freight and logistic services, and accelerate research and deployment.

The vision of the Enterprise Data Program is that State DOTs and Metropolitan Planning Organizations (MPOs) will have access to low cost, scalable, interoperable data management tools that can ingest new data sources and feed new applications in ways that protect the privacy of users while enabling on-demand data sharing at regional, state and national levels.

Concurrently, the program will investigate demand for accessing streaming data from the CV environment and other emerging ITS data sources as well as archiving these data for future research and other uses. The result will be a national strategy for sharing and archiving these data which accounts for public, commercial, and academic sector needs.

Program Objectives:

To integrate new data sets with other legacy data management systems (Research); to identify a model for data management and ownership (Development); and to enable new business relationships between the public and private sector to ensure privacy protection.

Anticipated Program Activities:

1. Investigate innovative approaches to integrate CV data into transportation management systems for integrated big data in operational practice.
2. Identify opportunities to integrate CV data and enhanced data collection into transportation management systems for integrated big data in operational practice.
3. Report on analysis of data-related program needs for the Dynamic Interrogative Data Capture project.

4. Create gap analysis for roadside devices and transportation management systems to collect CV data for integrated big data in operational practice.
5. Recommend architecture enhancements to enable hosting large data sets on RDE for connected vehicle data privacy investigation.
6. Conduct privacy analysis of data sets and environments for connected vehicle data privacy investigation.
7. Enhance de-identification procedures for connected vehicle data privacy investigation.
8. Prepare mobile devices initiative FY 2017-2022 work plan report for crowdsourcing/social media/mobile devices.
9. Conduct webinar promoting innovative practices for data challenges.

Expected Program Outcomes:

- Improve quality (accuracy and timeliness) of data.
- Increase efficiency of information sharing. Assuring the public that the privacy of data will be protected.
- Efficiently manage large datasets.
- Stimulate innovation in new applications by enabling research.
- Monitor performance and enabling more efficient responses.

FY 2017 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Connected Data Systems (CDS)	FHWA and FTA work with the JPO to provide specialized technical support to the CDS Program in the area of modern software development tools and methods.
Connected Data Systems (CDS)	OST, FHWA and FTA work with the JPO to jumpstart the ecosystem of third party development around the data made available through the USDOT's Smart City Challenge.
Connected Data Systems (CDS)	NHTSA, FHWA and OST work with the JPO to create operational procedures and open source algorithms for real-time connected vehicle data de-identification.
Connected Data Systems (CDS)	FTA, FHWA and BTS work with the JPO to develop the Concept of Operations (ConOps) for the sharing (or federation) of data among multiple Operational Data Environments (ODEs), namely: ingesting data collected by local ODEs, coordination data feeds among local ODEs, and merging/sharing the data for use on a state-wide or multi-state corridor level.
Connected Data Systems (CDS)	FTA and FHWA will work with the JPO to investigate use of new approaches to provide secure, revocable access to large and sensitive data sets in a secure enclave along with algorithms and shared computing resources approaches within the transportation sector to accelerate research into the safety of autonomous vehicles and other emerging technologies using cutting edge, re-usable analysis tools.

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Connected Data Systems (CDS)	FTA, FHWA and BTS will work with the JPO to conduct national/regional workshops (and supporting virtual events/activities) to elicit stakeholder needs related to data sharing, identify potential approaches to federate data among operational data environments, and summarize findings.
Connected Data Systems (CDS)	FTA, FHWA and BTS will work with the JPO to create a concise online collection of existing policies, principles and real-world examples of successful data management policies and practices.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

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Interoperability

($6,050)
($000)

Program Description:

As ITS evolves from primarily infrastructure systems – for example traffic signal coordination or ramp metering – towards a nationwide or North American, complex "system of systems" including connected and automated vehicles, secure system-wide interoperability becomes far more critical. Incorporating vehicles via Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) – collectively Connected Vehicle (CV) - capabilities offers great promise to improve safety and mobility while reducing environmental impact. However, once vehicles, which can easily travel across North America, become part of the ITS system, multi-regional interoperability becomes a requirement rather than merely a benefit.

The ITS JPO supports interoperability via funding and program execution in cross-modal cooperation with FHWA on V2I deployment, the National Highway Traffic Safety Administration (NHTSA) on V2V rulemaking, as well as, with other surface transportation modes and with state, local, international, industry and academic partners.

The Interoperability budget funds key technical research to advance ITS architecture and standards, cyber security, and human factors guidelines that support efficient, secure large-scale deployment of ITS technologies and regulatory decision-making. Interoperability programs support test beds and pilot deployments and serve to assure a broad, competitive marketplace for ITS equipment and services. The goal of this research is to ensure effective connectivity from the device level to the transportation system level.

Program Objectives:

To develop and evolve a comprehensive National ITS Architecture to support large scale interoperable ITS infrastructure, connected vehicle, and connected automation deployments across the nation – especially across borders with Canada and Mexico (Development); to develop and maintain an inventory of candidate interfaces for standardization and support standards development efforts for interfaces where there is greatest public interest and benefit, including those interfaces required to support regulatory activity (Development); to cooperate internationally, leveraging common interests to reduce US resource requirements, access broader expertise, speed development and harmonize architecture and standards to support an international marketplace for US vendors (Adoption); and to facilitate availability of testing and certification processes and procedures to ensure required interoperability and regulatory compliance (Adoption).

Anticipated Program Activities:

1. Evolution of the National ITS Architecture and software tools to be consistent with ITS infrastructure, connected vehicle and connected automation technological advancements, inclusive of and stakeholder input, and leveraging international cooperation when in the public interest.
2. Detailed IT and ITS standards specifications covering CV architecture developed in resource sharing collaboration with Australia and Europe.
3. Development and updates of key standards to support connected vehicle deployment, leveraging international cooperation when in the public interest.
4. Ongoing support for interoperable architectures with Mexico and Canada to permit North American interoperability for all ITS services and efficient cross-border movement of people and goods.
5. Self-sustaining certification capability for key connected vehicle capabilities.

Expected Program Outcomes:

- Nationwide—especially North American—interoperability for all participants in the ITS system inclusive of vehicles, infrastructure, and mobile devices and applications.
- Architecture and standards tools and solutions that facilitate efficient, effective and secure interoperable ITS infrastructure, connected vehicle and connected automation operations.
- Efficient, standardized sharing of relevant information across transportation network operators, users and stakeholders.
- Greater adoption rates with reduced anxiety over obsolescence.
- Increased harmonization between U.S. and other global ITS architectures and standards, resulting in broader, more efficient markets for vehicles, infrastructure and services.
- Maintenance of the forward and backward interoperability of ITS equipment and reduce need for re-investment over time.

FY 2017 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Interoperability	NHTSA and ITS JPO cooperate to develop, maintain and evolve standards required to support Vehicle-to-Vehicle safety broadcast and associated rulemaking actions.
Interoperability	FHWA and ITS JPO cooperate in identifying, prioritizing and executing Vehicle-to-Infrastructure standards development.
Interoperability	NHTSA, FHWA, FTA, FRA, FMCSA, SLSDC, MARAD, PHMSA and ITS JPO to incorporate all modal stakeholder needs in developing and evolving the integrated National ITS Architecture and software tools to support large scale, interoperable deployment of ITS, connected vehicle and connected automation technology.

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Interoperability	NHTSA and ITS JPO to cooperate in developing heavy-vehicle cybersecurity case studies and best practices.
Interoperability	FHWA and ITS JPO to cooperate on development of a Roadway Infrastructure Cybersecurity Partnership, Alert System, and capability maturity model for deployers and operators.
Interoperability	ITS JPO and the Volpe Center to collaborate on development of a cybersecurity five-year program plan and roadmap.
Interoperability	ITS JPO, FHWA, and NHTSA to cooperate on support to an industry-based certification lab consortium to develop certification test procedures.
Interoperability	ITS JPO and NHTSA to advance human-machine interface guidelines for cooperative ITS technologies.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous broadly attended events including those sponsored by AASHTO, APTA, IEEE, ITE, ITS America, SAE International. The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014. The ITS Architecture program has conducted numerous public workshops to gather input on the architecture and provide deployment support and accepts input via electronic means. The ITS standards program participates in numerous ITS standards working groups comprised of interested stakeholders.

Additionally, the research program managers and the professional capacity building and communications staff routinely host webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Accelerating Deployment

($15,300)
($000)

Program Description:

As new Intelligent Transportation Systems (ITS) technologies and systems evolve into market-ready products, the ITS Accelerating Deployment Program is addressing questions associated with adoption and deployment. The goal of the Accelerating Deployment program is to speed up the transformation of ITS research and prototypes into market-ready technologies that are commercially viable and adopted by the transportation community. This program provides communication and education support to facilitate awareness, understanding, acceptance, adoption, and deployment of ITS technologies across stakeholder groups; and ensures effective partnerships are fostered and developed at various levels – executive, program, and project. The ITS JPO seeks to spur adoption of technology, and help stakeholders and localities deploy maturing ITS systems. The program provides knowledge transfer, and supports technical assistance, training, outreach, program evaluation, and other stakeholder engagement. ITS JPO seeks to advance ITS work from research, to initial adoption, and subsequently on to wider scale deployment in coordination with other stakeholders at the federal, state, regional and local levels.

Program Objectives:

To define collaboration and communication mechanisms and targets to encourage public and private investment (Research); to develop comprehensive cost benefits and analytic tools that allow deployers to understand the financial and operational benefits of new technologies and systems (Development); and to establish the tools that support the new user base (Adoption).

Anticipated Program Activities:

1. Publish final report for Rural Connected Vehicle GAP Analysis.
2. Prepare final report for ICM Independent Evaluation.
3. Prepare publications in Technical Journals for Connected Vehicle outreach support.
4. Prepare 2016 Benefit Cost Lessons Learned Update Report for Evaluation.
5. Research site recommendations for ITS transit technical support.
6. Prepare Presentations, articles, and fact sheets for Mobility Services for All Americans (MSAA) Implementation materials.
7. Conduct MSAA best practices workshops for MSAA Knowledge and Technology Transfer.
8. Conduct CV and AV workshops to increase technical knowledge of connected vehicle and automated vehicle deployers.
9. Create CV Emerging Technologies outreach and training activities.
10. Develop University ITS & Community College ITS Workshops to facilitate deployment of ITS-CV-AV teaching within higher education venues.
11. Conduct stakeholder outreach through workshops and webinars including peer-to-peer events.

Expected Program Outcomes:

- Provide deployment support by assisting with transition planning, training, transition plans, timelines and milestone development.
- Provide communication and education support to facilitate awareness, understanding, acceptance, adoption, and deployment of ITS technologies across all stakeholder groups. Ensure effective partnerships are fostered and developed at various levels – executive, program and project.
- Develop partnerships encompassing a wide range of public and private partners.

FY 2017 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Professional Capacity Building (PCB) Program	NHI (FHWA) and TSI (OST) develop and offer courses on ITS Awareness, ITS National Architecture, Connected Vehicles and other topics.
PCB Program	FHWA, FTA, and FMCSA provide subject matter experts to review training materials and offer course instruction for PCB classes and webinars.
PCB Program	Volpe Center conducts transit standards course development, provides technical assistance for T3 webinar series, and also provides program management and internal collaboration support.
Evaluation Program	Volpe Center conducts evaluation research for JPO.
Mobility Services for All Americans (MSAA)	FTA conducts research, reviews publications, and assists with executing best practices workshops for MSAA.
Communications	FHWA, OST-R, NHTSA and FTA to work with the JPO to develop a redesigned, interactive website that engages external audiences such as ITS stakeholders, interested members of the public, policymakers, and media, and uses new and social media in a graphically appealing and engaging manner to convey the latest information on old ITS technologies.
Communications	All USDOT modes will continue to have a booth presence at key trade shows.
CV Pilot - Deployment Technical Assistance	FHWA and JPO work with the JPO to provide active technical assistance to early deployers of connected vehicle (CV) and other emerging ITS technologies.
CV Pilot - Deployment Technical Assistance	NHTSA, FHWA and FTA work with the JPO to ensure that policy is appropriately represented within the emerging certification test procedures, this project continues the work of the Test Labs and provides the Policy Program and modal partners with an opportunity to ensure the evolving test procedures are in line with policy.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014.

The ITS Professional Capacity Building (PCB) Program's Connected Vehicle (CV) Training and Education Implementation Plan FY2016 – 2020 incorporated input from nearly 200 individual stakeholders on CV training needs.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Advanced Transportation and Congestion Management Technologies Deployment Program

($60,000 total – ITS contribution is $21,000)
($000)

Program Description:

The FAST Act directs the USDOT to establish an advanced transportation and congestion management technologies deployment initiative to provide grants to eligible entities to develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. FHWA will enter into agreements with eligible entities to establish model technology deployment sites.

Per the FAST Act, the $60 million required for this program are carved out of three existing programs in the following amounts: Highway Research and Development ($20 million), Technology and Innovation Deployment ($19 million), and Intelligent Transportation Systems ($21 million) (amounts are estimates subject to change).

Program Objectives:

The technology deployments funded under this program will: reduce costs and improve return on investments; deliver environmental benefits that alleviate congestion and streamline traffic flow; measure and improve the operational performance of the applicable transportation network; reduce the number and severity of traffic crashes and increase driver, passenger, and pedestrian safety; use real-time transportation-related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation; monitor transportation assets to improve infrastructure management, reduce maintenance costs, prioritize investment decisions, and ensure a state of good repair; deliver economic benefits by reducing delays, improving system performance, and providing for the efficient and reliable movement of goods and services; or accelerate the deployment of vehicle-to-vehicle, vehicle-to-infrastructure, autonomous vehicles, and other technologies.

Anticipated Program Activities:

Each fiscal year, FHWA will make no fewer than 5 and no more than 10 awards of up to $12 million individually. Focus areas are identified for each year's solicitation and may include: Transportation Elements Associated with Smart Cities; Systemic Applied Pedestrian Crossing Technology; Multi-modal Integrated Corridor Management (ICM); Traffic Signal Data Acquisition, Analysis, and Management; Unified Fare Collection & Payment System across Transportation Modes and Jurisdictions; Incorporation of Connected Vehicle Technology in Public Sector and First Responder Fleets; Weigh-in-Motion (WIM) Facilities for Advanced Data Collection; and Dynamic Ridesharing.

Expected Program Outcomes:

These model technology deployments will demonstrate how emerging transportation technologies, data, and their applications can be effectively deployed and integrated with existing systems to address transportation challenges.

How does the Program incorporate public and stakeholder input?

The program conducts introductory webinars with stakeholders and prospective applicants after the release of the annual solicitation to describe the program, goals, and the focus areas to help applicants plan their proposals. The technology deployments provide annual reports on meeting their expected outcomes that are used in shaping future program solicitations.

Small Business Innovation Research

$2,000
($000)

Program Description:

The Small Business Innovation Research (SBIR) program is a highly competitive, awards-based program that encourages domestic small businesses to engage in research and development addressing high priority research areas within USDOT. The SBIR program favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, state departments of transportation, USDOT, or other federal agencies.

The program is administered by the Volpe Transportation Center. The SBIR Program Office publishes two solicitations each fiscal year for proposals on specific research topics of interest to USDOT operating administrations, including the FHWA.

Program Objectives:

To encourages small businesses to engage in research or research and development (R/R&D) that has the potential for commercialization and meets Federal R/R&D objectives.

Anticipated Program Activities:

In FY 2017, FHWA plans to continue participating in the USDOT SBIR program solicitation. It is expected that approximately two new topics will be solicited, with two contracts being awarded for feasibility studies (SBIR Phase I). In addition, it is expected that three or more SBIR Phase II contracts will be awarded to continue current Phase I work.

Expected Program Outcomes:

- Increased participation in innovation and entrepreneurship by small businesses and socially and economically disadvantaged persons; and
- Increased private sector commercialization of innovations derived from Federal R&D funding.

How does the Program incorporate public and stakeholder input?

The general public may suggest SBIR topics through the Volpe SBIR website: https://hostedsites.volpe.dot.gov/SBIR/SuggestTopic.aspx

Section 5: FY 2017 ITS JPO Projects
($5.0M or greater)
Fiscal Year 2017
FY 2017 ITS JPO Project Funding Details

RD&T Project Name	FY 2017 Pres. Budget ($000)	FY 2017 Basic	FY 2017 Applied	FY 2017 Development	FY 2017 Technology
ITS-Smart City Challenge	$15,000		$15,000		
ITS-Connected Vehicle Pilots	$8,000		$8,000		
ATCMTD [(1)]	$21,000				$21,000
Totals	**$44,000**		**$23,000**		**$21,000**

(1) Only ITS contribution to ATCMTD program is shown in this table

FY 2017 ITS JPO Project Budget Request by DOT Goal

RD&T Project Name	FY 2017 Pres. Budget ($000)	Safety	State of Good Repair	Economic Competitiveness	Quality of Life in Communities	Environmental Sustainability
ITS-Smart City Challenge	$15,000	$4,500		$4,500	$3,000	$3,000
ITS-Connected Vehicle Pilots	$8,000	$4,000		$4,000		
ATCMTD [(1)]	$21,000	$6,300	$2,100	$4,200	$4,200	$4,200
Totals	**$44,000**	**$14,800**	**$2,100**	**$12,700**	**$7,200**	**$7,200**

(1) Only ITS contribution to ATCMTD program is shown in this table

ITS-Smart City Challenge

$15,000
($000)
8/1/16 – 12/30/20

Project Description:

The Smart City Challenge was launched in December 2015 by USDOT Secretary Anthony Foxx as an innovative competition for cities to reshape their transportation systems by harnessing the power of technology, data and creativity to reimagine how people and goods move throughout cities. The Challenge called on cities to do more than merely introduce new technologies onto city streets, requiring them to boldly envision new solutions that would change the face of transportation in our cities by closing the gap between rich and poor; capturing the needs of both young and old; and bridging the digital divide through smart design so that the future of transportation meets the needs of all city residents.

The USDOT sought bold and innovative ideas for proposed demonstrations to effectively test, evaluate, and demonstrate the significant benefits of smart city concepts. Seventy-eight cities submitted entries to the competition, and in March 2016, seven finalists were selected. These finalists were Austin, Columbus, Denver, Kansas City, Pittsburgh, Portland, and San Francisco. Finalists were awarded $100,000 to develop detailed applications on their proposed plans to conduct a federally funded Smart City Demonstration in their jurisdiction.

In June 2016, Columbus was selected and will receive $40 million from USDOT and $10 million from Paul G. Allen's Vulcan Inc. to supplement the $90 million that the city raised from other private partners to carry out its plan for a Smart City Demonstration. Using these resources, Columbus will work to reshape its transportation system to become part of a fully-integrated city that harnesses the power and potential of data, technology, and creativity to reimagine how people and goods move throughout their city. Columbus' Smart City Demonstration will take place over a four year period. The Smart Columbus Program will pilot projects in four distinct types of districts (residential, commercial, downtown, and logistics). To tackle the challenges faced by each community, the Smart Columbus Program included smart solutions built upon four core-enabling technologies:

1. The **Connected Columbus Transportation Network (CCTN)** will include traffic signals equipped with traffic detection and sensors, dedicated short range communications (DSRC), and pedestrian detection; truck loading zones with machine vision detection of zone availability; multi-function kiosks with transit service information, first/last mile and bike/vehicle sharing information, parking availability, and Wi-Fi hot spots.
2. The **Integrated Data Exchange (IDE)** open data environment will contain data from many different sources; generate performance metrics for program monitoring and evaluation; transparently serve the needs of public agencies, researchers, and

entrepreneurs; provide practical guidance and lessons learned to other potential deployment sites; and assist health and human service organizations.

3. A suite of applications and processes will deliver **Enhanced Human Services (EHS)** to residents and visitors. These applications include a multi-modal trip planning application, a common payment system for all transportation modes, a smartphone application for assistance to persons with disabilities, and integration of travel options at key locations for visitors.
4. Smart Columbus will expand the Smart Grid program and increase **Electric Vehicle (EV) Infrastructure**. The city will install vehicle-to-grid capability for charging stations to manage grid resources, provide assistance and analysis to fleet operators to encourage EV adoption, increase investment in EV charging, create customer education programs, and create an EV cooperative buying program.

Project Objectives:

Through a Cooperative Agreement, the ITS JPO and our Modal partners at USDOT will work with the City of Columbus to implement its Smart Columbus program. The ITS JPO will provide technical assistance to support planning, design, implementation, evaluation, and outreach. The Smart City Challenge has garnered global interest catapulting the U.S. and DOT into a leadership position in the IoT/Smart Cities emerging technology field. This effort will produce a template to inspire duplication throughout the US and globally.

Anticipated Project Activities:

The project will follow a systems engineering process for project development, then will move to build phase, followed by operations and evaluation. FY 2017 will include development of a concept of operations, system requirements and design for 12 vision elements focusing on connected vehicles, automated vehicles, mobility on demand, electrification, and infrastructure communications.

Expected Project Outcomes:

Improve Safety – By using advanced technologies, including connected vehicle technologies, to reduce the number of collisions, fatalities, and injuries for both vehicle occupants and non-vehicle occupants.

Enhance Mobility – By providing real-time traveler information and emerging mobility services to improve personal mobility for all citizens including those with disabilities.

Enhance Ladders of Opportunity – By increasing connectivity to employment, education, services and other opportunities, increase access to digital resources, support workforce development , or contribute to community revitalization, particularly for disadvantaged groups.

Address Climate Change – By implementing advanced technologies and policies that support a more sustainable and cost-effective relationship between transportation and the environment through more efficient fuel use and emissions reductions.

How will the Project be evaluated?

Independent evaluation will be conducted. The evaluation will monitor the impact of the demonstration on mobility, safety, ladders of opportunity, efficiency, clean energy, sustainability, and climate change.

ITS - Connected Vehicle Pilots

$8,000
($000)
9/30/15 – 9/30/18

Project Description:

As our environments become more connected, ITS plays an ever-more important and central role in our cities, towns, suburbs, and rural communities, between regions and across borders. The transportation system as a whole can best serve vital needs when it is using technology to its fullest potential and enabling transportation system managers to effectively "connect the dots" of information from various factors that affect transportation operations (e.g., weather, congestion, accidents, and unanticipated emergencies).

The USDOT has awarded funding to the New York City Department of Transportation; Tampa Hillsborough Expressway Authority (THEA); and ICF/Wyoming for the initial wave of pilots of next-generation connected vehicle technology. The locations were selected in a competitive process to go beyond traditional vehicle technologies to help drivers better use the roadways to get to work and appointments, relieve the stress caused by bottlenecks, and communicate with pedestrians on cell phones of approaching vehicles. These three sites have developed comprehensive deployment plans and will go through a design /test/build phase before running an operational environment. All information from these projects are available publically and used in various training and outreach activities. .

Project Objectives:

The intent of these pilot deployments is to encourage partnerships of multiple stakeholders to deploy applications utilizing data captured from multiple sources across all elements of the surface transportation system to support improved system performance and enhanced performance-based management. The pilot deployments are also expected to support an impact assessment and evaluation effort that will inform a broader cost-benefit assessment of connected vehicle concepts and technologies.

Project Activities:

The three sites collectively envision a broad spectrum of connected vehicle applications driven by the specific needs of each region.

The Wyoming/ICF Pilot aims to reduce the number and severity of adverse weather-related incidents along the I-80 corridor to improve safety and reduce incident-related delays. The pilot is focusing on the needs of commercial vehicle drivers traveling on the Wyoming I-80 east-west corridor, which is critical to commercial heavy-duty vehicles moving across the northern portion of our country. Using vehicle to vehicle (V2V) and vehicle-to-infrastructure (V2I) technology, various vehicle types will transmit and share information such as road weather advisories, roadside alerts, and truck parking information.

The vision of the New York City Pilot is to move toward zero traffic deaths and injuries on city streets. The New York City Department of Transportation is installing V2V technology in up to 10,000 city-owned vehicles, including cars, buses, and limousines, that frequently travel in Midtown Manhattan, as well as V2I technology throughout Midtown. This includes upgrading traffic signals with V2I technology along avenues between 14th Street and 66th Street in Manhattan and throughout Brooklyn. Additionally, roadside units will be equipped with connected vehicle technology along FDR Drive between 50th Street and 90th Street. The connected vehicle applications will notify traveling vehicles and pedestrians of possible collisions.

The Tampa Pilot focuses on reducing congestion and improving pedestrian safety during morning commuting hours. The pilot is deploying various connected vehicle technologies on and near reversible express lanes and three major arterials in downtown Tampa to solve its transportation challenges. Tampa also committed to measuring the environmental benefits of using this technology.

These pilots are being conducted in three phases. The initial 12-month concept development phase for these pilots is complete. This first phase created the foundational plan to enable further design and deployment. Phase 2 is 20 months and involves detailed design and deployment followed by testing to ensure the deployment functions as intended (both technically and institutionally), and Phase 3 is 18 months and focuses on assessing the performance of the deployed system. During post-pilot operations, connected vehicle technology will be integrated into operational practice.

Expected Project Outcomes:

Our nation's transportation system is facing a period of revolutionary changes. The USDOT is investing in the advancement and widespread deployment of innovative and life-saving technologies. This effort is part of the department's larger initiative to improve the future of transportation by moving toward a more intelligent and connected system. With the Connected Vehicle Pilot Deployment Program, the USDOT is now focusing on accelerating the deployment of ITS technology in more regions throughout the nation. The USDOT's expected outcomes for the program are straightforward—advance deployment, measure impact, and uncover and address the technical and non-technical barriers to deployment in a hands-on way.

How will the Project be evaluated?

The Connected Vehicle Pilot Deployment (CVPD) evaluation is planned to assess the three CVPD sites in NYC; Tampa, FL; and Wyoming. The evaluation results will inform prospective deployers of connected vehicle-enabled applications of likely safety, mobility, environmental, and public agency efficiency impacts; quantify costs; and identify practical institutional and financial models for long-term deployment. Additionally, the evaluation results will inform the USDOT on the effectiveness of the CVPD in creating proven and transferable deployment concepts demonstrating measureable short-term impacts and longer-term transformational changes, overcoming deployment challenges, documenting

lessons learned, and accelerating deployment of successful and sustainable connected vehicle applications.

Advanced Transportation and Congestion Management Technologies Deployment

Up to $60,000 per year – ITS contribution is $21,000
($000)
12/4/2016-12/4/2017

Project Description:

As part of the ATCMTD program previously described, the FHWA will enter into agreements with eligible entities to establish model technology deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment.

Per the FAST Act, the $60 million required for this program are carved out of three existing programs in the following amounts: Highway Research and Development ($20 million), Technology and Innovation Deployment ($19 million), and Intelligent Transportation Systems ($21 million) (amounts are estimates subject to change).

Project Objectives:

The technology deployments funded under this program will: reduce costs and improve return on investments; deliver environmental benefits that alleviate congestion and streamline traffic flow; measure and improve the operational performance of the applicable transportation network; reduce the number and severity of traffic crashes and increase driver, passenger, and pedestrian safety; use real-time transportation-related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation; monitor transportation assets to improve infrastructure management, reduce maintenance costs, prioritize investment decisions, and ensure a state of good repair; deliver economic benefits by reducing delays, improving system performance, and providing for the efficient and reliable movement of goods and services; or accelerate the deployment of vehicle-to-vehicle, vehicle-to-infrastructure, autonomous vehicles, and other technologies.

Anticipated Project Activities:

Each fiscal year, FHWA will make no fewer than five and no more than ten awards of up to $12 million individually. Focus areas are identified for each year's solicitation and may include: Transportation Elements Associated with Smart Cities; Systemic Applied Pedestrian Crossing Technology; Analysis, and Management; Incorporation of Connected Vehicle Technology in Public Sector and First Responder Fleets; and Dynamic Ridesharing.

Expected Project Outcomes:

These model technology deployments will demonstrate how emerging transportation technologies, data, and their applications can be effectively deployed and integrated with existing systems to address transportation challenges.

How will the Project be evaluated?

The technology deployments provide annual reports on meeting their expected outcomes that are used in shaping future program solicitations.

Section 6: FY 2018 Outlook

Connected Vehicles

Program Description:

The connected vehicle program, like all ITS research, benefits from the multimodal planning and coordination process utilized by the ITS Joint Program Office. All surface transportation modes participate in the modal Strategic Planning Group (modal associate administrators), with concurrence by the Management Council (comprised of all surface mode administrators, chaired by the Deputy Secretary) to coordinate ITS project funding. Examples of integrated ITS research include the FHWA/FTA joint effort "Accessible Transportation Technologies Research Initiative (ATTRI)", FHWA's "Integrated Corridor Management" and "Deployment Readiness" efforts, and MARAD's "ITS Assessment" etc.

The CV program plans to advance the Department's goal of transferring research results into real world application. Building on over a decade and nearly $600 million in ITS investments, this program will continue to support: the issuance of the NHTSA Vehicle to Vehicle (V2V) rule; the FHWA Vehicle to Infrastructure (V2I) guidance; the development of a scalable operational Security Certification Management System (SCMS) to accommodate tens of millions of vehicles; and expand the deployment of both vehicles and infrastructure through the continued support of the connected vehicle pilots. The primary focus is to spur widespread adoption and deployment of the system nationwide reducing collisions, injuries, and fatalities.

The program will promote technology transfer of over 60 connected vehicle applications, that in addition to promoting safety, also enhance traveler and freight efficiency, address impacts of weather on road transportation, reduce fuel consumption and reduce greenhouse gas and other pollutants. Connected vehicle technology research and development is being leveraged in the USDOT CV pilots in New York City, Tampa, FL and Wyoming. This technology is also being leveraged in the agency's Smart City Challenge efforts and FAST Act Advanced Transportation and Congestion Management Technologies Deployment Program grants.

In addition, this program will commit resources to conduct research to respond to congressional interest in the use of Wi-Fi and Dedicated Short Range Communications spectrum (DSRC) for this collision avoidance technology.

Program Objectives:

To advance knowledge of Connected Vehicle (CV) systems (Research); to collect benefits and costs and implementation lessons learned information from high priority CV applications (Development); and to support State and local, and transit agency integrating CV environment deployments (Adoption).

Anticipated Program Activities:

1. Operate Connected Vehicle Pilot sites in NYC, Tampa, FL and Wyoming.
2. Conduct evaluation to support Connected Vehicle Pilot deployment.
3. Operate SCMS for connected vehicle deployment sites.
4. Prepare Final Report for Heavy Vehicles BSM and implementation issues for deployment.
5. Publish on-board requirements and certification procedures for V2V systems (from NHTSA CAMP SE task).
6. Publish minimum performance requirements and characteristic effectiveness for haptic driver-vehicle interfaces for crash warning systems (from NHTSA Haptic Warning project).

No major changes in program direction are anticipated in FY 2018; program objectives and activities will continue advancing.

Expected Program Outcomes:

- Demonstrations of CV environments that fit into real-world environments of today.
- Real-time and real-world data to help with transportation planning and transportation system operations.
- Increase in safety, mobility, system efficiency and access to resources for disadvantaged groups, and decreases in negative environmental impacts such as vehicle emissions, the need for physical expansion and noise.
- Increased opportunities to partner with non-government groups, such as private industry and universities.
- Decreases in undesirable transportation impacts to the environment and society.
- Reduction of fatalities through weather-related safety, infrastructure-based, and other applications.

FY 2018 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
CV Pilots	FHWA, FTA, FMCSA, NHTSA and Volpe work with the JPO to conduct evaluations of the safety, mobility, environmental and public agency efficiency impacts from the CV Pilot sites.
CV Pilots	FHWA, FTA, FMCSA, NHTSA and Volpe work with the JPO on the CV Pilots operations phase.
Connected Vehicle Policy	FTA and FHWA work with the JPO to assist state and local

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
	transportation agencies with decision-making and prioritization of implementing connected vehicle technologies and systems.
Connected Vehicle Policy	FHWA, FTA and NHTSA work with the JPO to better understand the relationships between connected and automated vehicle systems.
Mobility on Demand (MOD)	FTA and FHWA will work with the JPO to evaluate and analyze Mobility on Demand (MOD) approaches and demonstrations.
Connected Vehicle	NHTSA, FHWA, FTA and OST-R work with the JPO to evaluate the as-built Security Credential Management System (SCMS) and to provide continuing security credential management services to early connected vehicle deployments.
Road Weather Management	FHWA works with the JPO to analyze the effects of weather and road conditions on connected and automated vehicles.
V2X	FTA and FHWA work with the JPO to test market ready Vehicle-to-Pedestrian (V2P) technologies.
Vehicle-to-Infrastructure	FHWA, FTA, FRA and NHTSA work with the JPO to enable the V2I Deployment Coalition to work collaboratively with industry, state and local governments, academia and USDOT to achieve the goal of deploying and operating a functioning CV environment.
Vehicle-to-Infrastructure	FHWA, FTA and FRA work with the JPO on the Multi-Modal Intelligent Traffic Signal System (MMITSS) which focuses on the interaction of traffic as it moves between arterials and freeway.
Connected Vehicle	FTA, NHTSA and FMCSA work with the JPO to integrate unequipped vehicles and vulnerable road users into the CV environment.
Vehicle-to-Infrastructure	FHWA works with the JPO to ensure the V2I infrastructure components are accurately addressed in the Connected Vehicle Reference Implementation Architecture (CVRIA).

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 ITS Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Connected Vehicle Pilots: in 2015 and 2016, the ITS JPO held 12 public webinars and four webinars that were open only to the three pilot sites. Since 2014, the ITS JPO has held more than 18 webinars on CV Pilots.

Automated Vehicles

Program Description:

The development of Automated Vehicles (AV) technology is occurring at a rapid pace, with industry investing billions of dollars a year. Several states have enacted legislation regarding AV and testing is currently occurring on public roads. Partially automated vehicles are already available in the market today and heavy vehicle automation technologies are approaching commercialization. The speeds of these developments are challenging our existing regulatory frameworks and significant Federal investment is required to ensure the safe development and deployment of this technology.

Recognizing the importance of these advancements, the USDOT is playing a significant role in addressing the key technological and institutional barriers that have emerged. In early 2016, National Highway Traffic Safety Administration (NHTSA) announced its intention to develop operational guidance, model state policy, and identify potential new authorities needed for automation. In addition, the topic of urban automation was the highest of twelve priority areas for the 2016 Smart City Challenge. The development and adoption of safe vehicle automation through real-world pilot projects like the Smart City Challenge and the FAST Act ATCMTD Program grants would enable the USDOT to engage and catch up with other international activities. A key component of our Smart City Challenge includes investigating the impact of automated vehicle technology on mobility, safety and sustainability.

Program Objectives:

To define the core elements and the performance criteria for automation (Research); to test automation components in the Smart City Challenge and FAST Act Advanced Transportation and Congestion Management Technologies Deployment Program grants, as well as in other test situations (Development); and to define the Federal role in facilitating and encouraging deployment of automated systems (Adoption).

Anticipated Program Activities:

1. Advance the state-of-the-practice for understanding the impacts of AVs on congestion, personal mobility, and travel behavior.
2. Analyze the effects of weather and road conditions on automated vehicles and provide a document to support USDOT (JPO, FHWA, NHTSA), transportation agencies, and OEM decision-making and policy making.
3. Identify policy areas that require Federal government involvement and where policies may need to be revised or developed to support the safe deployment of automated vehicles.
4. Improve the safety of automated mixed function vehicles by ensuring that automated vehicle intent and status indications facilitate the decision processes of other road users including nearby drivers, vehicles, pedestrians, and automated vehicle operators.

5. Increase understanding of human factors related issues for vehicle automation, data and results to support Office of Operations' vehicle automation application research activities, information for standards development (e.g., SAE) and potential NHTSA performance requirements activities.
6. Begin testing and safety review of first mile/last mile driverless shuttle vehicles
7. Begin on-road demonstration of arterial truck platooning.

No major changes in program direction are anticipated in FY 2018; program objectives and activities will continue advancing.

Expected Program Outcomes:

- Provide guidance to State and local agencies to help the understanding of impacts of automated vehicles on the assets they manage.
- Expand the reach of transportation modes to disabled and older users and provide "last mile" connectivity services for all users.
- Increase the efficiency and effectiveness of existing transportation systems.
- Reduce the number and severity of crashes caused by drivers or by other conditions (e.g. weather, pedestrians, and roadway conditions).
- Reduce incidence of aggressive driving.

FY 2018 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Automated Vehicles (AV)	NHTSA conducts research for JPO on AV human factors, functional safety, test procedures, and cybersecurity.
Automated Vehicles	FHWA conducts research for JPO on AV human factors, technology and applications for connected automation, weather impacts, and accessibility.
Automated Vehicles	FMCSA provides requirements and oversight to JPO research on AV implications for Federal Motor Carrier Safety Regulations and prototype port applications.
Automated Vehicles	FTA provides requirements and oversight to JPO on first mile/last mile service and other Smart City AV applications.
Automated Vehicles	Volpe Center conducts AV policy and benefits research for JPO and also provides program management and internal collaboration support.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 ITS Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Emerging Technology

Program Description:

The United States Department of Transportation (USDOT) emerging capabilities program focuses on cultivating the next generation of transportation systems. As the scale of intelligent transportation systems (ITS) increases, vehicle manufacturers, infrastructure providers, innovators, and entrepreneurs discover new opportunities to use technology and the data that will be generated. Technological advances, new functionality, new applications, new operational concepts, and disruptive innovations result. The USDOT needs to track technological, market, and demographic trends throughout the globe and across industries to seek, evaluate, and sometimes incubate emerging capabilities that demonstrate the potential to transform transportation. As this happens, the USDOT will be positioned and engaged as a partner to guide research, development, and technology adoption in a systematic manner.

An example of a major initiative in Emerging Capabilities is the USDOT's Beyond Traffic: Smart City Challenge. The Smart City Challenge was launched in December 2015 by USDOT Secretary Anthony Foxx as an innovative competition for cities to reshape their transportation systems, harnessing the power of technology, data, and creativity to reimagine how people and goods move throughout cities. The Challenge called on cities to do more than merely introduce new technologies onto city streets, requiring them to boldly envision new solutions that would change the face of transportation in our cities by closing the gap between rich and poor; capturing the needs of both young and old; and bridging the digital divide through smart design so that the future of transportation meets the needs of all city residents.

The USDOT sought bold and innovative ideas for proposed demonstrations to effectively test, evaluate, and demonstrate the significant benefits of smart city concepts. Seventy-eight cities submitted entries to the competition, and in March 2016, seven finalists were selected. The finalists included Austin, Columbus, Denver, Kansas City, Pittsburgh, Portland, and San Francisco. In June 2016, Columbus was selected and the ITS JPO will work with the City of Columbus to implement its Smart Columbus program.

Program Objectives:

To establish ways to use new technologies and decision support tools for real-time needs, and to meet longer-term public policy objectives (Research); and to integrate the operational characteristics of new technologies into CV, AV, and legacy systems and applications (Development).

Anticipated Program Activities:

1. Conduct a demonstration and evaluation with Columbus, Ohio to test, evaluate and demonstrate the benefits of connected city concepts.
2. Develop, test and deliver three prototype applications for the Accessible Transportation Technologies Research Initiative (ATTRI).

3. Identify truck port staging, queuing and access technology applications and approaches for the ITS MARAD Program.

Expected Program Outcomes:

- Forge stronger relationships and partnerships with private industry and universities.
- Increase ability to adapt existing or upcoming program to accommodate new ITS technologies.
- Stimulate economic growth through innovation and technological leadership.

FY 2018 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Accessible Transportation Technologies Research Initiative (ATTRI)	Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) will work with the JPO on developing three prototype applications for ATTRI.
Smart City Challenge	OST, FHWA, FTA, FMCSA, NHTSA, MARAD, FRA work with the JPO to conduct the demonstration and evaluation of the Smart City winner to test, evaluate and demonstrate the benefits of connected city concepts.
ITS MARAD	MARAD, FHWA and FMCSA works with the JPO in a three-phased effort to incorporate maritime port ITS needs into current and existing ITS JPO research, including a project related to low speed automated truck queuing at ports and warehouses.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 ITS Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Enterprise Data

Program Description:

The ITS Joint Program Office (JPO)'s Enterprise Data program focuses on enabling effective data capture from ITS-enabled technologies, including Connected Vehicles (CV) (automobiles, transit, and commercial vehicles), Automated Vehicles, Smart Cities, mobile devices, and infrastructure in ways that protect the privacy of users while exchanging and utilizing real-time data. In addition, these activities focus on the creation of open source data environments that enable integration and sharing of open and protected data from multiple sources for use in transportation research, management, and performance measurement.

These efforts aim to establish a data system foundation for agility, data sharing, and privacy protection for future ITS, Internet of Things, and Smart City developments. This includes demonstrating how sharing streaming and archived data from connected and automated vehicles and combining it with other data sources can fuel innovative public and private transportation services, such as mobility on demand and urban freight and logistic services, and accelerate research and deployment.

The vision of the Enterprise Data Program is that State DOTs and Metropolitan Planning Organizations (MPOs) will have access to low cost, scalable, interoperable data management tools that can ingest new data sources and feed new applications in ways that protect the privacy of users while enabling on-demand data sharing at regional and national levels.

Concurrently, the program will investigate demand for accessing streaming data from the CV environment and other emerging ITS data sources as well as archiving these data for future research and other uses. The result will be a national strategy for sharing and archiving these data which accounts for public, commercial, and academic sector needs.

Program Objectives:

To integrate new data sets with other legacy data management systems (Research); to identify a model for data management and ownership (Development); and to enable new business relationships between the public and private section to ensure privacy protection

Anticipated Program Activities:

1. Identify opportunities to integrate CV data and enhanced data collection into transportation management systems for integrated big data in operational practice.
2. Conduct privacy analysis of data sets and environments for connected vehicle data privacy investigation.
3. Enhance de-identification procedures for connected vehicle data privacy investigation.
4. Prepare final report for data challenges.

5. Conduct national/regional workshops (and supporting virtual events/activities) to elicit stakeholder needs related to data sharing, identify potential approaches to federate data among operational data environments, and summarize findings.
6. Engage state and local agencies regarding the value of sharing data among multiple Operational Data Environments (ODEs), develop use cases for sharing real-time data among ODEs as well as finding regional/national uses of the data, development of institutional, financial, and technical products useful to encouraging efficient data sharing across jurisdictions and functional boundaries in the surface transportation system.

No major changes in program direction are anticipated in FY 2018; program objectives and activities will continue advancing.

Expected Program Outcomes:

- Improve quality (accuracy and timeliness) of data.
- Increase efficiency of information sharing. Assuring the public that the privacy of data will be protected.
- Efficiently manage large datasets.
- Stimulate innovation in new applications by enabling research.
- Monitor performance and enabling more efficient responses.

FY 2018 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Connected Data Systems (CDS)	FHWA and FTA work with the JPO to provide specialized technical support to the CDS Program in the area of modern software development tools and methods.
Connected Data Systems (CDS)	OST, FHWA and FTA work with the JPO to jumpstart the ecosystem of third party development around the data made available through the USDOT's Smart City Challenge.
Connected Data Systems (CDS)	NHTSA, FHWA and OST work with the JPO to create operational procedures and open source algorithms for real-time connected vehicle data de-identification.
Connected Data Systems (CDS)	FTA, FHWA and BTS work with the JPO to develop the Concept of Operations (ConOps) for the sharing (or federation) of data among multiple ODEs, namely: ingesting data collected by local ODEs, coordination data feeds among local ODEs, and merging/sharing the data for use on a state-wide or multi-state corridor level.
Connected Data Systems (CDS)	FTA and FHWA will work with the JPO to investigate use of new approaches to provide secure, revocable access to large and sensitive data sets in a secure enclave along with algorithms and shared computing resources approaches within the transportation sector to accelerate research into the safety of autonomous vehicles and other emerging technologies using

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
	cutting edge, re-usable analysis tools.
Connected Data Systems (CDS)	FTA, FHWA and BTS will work with the JPO to conduct national/regional workshops (and supporting virtual events/activities) to elicit stakeholder needs related to data sharing, identify potential approaches to federate data among operational data environments, and summarize findings.
Connected Data Systems (CDS)	FTA, FHWA and BTS will work with the JPO to create a concise online collection of existing policies, principles and real-world examples of successful data management policies and practices.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 ITS Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Interoperability

Program Description:

As ITS evolves from primarily infrastructure systems – for example traffic signal coordination or ramp metering – towards a nationwide or North American, complex "system of systems" including connected and automated vehicles, secure system-wide interoperability becomes far more critical. Incorporating vehicles via Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) – collectively Connected Vehicle (CV) - capabilities offers great promise to improve safety and mobility while reducing environmental impact. However, once vehicles, which can easily travel across North America, become part of the ITS system, multi-regional interoperability becomes a requirement rather than merely a benefit.

The ITS JPO supports interoperability via funding and program execution in cross-modal cooperation with FHWA on V2I deployment, the National Highway Traffic Safety Administration (NHTSA) on V2V rulemaking, as well as, with other surface transportation modes and with state, local, international, industry and academic partners.

The Interoperability budget funds key technical research to advance ITS architecture and standards, cyber security and human factors guidelines that support efficient, secure large-scale deployment of ITS technologies and regulatory decision-making. Interoperability programs support test beds and pilot deployments and serve to assure a broad, competitive marketplace for ITS equipment and services. The goal of this research is to ensure effective connectivity from the device level to the transportation system level.

Program Objectives:

To develop and evolve a comprehensive National ITS Architecture to support large scale interoperable ITS infrastructure, connected vehicle and connected automation deployments across the nation – especially across borders with Canada and Mexico (Development); to develop and maintain an inventory of candidate interfaces for standardization and support standards development efforts for interfaces where there is greatest public interest and benefit, including those interfaces required to support regulatory activity (Development); to cooperate internationally, leveraging common interests to reduce US resource requirements, access broader expertise, speed development and harmonize architecture and standards to support an international marketplace for US vendors (Adoption); and to facilitate availability of testing and certification processes and procedures to ensure required interoperability and regulatory compliance (Adoption).

Anticipated Program Activities:

1. Evolution of the National ITS Architecture and software tools to be consistent with ITS infrastructure, connected vehicle and connected automation technological

advancements, inclusive of and stakeholder input, and leveraging international cooperation when in the public interest.
2. Development and updates of key standards to support connected vehicle deployment, leveraging international cooperation when in the public interest.
3. Resource sharing, internationally cooperative efforts to evolve CV certification and testing capabilities and security policies.
4. Ongoing support for interoperable architectures with Mexico and Canada to permit North American interoperability for all ITS services and efficient cross-border movement of people and goods.
5. Self-sustaining certification capability for key connected vehicle capabilities.

No major changes in program direction are anticipated in FY 2018; program objectives and activities will continue advancing.

Expected Program Outcomes:

- Nationwide—especially North American—interoperability for all participants in the ITS system inclusive of vehicles, infrastructure, and mobile devices and applications.
- Architecture and standards tools and solutions that facilitate efficient, effective and secure interoperable ITS infrastructure, connected vehicle and connected automation operations.
- Efficient, standardized sharing of relevant information across transportation network operators, users and stakeholders.
- Greater adoption rates with reduced anxiety over obsolescence.
- Increased harmonization between U.S. and other global ITS architectures and standards, resulting in broader, more efficient markets for vehicles, infrastructure and services.
- Maintenance of the forward and backward interoperability of ITS equipment and reduce need for re-investment over time.

FY 2018 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Interoperability	NHTSA and ITS-JPO cooperate to develop, maintain and evolve standards required to support Vehicle-to-Vehicle safety broadcast and associated rulemaking actions.
Interoperability	FHWA and ITS-JPO cooperate in identifying, prioritizing and executing Vehicle-to-Infrastructure standards development.
Interoperability	NHTSA, FHWA, FTA, FRA, FMCSA, SLSDC, MARAD, PHMSA and ITS-JPO to incorporate all modal stakeholder needs in developing and evolving the integrated National ITS Architecture and software tools to support large scale, interoperable deployment of ITS, connected vehicle and connected automation technology.
Interoperability	NHTSA and ITS JPO to cooperate in developing heavy-vehicle

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
	cybersecurity case studies and best practices.
Interoperability	FHWA and ITS JPO to cooperate on development of a Roadway Infrastructure Cybersecurity Partnership, Alert System, and capability maturity model for deployers and operators.
Interoperability	ITS JPO and the Volpe Center to collaborate on development of a cybersecurity five-year program plan and roadmap.
Interoperability	ITS JPO, FHWA, and NHTSA to cooperate on support to an industry-based certification lab consortium to develop certification test procedures.
Interoperability	ITS JPO and NHTSA to advance human-machine interface guidelines for cooperative ITS technologies.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous broadly attended events including those sponsored by AASHTO, APTA, IEEE, ITE, ITS America, SAE International. The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014. The ITS Architecture program has conducted numerous public workshops to gather input on the architecture and provide deployment support and accepts input via electronic means. The ITS standards program participates in numerous ITS standards working groups comprised of interested stakeholders.

Additionally, the research program managers and the professional capacity building and communications staff routinely host webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Accelerating Deployment

Program Description:

As new Intelligent Transportation Systems (ITS) technologies and systems evolve into market-ready products, the ITS Accelerating Deployment Program is addressing questions associated with adoption and deployment. The goal of the Accelerating Deployment program is to speed up the transformation of ITS research and prototypes into market-ready technologies that are commercially viable and adopted by the transportation community. This program provides communication and education support to facilitate awareness, understanding, acceptance, adoption, and deployment of ITS technologies across stakeholder groups; and ensures effective partnerships are fostered and developed at various levels – executive, program, and project. We seek to spur adoption of technology, and help stakeholders and localities deploy maturing ITS systems. ITS JPO provides knowledge transfer, and supports technical assistance, training, outreach, program evaluation, and other stakeholder engagement. ITS JPO seeks to advance ITS work from research, to initial adoption, and subsequently on to wider scale deployment in coordination with other stakeholders at the federal, state, regional and local levels.

Program Objectives: To define collaboration and communication mechanisms and targets to encourage public and private investment (Research); to develop comprehensive cost benefits and analytic tools that allow deployers to understand the financial and operational benefits of new technologies and systems (Development); and to establish the tools that support the new user base (Adoption).

Anticipated Program Activities:

1. Prepare publications in Technical Journals for Connected Vehicle (CV) outreach support.
2. Research site recommendations for ITS transit technical support.
3. Conduct CV and AV workshops to increase technical knowledge of connected vehicle and automated vehicle deployers.
4. Create Emerging Technologies outreach and training activities.
5. Develop University ITS & Community College ITS Workshops to facilitate deployment of ITS-CV-AV teaching within higher education venues.
6. Conduct stakeholder outreach through workshops and webinars including peer-to-peer events.
7. Provide active technical assistance to early deployers of CV and other emerging ITS technologies.

No major changes in program direction are anticipated in FY 2018; program objectives and activities will continue advancing.

Expected Program Outcomes:

- Provide deployment support by assisting with transition planning, training, transition plans, timelines and milestone development.

- Provide communication and education support to facilitate awareness, understanding, acceptance, adoption, and deployment of ITS technologies across all stakeholder groups. Ensure effective partnerships are fostered and developed at various levels – executive, program and project.
- Develop partnerships encompassing a wide range of public and private partners.

FY 2018 Collaboration Partners (Internal USDOT)

Program Name	Name of Collaboration Partner(s) (Internal USDOT)
Professional Capacity Building (PCB) Program	NHI (FHWA) and TSI (OST) develop and offer courses on ITS Awareness, ITS National Architecture, Connected Vehicles and other topics.
PCB Program	FHWA, FTA, and FMCSA provide subject matter experts to review training materials and offer course instructors for PCB classes and webinars.
PCB Program	Volpe Center conducts transit standards course development, provides technical assistance for T3 webinar series, and also provides program management and internal collaboration support.
Evaluation Program	Volpe Center conducts evaluation research for JPO.
Communications	FHWA, OST-R, NHTSA and FTA to work with the JPO to develop a redesigned, interactive website that engages external audiences such as ITS stakeholders, interested members of the public, policymakers, and media, and uses new and social media in a graphically appealing and engaging manner to convey the latest information on old ITS technologies.
Communications	All USDOT modes will continue to have a booth presence at key trade shows.
CV Pilot - Deployment Technical Assistance	FHWA and JPO work with the JPO to provide active technical assistance to early deployers of connected vehicle (CV) and other emerging ITS technologies.
CV Pilot - Deployment Technical Assistance	NHTSA, FHWA and FTA work with the JPO to ensure that policy is appropriately represented within the emerging certification test procedures, this project continues the work of the Test Labs and provides the Policy Program and modal partners with an opportunity to ensure the evolving test procedures are in line with policy.

How does the Program meet statutory requirements?

This program is authorized in sections 512 to 518 of Title 23, United States Code.

How does the Program incorporate public and stakeholder input?

The 2015-2019 Strategic Plan incorporated public and stakeholder (including external and internal partners) input from over 700 stakeholders: the JPO hosted three series of webinars; over 286 different organizations participated in the development of the plan; public meetings for stakeholder input were held at numerous national annual meetings, including the National Rural ITS Annual Meeting (NRITS), the Institute for Transportation Engineers Annual Meeting (ITE), ITS American Annual Meeting, IEEE (formally known as the Institute for Electrical and Electronics Engineers) and the Connected Vehicle Trade Association (CVTA). The ITS Strategic Plan has had 8,500 visitors since it was published on line in 2014.

The ITS Professional Capacity Building (PCB) Program's Connected Vehicle (CV) Training and Education Implementation Plan FY2016 – 2020 incorporated input from nearly 200 individual stakeholders on CV training needs.

Additionally, the research program managers and the professional capacity building and communications staff routinely host a multitude of webinars; utilize social media (email and Twitter); issue publications; and speak at conferences and events.

Advanced Transportation and Congestion Management Technologies Deployment Program

Program Description:

The FAST Act directs the USDOT to establish an advanced transportation and congestion management technologies deployment initiative to provide grants to eligible entities to develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. FHWA will enter into agreements with eligible entities to establish model technology deployment sites.

Per the FAST Act, the $60 million required for this program are carved out of three existing programs in the following amounts: Highway Research and Development ($20 million), Technology and Innovation Deployment ($19 million), and Intelligent Transportation Systems ($21 million) (amounts are estimates subject to change).

The program solicitation in FY 2018 will have adjusted focus areas to reflect then-current USDOT priorities.

Program Objectives:

The technology deployments funded under this program will: reduce costs & improve return on investments; deliver environmental benefits that alleviate congestion & streamline traffic flow; measure & improve the operational performance of the applicable transportation network; reduce the number & severity of traffic crashes & increase driver, passenger, & pedestrian safety; use real-time transportation-related information to improve mobility, reduce congestion, & provide for more efficient & accessible transportation; monitor transportation assets to improve infrastructure management, reduce maintenance costs, prioritize investment decisions, & ensure a state of good repair; deliver economic benefits by reducing delays, improving system performance, & providing for the efficient & reliable movement of goods & services; or accelerate the deployment of vehicle-to-vehicle, vehicle-to-infrastructure, autonomous vehicles, & other technologies.

Anticipated Program Activities:

Each fiscal year, FHWA will make no fewer than 5 and no more than 10 awards of up to $12 million individually. Focus areas are identified for each year's solicitation and may include: Transportation Elements Associated with Smart Cities; Systemic Applied Pedestrian Crossing Technology; Multi-modal Integrated Corridor Management (ICM); Traffic Signal Data Acquisition, Analysis, and Management; Unified Fare Collection & Payment System across Transportation Modes and Jurisdictions; Incorporation of Connected Vehicle Technology in Public Sector and First Responder Fleets; Weigh-in-Motion (WIM) Facilities for Advanced Data Collection; and Dynamic Ridesharing.

Expected Program Outcomes:

These model technology deployments will demonstrate how emerging transportation technologies, data, and their applications can be effectively deployed and integrated with existing systems to address transportation challenges.

How does the Program incorporate public and stakeholder input?

The program conducts introductory webinars with stakeholders and prospective applicants after the release of the annual solicitation to describe the program, goals, and the focus areas to help applicants plan their proposals. The technology deployments provide annual reports on meeting their expected outcomes that are used in shaping future program solicitations.

Small Business Innovation Research

Program Description:

The Small Business Innovation Research (SBIR) program is a highly competitive, awards-based program that encourages domestic small businesses to engage in research and development addressing high priority research areas within USDOT. The SBIR program favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, state departments of transportation, USDOT, or other federal agencies.

The program is administered by the Volpe Transportation Center. The SBIR Program Office publishes two solicitations each fiscal year for proposals on specific research topics of interest to USDOT operating administrations, including the FHWA.

Program Objectives:

To encourages small businesses to engage in research or research and development (R/R&D) that has the potential for commercialization and meets Federal R/R&D objectives.

Anticipated Program Activities:

In FY 2018, FHWA plans to continue participating in the USDOT SBIR program solicitation. It is expected that approximately two new topics will be solicited, with two contracts being awarded for feasibility studies (SBIR Phase I). In addition, it is expected that two or more SBIR Phase II contracts will be awarded to continue current Phase I work.

Expected Program Outcomes:

- Increased participation in innovation and entrepreneurship by small businesses and socially and economically disadvantaged persons; and
- Increased private sector commercialization of innovations derived from Federal R&D funding.

How does the Program incorporate public and stakeholder input?

The general public may suggest SBIR topics through the Volpe SBIR website: https://hostedsites.volpe.dot.gov/SBIR/SuggestTopic.aspx

Section 7: FY 2018 ITS JPO Projects
($5.0M or greater)
Fiscal Year 2018

ITS-Smart City Challenge

8/1/16 – 12/30/20

Project Description:

The Smart City Challenge was launched in December 2015 by USDOT Secretary Anthony Foxx as an innovative competition for cities to reshape their transportation systems harnessing the power of technology, data and creativity to reimagine how people and goods move throughout cities. The Challenge called on cities to do more than merely introduce new technologies onto city streets, requiring them to boldly envision new solutions that would change the face of transportation in our cities by closing the gap between rich and poor; capturing the needs of both young and old; and bridging the digital divide through smart design so that the future of transportation meets the needs of all city residents.

The USDOT sought bold and innovative ideas for proposed demonstrations to effectively test, evaluate, and demonstrate the significant benefits of smart city concepts. Seventy-eight cities submitted entries to the competition, and in March 2016, seven finalists were selected. These finalists were Austin, Columbus, Denver, Kansas City, Pittsburgh, Portland, and San Francisco. Finalists were awarded $100,000 to develop detailed applications on their proposed plans to conduct a federally funded Smart City Demonstration in their jurisdiction.

In June 2016, Columbus was selected and will receive $40 million from USDOT and $10 million from Paul G. Allen's Vulcan Inc. to supplement the $90 million that the city raised from other private partners to carry out its plan for a Smart City Demonstration. Using these resources, Columbus will work to reshape its transportation system to become part of a fully-integrated city that harnesses the power and potential of data, technology, and creativity to reimagine how people and goods move throughout their city. Columbus' Smart City Demonstration will take place over a four year period. The Smart Columbus Program will pilot projects in four distinct types of districts (residential, commercial, downtown, and logistics). To tackle the challenges faced by the community, the Smart Columbus Program included smart solutions built upon four core-enabling technologies:

1. The **Connected Columbus Transportation Network (CCTN)** will include traffic signals equipped with traffic detection and sensors, dedicated short range communications (DSRC), and pedestrian detection; truck loading zones with machine vision detection of zone availability; multi-function kiosks with transit service information, first/last mile and bike/vehicle sharing information, parking availability, and Wi-Fi hot spots.

2. The **Integrated Data Exchange (IDE)** open data environment will contain data from many different sources; generate performance metrics for program monitoring and evaluation; transparently serve the needs of public agencies, researchers, and entrepreneurs; provide practical guidance and lessons learned to other potential deployment sites; and assist health and human service organizations.
3. A suite of applications and processes will deliver **Enhanced Human Services (EHS)** to residents and visitors. These applications include a multi-modal trip planning application, a common payment system for all transportation modes, a smartphone application for assistance to persons with disabilities, and integration of travel options at key locations for visitors.
4. Smart Columbus will expand the Smart Grid program and increase **Electric Vehicle (EV) Infrastructure**. The city will install vehicle-to-grid capability for charging stations to manage grid resources, provide assistance and analysis to fleet operators to encourage EV adoption, increase investment in EV charging, create customer education programs, and create an EV cooperative buying program.

Project Objectives:

Through a Cooperative Agreement the ITS JPO and our Modal partners at USDOT will work with the City of Columbus to implement its Smart Columbus program. The ITS JPO will provide technical assistance to support planning, design, implementation, evaluation, and outreach. The Smart City challenge has garnered global interest catapulting the U.S. and DOT into a leadership position in the IoT/Smart Cities emerging technology field. This effort will produce a template to inspire duplication throughout the US and globally.

Anticipated Project Activities:

The project will follow a systems engineering process for project development, then will move to build phase, followed by operations and evaluation. FY 2018 will include testing and deployment of ITS technology for 12 vision elements focusing on connected vehicles, automated vehicles, mobility on demand, electrification, and infrastructure communications.

Expected Project Outcomes:

Improve Safety – By using advanced technologies, including connected vehicle technologies, to reduce the number of collisions, fatalities, and injuries for both vehicle occupants and non-vehicle occupants.

Enhance Mobility – By providing real-time traveler information and emerging mobility services to improve personal mobility for all citizens including those with disabilities.

Enhance Ladders of Opportunity – By increasing connectivity to employment, education, services and other opportunities, increase access to digital resources, support workforce development , or contribute to community revitalization, particularly for disadvantaged groups.

Address Climate Change – By implementing advanced technologies and policies that support a more sustainable and cost-effective relationship between transportation and the environment through more efficient fuel use and emissions reductions.

How will the Project be evaluated?

Independent evaluation will be conducted. The evaluation will monitor the impact of the demonstration on mobility, safety, ladders of opportunity, efficiency, clean energy, sustainability, and climate change.

ITS- Connected Vehicle Pilots
9/30/15 – 9/30/18

Project Description:

As our environments become more connected, ITS plays an ever-more important and central role in our cities, towns, suburbs, and rural communities, between regions and across borders. The transportation system as a whole can best serve vital needs when it is using technology to its fullest potential and enabling transportation system managers to effectively "connect the dots" of information from various factors that affect transportation operations (e.g., weather, congestion, accidents, and unanticipated emergencies).

The USDOT has awarded funding to the New York City Department of Transportation; Tampa Hillsborough Expressway Authority (THEA); and ICF/Wyoming for the initial wave of pilots of next-generation connected vehicle technology. The locations were selected in a competitive process to go beyond traditional vehicle technologies to help drivers better use the roadways to get to work and appointments, relieve the stress caused by bottlenecks, and communicate with pedestrians on cell phones of approaching vehicles. These three sites have developed comprehensive deployment plans and will go through a design/test/build phase before running an operational environment. All information from these projects are available publically and used in various training and outreach activities.

Project Objectives:

The intent of these pilot deployments is to encourage partnerships of multiple stakeholders to deploy applications utilizing data captured from multiple sources across all elements of the surface transportation system to support improved system performance and enhanced performance-based management. The pilot deployments are also expected to support an impact assessment and evaluation effort that will inform a broader cost-benefit assessment of connected vehicle concepts and technologies.

Project Activities:

The three sites collectively envision a broad spectrum of connected vehicle applications driven by the specific needs of each region.

The Wyoming/ICF Pilot aims to reduce the number and severity of adverse weather-related incidents along the I-80 corridor to improve safety and reduce incident-related delays. The pilot is focusing on the needs of commercial vehicle drivers traveling on the Wyoming I-80 east-west corridor, which is critical to commercial heavy-duty vehicles moving across the northern portion of our country. Using vehicle to vehicle (V2V) and vehicle-to-infrastructure (V2I) technology, various vehicle types will transmit and share information such as road weather advisories, roadside alerts, and truck parking information.

The vision of the New York City Pilot is to move toward zero traffic deaths and injuries on city streets. The New York City Department of Transportation is installing V2V technology

in up to 10,000 city-owned vehicles, including cars, buses, and limousines, that frequently travel in Midtown Manhattan, as well as V2I technology throughout Midtown. This includes upgrading traffic signals with V2I technology along avenues between 14th Street and 66th Street in Manhattan and throughout Brooklyn. Additionally, roadside units will be equipped with connected vehicle technology along the FDR Drive between 50th Street and 90th Street. The connected vehicle applications will notify traveling vehicles and pedestrians of possible collisions.

The Tampa Pilot focuses on reducing congestion and improving pedestrian safety during morning commuting hours. The pilot is deploying various connected vehicle technologies on and near reversible express lanes and three major arterials in downtown Tampa to solve its transportation challenges. Tampa also committed to measuring the environmental benefits of using this technology.

These pilots are being conducted in three phases. The initial 12-month concept development phase for these pilots is complete. This first phase created the foundational plan to enable further design and deployment. Phase 2 is 20 months and involves detailed design and deployment followed by testing to ensure the deployment functions as intended (both technically and institutionally), and Phase 3 is 18 months and focuses on assessing the performance of the deployed system. During post-pilot operations, connected vehicle technology will be integrated into operational practice.

Expected Project Outcomes:

Our nation's transportation system is facing a period of revolutionary changes. The USDOT is investing in the advancement and widespread deployment of innovative and life-saving technologies. This effort is part of the department's larger initiative to improve the future of transportation by moving toward a more intelligent and connected system. With the Connected Vehicle Pilot Deployment Program, the USDOT is now focusing on accelerating the deployment of ITS technology in more regions throughout the nation. The USDOT's expected outcomes for the program are straightforward—advance deployment, measure impact, and uncover and address the technical and non-technical barriers to deployment in a hands-on way.

How will the Project be evaluated?

The Connected Vehicle Pilot Deployment (CVPD) evaluation is planned to assess the three CVPD sites in NYC; Tampa, FL; and Wyoming. The evaluation results will inform prospective deployers of connected vehicle-enabled applications of likely safety, mobility, environmental, and public agency efficiency impacts; quantify costs; and identify practical institutional and financial models for long-term deployment. Additionally, the evaluation results will inform the USDOT on the effectiveness of the CVPD in creating proven and transferable deployment concepts demonstrating measureable short-term impacts and longer-term transformational changes, overcoming deployment challenges, documenting lessons learned, and accelerating deployment of successful and sustainable connected vehicle applications.