United States Department of Transportation
Annual Modal Research Plans FY 2024
Program Outlook FY 2025

Cover Page

Intelligent Transportation Systems Joint Program Office (ITS JPO)
June 29, 2023
Update: August 25, 2023
Egan Smith, Acting Director

Executive Summary

The Intelligent Transportation Systems (ITS) Joint Program Office (JPO) was created through 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 ITS Program is designed to facilitate the deployment of technology to enhance the efficiency, safety, and convenience of surface transportation resulting in improved access, saved lives and time, and increased productivity. The ITS Program continues to address Congressional goals for transportation and technology under the new Bipartisan Infrastructure Law (BIL).

The mission of the U.S. Department of Transportation (USDOT) is to deliver the world's leading transportation system, serving the American people and economy through the safe, efficient, sustainable, and equitable movement of people and goods. The ITS JPO serves as the USDOT's multi-modal technology research program, working toward improving transportation safety, mobility, and efficiency; and enhancing productivity through the integration of innovative technologies within the nation's transportation system. Through these efforts, the ITS JPO serves as a Departmental leader in addressing innovation.

The ITS JPO is uniquely positioned within USDOT to facilitate multi-modal ITS activities and has organizational relationships with the Office of the Assistant Secretary for Research and Technology (OST-R) and Federal Highway Administration (FHWA) and reports to both the FHWA Administrator and OST-R Assistant Secretary. The ITS JPO is a FHWA Office and utilizes FHWA support functions while receiving research portfolio guidance from OST-R and is charged with executing *Subtitle C- Intelligent Transportation System Research of Public Law 109-59 Safe Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, enacted August 10, 2005*.

The **Vision** of the ITS JPO is to "Accelerate the use of ITS to transform the way society moves." That vision is executed through leading collaborative and innovative research, development, and implementation of intelligent transportation systems technologies to improve the safety and mobility of people and goods. By undertaking the research and deployment of advanced and innovative technologies, the ITS JPO serves as the USDOT's organizational resource for avoiding duplication and ensuring the Department is on the forefront of advancing technologies to make certain our transportation system is safe and efficient.

The ITS JPO will continue to provide a focused role for the Department in supporting development and deployment of new technologies as well as adopting and adapting innovative technologies from other industries to meet the specific needs of the surface

transportation system. By working with industry partners, academia, and stakeholders through cooperative agreements and grant programs, the ITS JPO will continue to develop intelligent and advanced technologies that address some of the more intractable transportation-specific problems. However, the ITS JPO's broad mission is neutral to any particular technology or platform that meets performance and interoperability requirements.

To fulfill its mission, the ITS JPO is guided by the USDOT's 2022-2026 Strategic Plan and RD&T Strategic Plan (FY 2022-2026); which outlines a focused set of strategies to lead collaborative ITS research, development, and implementation across USDOT modal administrations and with the private and public sector.

The ITS JPO continually assesses the feasibility, maturity, and benefits of ITS technologies and approaches, and shepherds' transportation solutions from inception to implementation. The ITS JPO capitalizes on past investments in key research areas including automation, accessible transportation, interoperable connectivity, and data access and exchanges. The ITS JPO will continue to augment such efforts with USDOT partners to focusing on new emerging technologies that will transform transportation.

The ITS JPO includes a portfolio of research and technology deployment support programs focused on diverse systems and technologies geared towards producing the most effective set of public benefits from transportation's increasing technological transformation. The ITS JPO is responsible for coordinating the ITS Program and multimodal technology research initiatives among the various USDOT operating administrations: Federal Highway Administration (FHWA); Federal Motor Carrier Safety Administration (FMCSA); Federal Transit Administration (FTA); Federal Railroad Administration (FRA); National Highway Traffic Safety Administration (NHTSA); Maritime Administration (MARAD), Pipeline Hazardous Materials Safety Administration (PHMSA), and the Great Lakes St. Lawrence Seaway Development Corporation (GLS). The ITS JPO partners with the Office of the Assistant Secretary for Technology and Research (OST-R) on research and analysis for key ITS enablers—spectrum access and communications engineering plus advances in positioning, navigation, and technology for ITS services – both of which include a focus on cybersecurity, including resiliency for these key enablers. In addition, close collaboration with current industry and academic technology innovators and leaders is a cornerstone of the ITS Program. The research builds on, leverages, and transfers knowledge and technology, while seeking to integrate and make interoperable, the technology and applications developed across all modes to deliver advances such as smart communities, Vision Zero transportation crash goals, significant reduction of transportation environmental impact, greater accessibility and mobility, and other future advances in an equitable manner for travelers of this Nation.

Through its research activities the ITS JPO serves two distinct roles within the USDOT, as both a project lead and as a multi-modal coordinator, working to ensure that ITS research and technology deployments are successful. The ITS JPO serves as the lead in forward-looking and emerging multimodal research and undertakes activities where cross cutting capabilities are required. This includes interoperable connectivity and large-scale pilot deployments among other types of activities.

The ITS JPO portfolio is divided into four overarching Program Categories: Deployment Program; Automation Program; Emerging and Enabling Technologies Program and the Accelerating Deployment Program. In addition, the ITS JPO works in coordination with FHWA to provide funding for the Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD) program (otherwise known as Advanced Transportation Technology and Innovation (ATTAIN) and with Volpe to provide funding for the Small Business Innovative Research (SBIR) program.

- **ITS Deployment Program:** The ITS Deployment Program works in coordination with multimodal partners, including the Office of the Secretary of Transportation (OST), Federal Transit Administration (FTA), Federal Motor Carrier Safety Administration (FMCSA), Federal Highway Administration (FHWA), National Highway Traffic Safety Administration (NHTSA), and Maritime Administration (MARAD) to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and technology deployments. Four examples are:
    - The **ITS4US Deployment Program,** a major multimodal initiative led by the ITS JPO in partnership with OST, FTA, and FHWA. Since 2021 the Program has made over $40 million available to enable communities to showcase innovative business partnerships, technologies, and practices that promote independent mobility for all travelers. The Program leverages innovative technologies and facilitates public private partnerships to allow for a traveler-centric approach that improves mobility options for all travelers, including travelers with disabilities, travelers from rural areas, and lower income travelers. The Program is designed to bring publicly and privately sponsored research together to create large-scale, replicable deployments that generate increased multimodal mobility options for all travelers regardless of location, income, or disability.
    - The **Interoperable Connectivity Program (ICP)** is a new program area dedicated to accelerating the adoption and deployment of interoperable connectivity nationwide. USDOT will pursue opportunities to support Interoperable Connectivity Accelerator(s) through this program. By presenting opportunities to deploy, operate, and showcase integrated, advanced deployments featuring applications enabled by interoperable connectivity that: substantially and quantitatively improve system safety (particularly the safety of

vulnerable road users); enhance traveler mobility; improve the efficiency of goods movement; address disparities in transportation equity; and demonstrate a significant return on public and private investment.

- **Intersection Safety Challenge**. The USDOT Intersection Safety Challenge aims to transform intersection safety by incentivizing the innovative application of new and emerging technologies to identify and mitigate unsafe conditions involving vehicles and vulnerable road users at intersections. The Challenge complements other Federal efforts to improve intersection safety, with the Challenge specifically focused on the use of technology. Further, the intersection environment itself is well-suited to innovative mitigative approaches leveraging, utilizing, and potentially repurposing existing traffic control and support infrastructure.
- **Scalable Technology for Actionable Transportation Solutions (STATS).** is a USDOT multimodal initiative, led by ITS JPO with support from OST and USDOT modal administrations. This program explores emerging technology deployments that support an equitable transportation system that provides safe, affordable, accessible, and convenient mobility options for all users. Aligning with the USDOT's 2022-2026 Strategic Plan and the RD&T Strategic Plan's focus on equity, the STATS program aims to support "a more just and equitable transportation system by investing in historically underserved communities to connect them with jobs, resources, and opportunities, and empowering them to build generational wealth." Leveraging recent successes in other deployment programs, ITS JPO will model STATS off a proven playbook for successful deployment programs but with a new focus on developing technology solutions that can address some critical equity challenges in our transportation system.

- **Automation Program:** The Automation Program's collaborative and multi-modal research portfolio provides cross-cutting support across the USDOT. Through the development of cooperative and standards-based interoperable technologies and comprehensive, stakeholder-driven policies, the Automation Program works to enable the safe and efficient adoption of automated vehicles across the transportation system. In the near term, vehicles with varying levels of driving automation systems will enter the market and may potentially offer new benefits in travel comfort, convenience, and accessibility. There is a clear government role in ensuring public safety as these vehicles are introduced into service, and in exploring how these vehicles can be integrated into the road network in a manner that improves the efficiency of the system and provides equitable mobility for all. As more vehicles are deployed, coordination through connectivity could enable cooperative automated driving technologies that can produce system-wide safety, mobility, and congestion-reduction benefits in addition to vehicle-level improvements in traveler safety, comfort, and convenience.

- **Emerging and Enabling Technologies Program:** The Emerging and Enabling Technologies Program focuses on cultivating the next generation of transportation systems. As the scale of ITS deployments increase and expand to become part of other industry internet of things (IoT) environments (i.e., smart cities), vehicle manufacturers, infrastructure providers, innovators, and entrepreneurs discover new opportunities to use technology and the data that will be generated. These technological advances, along with new functionality, new applications, new operational concepts, and disruptive innovations, need to be tracked and planned for by the USDOT. Current examples of these Emerging and Enabling technologies include Next Generation Wireless Communications (including the emerging 5G variations), digital infrastructure, quantum computing, blockchain, Artificial Intelligence (AI), and others.
    - A key component of the Program focuses on Wireless Communications research for interoperable, connected ITS, which includes various forms of Wi-Fi, Long-Term Evolution Vehicle-to-Everything (LTE-V2X), new forms of satellite communications, or the upcoming 5G New Radio (NR) Cellular V2X (C-V2X) or 5G NR Unlicensed (5G NRU), as well as future "G's"; other recent efforts include a focus on digital roadway infrastructure and using ITS for climate change and environmental solutions.
    - Securing transportation's critical assets and infrastructure against cyber threats is a shared responsibility of both the public and private sectors. The ITS JPO efforts in secure interoperability involve coordination across the USDOT with our modal partners to develop and coordinate multimodal research projects that are central to meet ITS cybersecurity needs. These efforts have included convening and facilitating the transportation ecosystem around shared priorities, facilitating the development of related policies, identifying, and addressing cross-modal issues, sharing best practices and information, and eliminating "silo" activities. This has become increasingly important as the Internet of Things (IoT) concept becomes reality and new industry ecosystems that might desire to interface with transportation emerge. As a result, through the interoperable connectivity efforts, the ITS JPO has begun to work with the National Institute of Standards and Technology (NIST) to document the interoperable Connected Vehicle environment as a leading example of an IoT transportation environment, including understanding the interface/standards requirements.
- **Accelerating Deployment Program:** As new ITS technologies and systems evolve into market-ready products, the primary goal of the Accelerating Deployment Program is to provide research, analytics, and technical services that support adoption and deployment of ITS technologies. The Accelerating Deployment Program leads in building evidence-based decision-making capacity both inside and outside of USDOT and supporting a wide variety of activities to accelerate the deployment of ITS

including: providing the ITS stakeholder community with data on the costs, benefits and extent of deployed ITS; technical assistance, training, and professional capacity building; development and support of the online Smart Community Resource Center; support for system interoperability with a focus on evolving the ITS National Architecture Reference and industry-consensus ITS standards; enhancing outreach and communication with our stakeholders; continuing work with ITS data through data repositories and the Code Hub and supporting and coordinating analysis modeling and simulation activities within the USDOT. The Accelerating ITS Deployment Program includes work in six key areas:

1. **Professional Capacity Building.** The Professional Capacity Building (PCB) Program area is the USDOT's primary mechanism for educating the transportation workforce about current and emerging ITS technology. The ITS JPO supports activities that deliver multimodal ITS learning opportunities to transportation professionals by providing ITS trainings and webinars, fostering communities of practice support, and providing technical assistance to agencies deploying ITS technologies. The ITS JPO develops and delivers knowledge and technology transfer in coordination with key stakeholders and ITS-engaged organizations.

2. **Deployment Evaluation.** The Deployment Evaluation Program area continues to acquire and disseminate quantitative data instrumental to understanding trends in ITS technology deployment and assisting decision makers with making the business case for investing in ITS.

3. **Communication and Outreach.** The Communications and Outreach Program area supports ITS JPO efforts to engage with the ITS community and the transportation industry. By maintaining ties with national and international ITS practitioners, the ITS JPO research efforts can better identify transportation problems worth solving. The Communications and Outreach Program also facilitates the ITS JPO's engagement within the transportation industry to address system safety, multimodal improvements, interoperability, underserved populations, and other long-term challenges**.** Outreach programs provide communication and educational support to facilitate awareness, understanding, acceptance, adoption, and deployment of ITS technologies across stakeholder groups and ensure effective partnerships are fostered and developed at various levels including executive, program, and project.

4. **ITS Architecture and Standards.** The ITS Architecture and Standards Program area supports efforts to ensure system interoperability which allows transportation system users to access ITS services anywhere they may travel.

This capability is essential to maximize safety, mobility, environmental, and connectivity benefits from rapidly advancing ITS technologies. To support interoperability, ITS JPO maintains and evolves a system architecture reference along with companion planning and diagramming software tools ITS JPO cooperates with stakeholders to evolve this architecture reference – currently supporting tailorable implementations of over 150 ITS services – to accommodate, and when appropriate lead, technological evolution. ITS JPO cooperates with stakeholders to develop needed voluntary ITS technical standards and to specify and adapt appropriate Information and Communications Technology (ICT) standards to support customized local ITS infrastructure implementations as well as large-scale interoperable integration of automation and connectivity technologies.

5. **ITS Data.** The ITS Data Program area facilitates effective generation, acquisition, governance, management, and analysis of ITS data and code across all modes to advance the state of multimodal ITS research and support deployment of innovations in operations. While enabling broader ITS research and deployment activities, these investments drive implementation of various Federal and USDOT directives on increasing access to data, source code, and federally funded research results.

6. **Analysis Modeling and Simulation (AMS).** The Analysis Modeling and Simulation Program area consists of a suite of tools and technologies that can be used to improve the current practices in understanding, analyzing, planning, designing, and evaluating the ITS implementation. The AMS Program supports a variety of diverse areas including FHWA's Traffic Analysis Tool Program, Connected Automated Vehicle AMS Program, Office of Planning, Office of Policy, Office of Infrastructure, and others. In addition, other modal partners such as NHTSA and FMCSA also have some AMS related activities.

Table 1 - FY 2024 RD&T Program Funding Details

RD&T Program Name	FY 2024 President's Budget Request* ($000)	Applied ($000)	Technology Transfer ($000)	Facilities ($000)	Experimental Development ($000)	Major Equipment, R&D Equipment ($000)
ITS Deployment		$30,000				
Automation		$14,000				
Emerging & Enabling Tech		$9,000				
Accelerating Deployment		$19,000	$6,000			
ATTIMD			$21,000			
SBIR		$2,500				
Program Support		$8,500				
Totals	**$110,000**	**$83,000**	**$27,000**			

The AMRP reflects funding as found in the annual President's budget request per 49 U.S.C. Chapter 65 Sec. 6501 Research Planning. The enacted numbers will be posted as part of the President's budget request for the ensuing fiscal year.

Table 2 - FY 2024 RD&T Program Budget Request by DOT Strategic Goal

RD&T Program Name	FY 2024 President's Budget Request* ($000)	Safety ($000)	Economic Strength and Economic Competitiveness ($000)	Equity ($000)	Climate and Sustainability ($000)	Transformation ($000)	Organizational Excellence ($000)
ITS Deployment				$15,000		$15,000	
Automation						$14,000	
Emerging & Enabling Tech						$9,000	
Accelerating Deployment				$6,000		$19,000	
ATTIMD				$21,000			
SBIR			$2,500				
Program Support							$8,500
Totals	$110,000		$2,500	$42,000		$57,000	$8,500

The AMRP reflects funding as found in the annual President's budget request per 49 U.S.C. Chapter 65 Sec. 6501 Research Planning. The enacted numbers will be posted as part of the President's budget request for the ensuing fiscal year.

Chapter 1 – FY 2024 RD&T Programs

ITS Deployment Program
($30,000)

Program Description:
The ITS Deployment Program works in coordination with multimodal partners, including the Office of the Secretary of Transportation (OST), Federal Transit Administration (FTA), Federal Motor Carrier Safety Administration (FMCSA), and Federal Highway Administration (FHWA), to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and other emerging technology deployments.

Included within the program are four key program areas: ITS4US; Scalable Technology for Actionable Transportation Solutions (STATS); the Interoperable Connectivity Program (ICP); and the Intersection Safety Challenge.

ITS4US. The ITS4US Deployment Program is a multimodal effort led by the Intelligent Transportation Systems Joint Program Office (ITS JPO) through partnership with the Office of the Secretary of Transportation (OST), Federal Transit Administration (FTA), and Federal Highway Administration (FHWA). The Program makes $40 million available to enable communities to deploy innovative technologies, partnerships, and practices that promote independent mobility for all, regardless of location, income, or disability. The program is designed in three phases (planning, design and testing, and operation and evaluation) to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and other emerging technology deployments to address the challenges of planning and executing all segments of a complete trip. The Program leverages innovative technologies that improves mobility options for all travelers, including travelers with disabilities, travelers from rural areas, and lower income travelers.

The ITS4US Deployment Program is funding multiple large-scale, replicable deployments of integrated innovative technologies to address the challenges of planning and executing all segments of a complete trip. The program is conducting deployments through a phased approach with decision gates at the end of each phase. Currently the program is conducting Phase 2 to conduct design and testing for the integrated technologies within each deployment. The four deployment projects in Phase 2 are:

- University of Washington (UW) - Transportation Data Equity Initiative: This deployment will span three states (Washington, Oregon, and Maryland) and aims to create the foundational data tools necessary for both public and private entities to collect, share, manage, and use transportation data that provide equitable outcomes to all travelers regardless of location, income, or disability.

- Heart of Iowa Regional Transit Agency (HIRTA) - Health Connector for the Most Vulnerable: This deployment will implement a scalable and replicable solution that enables inclusive transportation access to healthcare for all underserved populations and their caregivers by resolving access to barriers with the use of advanced technologies in a rural deployment environment.

- Niagara Frontier Transportation Authority (NFTA)/Buffalo - Complete Trip Deployment in Buffalo: This deployment will improve mobility to, from, and within the Buffalo Niagara Medical Campus (BNMC) by deploying new and advanced technologies focused on addressing existing mobility and accessibility challenges. The project integrates an accessible trip planning tool with current transit services, indoor/outdoor wayfinding, community-based on-demand shuttle services that include a fleet of fully autonomous shuttles, and intersection pedestrian safety technologies aimed at providing complete trip support to travelers with disabilities in BNMC and neighboring communities.

- Georgia Department of Transportation (GDOT) - Safe Trips in a Connected Transportation Network: This deployment will provide Gwinnett County residents with detailed information and step-by-step navigation tailored for users' specific needs along with a range of other features geared to improve trip efficiency and safety. This ITS solution is comprised of connected vehicles, transit signal priority, machine learning, and predictive analytics to support safe and complete trips, with a focus on accessibility for those with disabilities, aging adults, and those with limited English proficiency.

Scalable Technology for Actionable Transportation Solutions (STATS). STATS is a USDOT multimodal initiative, led by ITS JPO with support from OST, and USDOT modal administrations. This program explores emerging technology deployments that support an equitable transportation system that provides safe, affordable, accessible, and convenient mobility options for all users. Aligning with the U.S. DOT's 2022-2026 Strategic Plan and the RD&T Strategic Plan's focus on equity, the STATS program aims to support "a more just and equitable transportation system by investing in historically underserved communities to connect them with jobs, resources, and opportunities, and empowering them to build generational wealth." Leveraging recent successes in other deployment programs, ITS JPO will model STATS off a proven playbook for successful deployment programs but with a new focus on developing technology solutions that can address some critical equity challenges in our transportation system.

STATS is being designed as a phased deployment program with a pre-solicitation strategic planning phase, multiple deployment phases (planning, concept development, design & testing, and deployment) and a post-deployment operations phase. In FY23, the STATS

program is in the strategic planning phase. In this phase, the federal team is organizing a multimodal team of USDOT experts; drafting program messaging, including vision, mission, and goals; conducting a gap analysis; and engaging with stakeholders. The program is also preparing a procurement strategy for an upcoming solicitation of technology deployments to address transportation equity challenges.

Interoperable Connectivity Program (ICP). The Interoperable Connectivity Program (ICP) is a new program area dedicated to accelerating the adoption and deployment of interoperable connectivity nationwide. USDOT will pursue opportunities to support Interoperable Connectivity Accelerator(s) through this program. By presenting opportunities to deploy, operate, and showcase integrated, advanced deployments featuring applications enabled by interoperable connectivity that substantially and quantitatively improve system safety (particularly the safety of vulnerable road users); enhance traveler mobility; improve the efficiency of goods movement; address disparities in transportation equity, and demonstrate a significant return on (public and private) investment.

Intersection Safety Challenge. The USDOT Intersection Safety Challenge aims to transform intersection safety by incentivizing the innovative application of new and emerging technologies to identify and mitigate unsafe conditions involving vehicles and vulnerable road users at intersections. The Challenge complements other Federal efforts to improve intersection safety, with the Challenge specifically focused on the use of technology. Further, the intersection environment itself is well-suited to innovative mitigative approaches leveraging, utilizing, and potentially repurposing existing traffic control and support infrastructure.

Major Program Objectives:
The Deployment Program has developed four Guiding Principles for deployers to consider while planning and designing ITS deployments:

1. ***Integrated, Innovative and Emerging Technologies:*** Design flexible and integrated systems with innovative and emerging technologies that combine multiple technologies, modes, operators and payment systems to facilitate an ITS vision of efficient and optimized travel, for spontaneous or planned trips.

2. ***Inclusive Design:*** Plan, design and deploy for the mobility and safety needs of all travelers. Ensure that all technologies, systems, modes, and infrastructure are universally accessible, affordable, and user friendly.

3. ***Long-term Viability and Partnerships****:* Develop robust, replicable business models and identify funding sources that allow successful deployments to

continue beyond the pilot phase. Encourage strong partnerships, both public and private, to expand opportunities for innovation and integration.

4. ***Open and Secure Data and Standardization:*** Establish or enhance public access to open data platforms. Encourage civic engagement and development of third-party solutions along with ensuring the security of sensitive information. Adopt the use of standards, specifications, and best practices for implementation of infrastructure and technologies.

ITS4US: The ITS4US Program aims to solve the mobility challenges of all travelers, regardless of location, income, or disability, in accessing jobs, education, healthcare, and other activities. The objective of this program is to develop multiple large-scale, replicable, real-world deployments of integrated innovative technologies to address the challenges of planning and executing complete trips.

- **Vision:** Innovative and integrated complete trip deployments to support seamless travel for all users across all modes, regardless of location, income, or disability.
- **Mission:** Facilitate the integration and deployment of emerging technologies, along with innovative and replicable, traveler-centric partnerships, business models and practices to foster reliable, spontaneous, independent, safe, affordable, accessible, and efficient mobility options for all travelers.

The flagship effort of the ITS4US Program will be the demonstration of integrated technology deployments supporting independent and seamless travel for all users across all modes, regardless of location, income, or disability.

STATS: The STATS Program aims to advance safe and equitable mobility for all. The program concept, in alignment with the US DOT's equity goal, is to collaboratively build next-generation transportation system that provides safe, affordable, accessible, and convenient mobility options for all users. Though the program is still in its infancy, the program looks to accomplish the Program Vision and Mission by using innovative and integrated technology solutions to empower communities by expanding access and opportunities for all travelers through this deployment program.

- **Vision:** Enable safe and equitable transportation systems through effective, scalable technology solutions and knowledge transfer.
- **Mission:** Empower communities to expand access and opportunities for all travelers through the by facilitating integration and deployment of innovative technologies that identify and address transportation barriers

Interoperable Connectivity Program (ICP): The USDOT's objective for interoperable connectivity is to develop, evaluate and document a suitable reference implementation for interoperable connectivity. This reference implementation can serve as a practical template spurring broader, at-scale national deployment of wireless communications. The Interoperable Connectivity Accelerator(s) support the ICP reference implementation objective through the development, evaluation, and documentation of multiple operational systems that both achieve the goals related to safety, mobility, efficiency, equity, and return on investment, and can demonstrate both intra- and inter-site interoperability. Functional interfaces developed, technical insights gained, and lessons learned recorded from these deployments will be identified and documented to augment federal efforts to create a practical and effective reference implementation. The USDOT will support motivated organizations to innovate while demonstrating interoperability and measuring benefits to share insights with the broader transportation community – and act as key enablers of the vision of interoperable connectivity.

Intersection Safety Challenge: The vision of the Intersection Safety Challenge is to transform intersection safety through the development of one or more innovative intersection safety systems that identify, predict, and mitigate unsafe conditions involving vehicles and vulnerable road users in real-time.

Anticipated Program Activities:

ITS4US: In FY24, ITS4US will continue conducting Phase 2: Design and Testing completing equipment acquisition and moving from design into system testing. Teams will continue with active participation in System Engineering Roundtables to discuss and share technical issues and solutions. Teams will also continue to participate in outreach and performance measurement roundtables to support cross-team information sharing and discussion. In FY24, the program will continue stakeholder engagement and sites will continue conducting robust outreach activities, including participating in industry conferences, delivering webinars, authoring journal articles, and giving presentations to stakeholders and the public. The sites will conduct performance measurement and work with the Independent Evaluation (IE) team. IE efforts will focus on reviewing site lessons learned logbooks; conducting performance results assessment; conducting interviews and questionnaires with the site teams and the USDOT staff supporting the program; conducting financial and institutional assessments of each site; and working on the national replication estimate. The USDOT program leadership and technical services support will provide review and comment on the reports.

STATS: The program intends to fund multiple large-scale, replicable deployments of integrated technologies aimed at expanding access and opportunities for all travelers by identifying and addressing transportation barriers to equity and safety. The program plans to conduct deployments through a phased approach with decision gates at the end of each

phase. In FY24, the STATS program will conduct program planning and pre-procurement activities including drafting a procurement package for the first phase of the deployments and releasing a solicitation for large scale replicable technology deployments. STATS expects to award the first phase by the end of FY24.

This program also includes continuous outreach and stakeholder engagement activities and technical services support activities providing visioning, program management, project technical assistance and procurement support. The program will develop communications and outreach materials, including a website, factsheets, and pre-solicitation webinar series to inform potential deployers of the program and upcoming solicitation opportunities.

In addition, the technical services support work includes assisting in managing and integrating the portfolio of deployment projects ensuring that they produce actionable results while remaining on schedule and on budget, provide program management functions including roadmap development, meeting coordination, quick-response scanning, and acquisition expertise for the later phases of the program.

Interoperable Connectivity Program (ICP): In FY24 the ICP area will continue development of a National Interoperable Connectivity Deployment Plan. This Plan will be developed in coordination with OST-R and FHWA, to provide a framework for deployers. A key input to the National Interoperable Connectivity Deployment Plan will be the USDOT's pursuit of opportunities to support Interoperable Connectivity Accelerator(s) through this program, which will spur widespread deployment of connectivity.

Intersection Safety Challenge: The Challenge was announced in April 2023, and the submission period closes on September 25th, 2023. It will begin with a two-part prize competition:

- **Stage 1A: Concept Assessment** — Participants submit an Intersection Safety System Concept. Up to ten (10) well-formed, differentiable concepts scoring highest against a set of uniform judging criteria will receive a Challenge prize and may advance to the next part of the Stage 1 Prize Competition.

- **Stage 1B: System Assessment and Virtual Testing.** Participants develop, train, and improve algorithms for the detection, localization, and classification of vulnerable road users and vehicles using USDOT-supplied sensor data collected at a controlled test intersection. Further, participants will use these data and algorithms in real-time to predict future intersection conditions and identify potentially unsafe conditions and events. Entries will be scored using a rubric testing the accuracy of algorithms against observed ground truth conditions. USDOT will provide information regarding the perception and prediction competition of Stage 1B after Stage 1A awards are made.

Potential Program Outputs, Outcomes, and Impacts on Technologies and Practices:

ITS4US: The ITS4US program is designed to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and other emerging technology deployments to address the challenges of planning and executing all segments of a complete trip.

***Outputs**:* The ITS4US Program conducted extensive stakeholder outreach during the past several years that entailed three main efforts:

- Assembled a large, active multimodal federal team.
- Garnered strong stakeholder involvement for the deployment sites throughout concept development with broad representation.
- Conducted extensive public outreach to disability advocacy groups; transportation providers; state, regional, and local agencies; universities; consultancy groups; integrators; and others.

***Outcomes**:* The ITS4US program is designed to solve a very important gap in the transportation system of providing safe and reliable transportation services for all travelers with a focus on underserved communities. This program is designed to identify and provide solutions to local challenges that can then be replicated nationwide.

The ITS4US program has identified five program-level goals. Information presented below reflects progress made by the site's Phase 1 deployment efforts to support USDOT achieving strides towards these goals.

1. **Spur high-impact integrated complete trip deployments nationwide.** Assist the transportation industry in tackling the difficult challenge of providing complete trips for all travelers nationwide by streamlining and expediting solution development through complete trip deployments. High impact, replicable, integrated solutions developed by complete trip deployments will reduce the cost of future deployments of these critical personal mobility enhancements.

2. **Identify needs and challenges by populations.** Identify the transportation challenges and needs of communities to support mobility options for all travelers regardless of location, income, or disability. Populations within each community have different needs and challenges in accessing transportation options to improve their quality of life.

3. **Develop and deploy mobility solutions that meet user needs.** Support and encourage communities to take revolutionary steps to integrate advanced technologies – especially those that enable adaptive and assistive transportation technologies – into the management and operations of the transportation network, including non-motorized modes. Engage key partners, within the federal government, the research community, stakeholder organizations, and private industry to support development of potential solutions for all travelers.

4. **Measure the impact of integrated deployments.** Quantify and evaluate the impact of the integration of these advanced technologies, strategies, and applications towards the improved safety and mobility of all travelers. Quantified impacts support communication of technology benefits to future deployers and decision makers.

5. **Identify replicable solutions and disseminate lessons learned.** Determine which technologies, strategies, applications, and institutional partnerships demonstrate the most potential to address identified barriers to providing Complete Trips to all travelers in a variety of communities and built environments. Disseminate lessons learned from replicable solutions developed by deployment sites to catalyze additional deployment.

***Impacts**:* As a result of the continued progress toward achieving the ITS4US Program goals, there will be an increase in deployment of systems and services that help underserved communities achieve the ability to complete their trips that previously have not always been attainable. These completed trips will be safe, efficient, and affordable. The increased accessibility for all will be the result of integration of new capabilities with exiting systems; leveraging emerging technologies and technology integration; and project outreach and recruitment to targeted populations. Use of open-standards and open-source software will support cost-effective replicable deployments through the U.S. In addition, lessons learned captured during the program will assist future deployers avoid missteps, minimize mistakes, and spurring resource efficient deployments. The program is being evaluated to ensure that the program goals are being met.

STATS: The STATS Program aims to advance safe and equitable mobility for all. The program concept, in alignment with the US DOT's goals is to collaboratively build next-generation transportation system that provides safe, affordable, accessible, and convenient mobility options for all users.

***Outputs**:* The STATS Program conducted extensive stakeholder outreach since inception, including:

- Introduced the program to industry stakeholders at the 2023 Transportation Research Board Annual meeting, the 2023 ITS America Annual Conference, and Community Transportation Association of America conference 2023.
- Conducted a Stakeholder Workshop at the ITS America Annual Conference on April 24, 2023, with 90 participants that introduced the program concept, and gathered needs and barriers to equitable transportation that can be addressed using ITS technologies.
- Invited federal modal partners from OST-R; FHWA Planning- Office of Human Environment, Civil Rights, Office of Safety, Office of Safety and Operations Research and Development; FTA Research, Demonstration and Innovation and Office of Civil Rights; and NHTSA to participate in shaping the program.

Outcomes*:* The STATS program has identified 5 program-level goals

1. Enable collaboration across communities with shared barriers to equitable transportation.
2. Empower communities to identify needs and challenges to transportation access.
3. Develop and deploy innovative and sustainable ITS solutions that reduce transportation inequities.
4. Measure impacts of deployments.
5. Identify successful replicable scalable technology and actionable transportation solutions and disseminate lessons learned through the ITS Capacity Building Program.

Impacts*:* As a result of the continued progress toward achieving the STATS program goals, there will be an increase in deployment of systems and services that align with USDOT objectives by facilitating:

- **Expanding Access**: enhancing alternative mobility options in underserved rural and urban communities and providing safe, efficient, affordable, and accessible multimodal options to meet needs of all travelers in the community.

- **Wealth Creation**: addressing spatial inequities preventing travelers from accessing high-paying jobs, integrating equity considerations during program and funding design, and supporting community-driven projects that promote opportunities for disadvantaged communities.

- **Power of Community**: conducting robust public engagement with diverse stakeholders representing underserved communities and promoting strong engagement with broad range of stakeholder groups throughout the planning and development of technology solutions.

- **Interventions**: ensuring underserved communities considerations in the planning, development and deployment of transportation solutions and supporting data collection and measurement of equity impacts.

Interoperability Connectivity Program (ICP): ITS JPO in collaboration with OST-R and FHWA is developing a National Interoperable Connectivity Deployment Plan. The ITS JPO has developed a quick turnaround timeline to develop the plan and associate guidance in order to rapidly support state and local deployers. In addition, the work undertaken as part of the Interoperable Connectivity Accelerator, the functional interfaces developed, technical insights gained, and lessons learned recorded from these deployments will be identified and documented to augment federal efforts to create a practical and effective reference implementation.

> ***Outputs/Outcomes/Impacts***: The ICP Program kicked into gear in July 2022 and the ITS JPO led collaborative summit efforts on behalf of the USDOT through collaboration with the Assistant Secretary for Research and Technology and FHWA. The first summit was held on August 24 and 25, 2022 titled Vehicle-to-Everything (V2X) Communications Summit at USDOT headquarters in Washington, DC, with over 600 in-person and virtual attendees. This first summit led to a working relationship/collaboration between the Federal Communications Commission (FCC), the National Telecommunications and Information Administration (NTIA) and the USDOT. The resulting collaborative effort between USDOT, NTIA and FCC led to the FCC approval on April 24, 2023, of a joint waiver request for C-V2X technology deployment, to 14 automakers and equipment manufacturers while our multi agency federal team continues working towards widespread deployment. This progress and continued collaboration with transportation stakeholders inspired the USDOT to collaborate with all transportation interests to lead the development of a vision and comprehensive plan for interoperable, cyber-secure, connected transportation deployments nationwide. And in April 2023 just days after the FCC waiver announcement the second public summit led by the federal team was held with a focus on collaboration needed to develop a National Interoperable Connectivity Deployment Plan. This program will continue development of the Plan.

Intersection Safety Challenge: Improving intersection safety is a foundational element in enhancing equity and accessibility in many communities. Safe and reliable transportation, including access to and use of various transportation modes in and around intersections, can be a powerful engine of opportunity, connecting people to jobs, education, and resources. The Challenge aims to incentivize the development of new, cost-effective, real-time roadway Intersection Safety System (ISS) concepts. Further, to set the stage for future

deployment nationwide, the potential safety benefits relative to the estimated costs of deploying new system concepts must be compelling enough to motivate equitable at-scale deployment across the nation.

Potential Economic or Societal Impacts:
Safety, equitable economic strength, rebalancing investments to meet racial equity and economic inclusion goals are all supported by ITS Deployments. To accelerate the adoption and deployment of ITS nationwide, USDOT coordinates and provides funding to eligible entities to deploy, operate, and showcase integrated, advanced deployments featuring ITS applications that substantially and quantitatively:

- improve system safety (particularly the safety of vulnerable road users),
- enhance traveler mobility,
- improve the efficiency of goods movement,
- address disparities in transportation equity, and
- demonstrate a significant return on (public and private) investment.

In order to address transportation needs of all travelers, and specifically travelers of transportation underserved communities, the entire trip from conception and planning to execution and from origin to destination must be considered. The USDOT has defined the Complete Trip Concept to capture the idea that a trip can be composed of several parts or segments and any individual traveler must be able to execute every part of their trip from origin to destination regardless of location, income, or disability. A complete trip can be made up on any combination of trip segments such as: trip planning, outdoor navigation, intersection crossing, boarding and using vehicles, transferring between vehicles, modes and payment services, using stops and stations, indoor and outdoor transitions, indoor navigation and completing travel to destination. The different segments of the trip may have unique challenges that can be addressed to support a successful complete trip. If the infrastructure is not available or in a state of good repair or if one segment of the trip is inaccessible, unreliable, or inefficient, then access to subsequent segments is broken, and the trip cannot be completed. This Program will help local partners develop and deploy safe and integrated mobility solutions to achieve complete trips for all travelers.

Potential Progress Made Toward Achieving Modal Strategic Goals:
The focus areas of the Deployment Program address all the Strategic Goals identified in the FY 2022-26 USDOT RD&T Strategic Plan. The ITS Deployment Program serves critical multimodal USDOT efforts supporting independent and seamless travel for all users across all modes, regardless of location, income, or disability. Progress towards achieving specific goals include:

Safety.

- **Enhance alternative mobility options for underserved communities, and support safe and efficient connections to public services.** In Phase 1 of ITS4US, the five sites developed project concepts and supporting planning documents with safety a foremost priority. Three ITS4US Phase 2 sites (NFTA/Buffalo, GDOT, and UW) are specifically targeting to increase traveler safety in their deployments.

- **Advance a future without transportation-related serious injuries and fatalities.** The Intersection Safety Challenge and the Interoperable Connectivity Program both work towards the goal of the Departments' National Roadway Safety Strategy (NRSS) of reaching zero roadway fatalities.

Equity.

- **Provide efficient, affordable, and accessible transportation options to all travelers regardless of location, income, or disability.** All ITS4US Phase 2 sites have focused on local mobility challenges for underserved populations. Specifically, older adults and individuals with disabilities (All 4 sites); limited English proficiency (HIRTA, NFTA and GDOT); low-income populations (GDOT and NFTA); rural travelers (HIRTA); and veterans (HIRTA).

Transformation.

- **Develop connected intelligent infrastructure that provides people-centered mobility.** The Deployment Program areas are enabling the USDOT to bring emerging technologies on roadways, at intersections and throughout the network together to develop new transportation system-of-systems.

Collaboration Partners:
The ITS Deployment Program works in coordination with multimodal partners, including the Office of the Secretary of Transportation (OST), Federal Transit Administration (FTA), Federal Motor Carrier Safety Administration (FMCSA), Federal Highway Administration (FHWA), National Highway Traffic Safety Administration (NHTSA), and Maritime Administration (MARAD) to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and other emerging technology deployments. Inter-agency collaboration with the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA). In addition, the program includes collaboration with multiple transportation stakeholders for example original equipment manufacturers (OEMs), infrastructure owners and operators (IOOs), Vehicle to everything (V2X) technology companies, ITS America, the American Association of State Highway Transportation Officials (AASHTO), and the Institute of

Transportation Engineers (ITE). One example of the anticipated benefits of these collaboration opportunities is the development of a National Interoperable Connectivity Deployment Plan for the US that greatly enhances the Nation's economic strength and global competitiveness.

Automation Program
($14,000)

Program Description:

Driving automation is one of the major transportation industry trends of this decade. Through close collaboration and monitoring of current industry and academic technology innovators and leaders in automation the ITS JPO continues the pursuit of an automation program that will support the safe deployment of an automated future. Advanced Driver Assistance Systems (ADAS) with automation of lateral or longitudinal controls are widely available in passenger vehicles, although their development and refinement continue. Automated Driving System (ADS)-equipped vehicles are being piloted in passenger vehicles, commercial motor vehicles, and transit buses. While driving automation research has been, to some degree, mainstreamed across the Department's Operating Administrations, research needs are evolving alongside the technology. The technological and practical challenges of translating research breakthroughs into daily transportation are significant and often are not fully understood at the outset. Many foundational questions around ADS and ADAS cannot be resolved until more and better data are available. The ITS JPO Automation Program's collaborative and multi-modal research portfolio provides cross-cutting support across the USDOT.

As excitement builds around an automated future, we must continue to ask the following:

- How will vehicles with a range of automated driving capabilities interact with one another on the road?
- What are potential impacts on personal mobility, user costs, and equity?
- What physical and digital infrastructure are needed or desirable to facilitate the safe deployment of ADS-equipped vehicles?
- How will driving automation influence the operational characteristics, costs, and structure of the nation's freight network?
- How can limited deployments and pilots inform long-term policy-making?
- How might ADS-equipped vehicles use communications technologies to improve safe operation as they mature?

The ITS JPO Automation Program will continue to coordinate cross-modal research and build on past activities to achieve program objectives. The program will provide a platform for internal USDOT research coordination and exchange, contributing to better outcomes across the Department.

Major Program Objectives:
The ITS JPO Automation Program will promote cross-modal safety, operations, and policy research through:

- **Business Intelligence and Emerging Issues Assessment**: What is the current state of the industry? What companies appear to be leading? Which have failed? Where are investments being made? Where is testing most concentrated, in terms of: geography, vehicle types, ADS levels, operating models? New questions and issues can emerge quickly and may need modest short-term investigation.

- **Research Coordination and Information Exchange**: Addressing some big questions may require input and collaboration across modal subject areas.

- **Cross-Modal Research:** Facilitate the planning and execution of research on topics that span the information needs, capabilities, and interests of multiple operating administrations, as well as topics that are important to USDOT as a whole, but may not fit cleanly into the mission of a single agency.

Anticipated Program Activities:
The ITS JPO Automation Program will focus on the following activities, aligned with its major program objectives:

Business Intelligence and Emerging Issues Analysis

- **Automated Driving System Testing and Deployment Tracking** – The ITS JPO will continue to provide offices across USDOT with insight into the state and extent of ADS testing and deployment on public roads through industry monitoring and regular internal briefs.

- **Emerging Issue Analysis** – ITS JPO will continue to conduct short, targeted studies on emerging issues related to vehicle automation and its potential impacts on/implications for key USDOT priorities.

Research Coordination and Information Exchange

- **Automation Research Working Group Facilitation and Management** – ITS JPO will continue to facilitate and manage exchange of information around automated vehicles research across USDOT, including providing a weekly discussion forum and facilitating discussions on topics of cross-modal interest.

- **Research Product Dissemination** – ITS JPO will continue to provide a central online library of USDOT automation research publications.

- **External Engagement** – the ITS JPO will continue to support Departmental participation in events such as those sponsored by the Transportation Research Board and facilitate international research exchange through the European Commission-Japan-United States Automation in Road Transportation Working Group.

Cross-Modal Research

- **Cooperative Driving Automation (CDA)** – Research to combine vehicle automation and the connectivity together to further improve the efficiency the surface transportation system.
- **Human Factors** – Research to examine how a human can impact and be impacted by the vehicle automation.
- **Advanced Driver Assistance Systems (ADAS)** – Research to better understand the impacts of increasing adoption of ADAS in production vehicles on the transportation system.
- **Commercial Vehicle Automation Research –** Collaborative research across USDOT modes focused on the safe deployment of Automated Driving Systems and Advanced Driver Assistance Systems on commercial motor vehicles.
- **Vulnerable Road User Safety and Complete Streets –** Research with modal partners to support safe streets for all users.

Potential Program Outputs, Outcomes, and Impacts on Technologies and Practices:
Safety outcomes will include results from driving simulator and field experiments to better understand the human factors issues related to the adoption of automation in varied modes, use cases, and settings. They will also inform understanding safety issues related to automated vehicle interactions with transportation systems management and operations (TSMO) functions, as well as infrastructure.

Cross-cutting activities will improve information dissemination, identification of emerging needs, and research coordination across internal and external actors.

Potential Economic or Societal Impacts:
Socio-economic benefits will result from the pursuit of an automation program that will support the safe deployment of an automated future. The analyses, coordination, and outreach will inform cross-modal policy development moving the national transportation system closer to the goal of zero roadway fatalities and serious injuries.

Potential Progress Made Toward Achieving Modal Strategic Goals:
The Program pursuit of research to lead to the safe deployment of an automated future addresses the USDOT's strategic goal of making our transportation system safer for all people.

This program also addresses the Transformation strategic goal of the USDOT by investing in research and innovation to help spur the implementation of a safe automated future within an infrastructure connected through technology.

Collaboration Partners:
The ITS JPO will continue to facilitate multimodal automation research in collaboration with the Office of the Secretary and Operating Agency partners. Through close collaboration and monitoring of current industry and academic technology innovators and leaders in automation the ITS JPO continues the pursuit of an automation program that will support the safe deployment of an automated future.

External partners include stakeholder communities such as Transportation Research Board (TRB) standing committees, the National Cooperative Highway Research Program (NCHRP), the Association of American State Highway and Transportation Officials (AASHTO), and Standards Development Organizations (SDOs), such as SAE International.

By collaborating extensively, the ITS JPO can improve the quality and comprehensiveness of the Automation Program research by providing diverse and informed perspectives and subject matter expertise and expand outreach to inform the transportation community regarding Automation Program work products.

Emerging and Enabling Technologies Program
($9,000)

Program Description:

The Emerging and Enabling Technologies Program focuses on investigating emerging and evolving transportation systems and technologies that can provide increased or additional public benefit in safety, mobility, equity, or environmental performance. As the scale of Intelligent Transportation Systems (ITS) increases and expands to become part of other industry IoT environments (i.e., smart communities), vehicle manufacturers, infrastructure providers, innovators, and entrepreneurs discover new opportunities to use technology and the data that will be generated. These technological advances, along with new functionality, new applications, new operational concepts, and disruptive innovations, need to be tracked and planned for by the USDOT. Current examples of these Emerging and Enabling technologies include Interoperable Connectivity through new advances in wireless communications (including the emerging 5G/6G and new Wi-Fi/broadband or satellite variations), digital infrastructure, quantum computing, blockchain, Artificial Intelligence (AI), and others.

The USDOT will be positioned and engaged as a partner to guide research, development, and technology adoption in a systematic manner. The USDOT recognizes the need to advance the adoption and use of emerging practices and technologies for transportation—particularly, where they play a key role in providing public benefits to Americans. The ITS JPO will coordinate and conduct investigations and exploratory research into emerging technologies across government, academia, and the private sector. This research will provide the USDOT with a significant understanding of the potential benefits and disruptions these technologies could represent to the transportation system. Through multi-modal coordination, the ITS JPO works to avoid duplicative ITS work and to ensure the efficient allocation of ITS resources.

Major Program Objectives:

The Emerging and Enabling Technologies Program area focuses on cultivating the next generation of transportation technologies that either change the way we deliver transportation or enhance existing systems, services, and applications. As emerging technologies offer the potential to transform the transportation environment, ITS JPO will evaluate their safety, performance, and suitability for meeting transportation needs, and partner with USDOT modal agencies to accelerate adoption and extend resulting benefits from these technologies across the transportation ecosystem. Securing transportation's critical assets and infrastructure against cyber threats is a shared responsibility of both the public and private sectors. The ITS JPO efforts in secure interoperability involve coordination across the USDOT with our modal partners to develop and coordinate multimodal research projects that are central to meet ITS cybersecurity needs. These

efforts have included convening and facilitating the transportation ecosystem around shared priorities, facilitating the development of related policies, identifying, and addressing cross-modal issues, sharing best practices and information, and eliminating "silo" activities.

Interoperable Connectivity/ Spectrum: Given the magnitude of impacts that transitioning to the new communications technologies can have on transportation, the ITS JPO proposes the establishment of a focused research initiative. There are four proposed research objectives that will concern the USDOT moving into the future:

A. *Analysis and Testing of new wireless communications technologies for safety, interoperability, and security:*

- Develop and maintain a set of transportation communications requirements associated with safety and system efficiency against which any new technology can be assessed and tested including cost and lifecycle expenses.
- Test new communications technologies for their suitability for the transportation environment, including testing for safety (e.g., consistent/reliable communications, no unintended consequences from use, etc.) interoperability, interference challenges, or other harms to existing operations.

B. *Institutional adoption of new wireless communications technologies:*

- Assess the ease and costs associated with transitioning to new communications technologies for State, local, tribal, and territorial (SLTT) agencies and work with industry to identify how to ensure backward compatibility as well as how to enable software updates as opposed to hardware updates.
- Promote adoption of next generation wireless technologies with SLTT agencies by assisting them in articulating their communications and connectivity needs, identifying the institutional and technical challenges to adoption, analyzing impacts of adoption, and coordinating transition planning from older technologies to new ones.
- Analyze the additional skills/knowledge needed by transportation workers to manage each next generation of communications technologies, equipment, and systems.
- Work with transportation private sector equipment manufacturers and application developers to facilitate transition of safety-critical elements and interoperability.

C. *Public sector representation:*

- Conduct necessary research and analysis in partnership with modal administrations and stakeholders to gather public sector needs—feed into the ITS Architecture and Standards Program to translate into requirements and standards.

- Create transportation safety use cases to facilitate the incorporation of transportation safety requirements into each next generation of communications technologies.
- Participate in and leverage existing relationships with US-based globally relevant SDOs (e.g., SAE, IEEE) along with international (e.g., ISO, ITU, 3GPP) SDOs to ensure that the transportation needs are represented in each next generation communications systems.

Digital Infrastructure: One of the definitions of Roadway Digital Infrastructure (RDI) is "the collective public and private technology assets that create, exchange, or use data or information to improve national transportation system outcomes by optimizing the provision of existing and new transportation services." The first step of ITS JPO's activities in advancing the digital infrastructure is to answer the following questions:

- What is your greatest need around supporting roadway digital infrastructure?
- What one problem related to roadway digital infrastructure, if solved, would have the highest impact?
- What capabilities/solutions/initiatives would you put in place to solve the problem?

To address these questions, the ITS JPO will identify and set the directions to go forward with the Digital Infrastructure by supporting the modal partners to develop a strategy for the national Digital Infrastructure.

Environment and Climate Change: The ITS JPO is working to leverage past and current ITS and environmental research into new, innovative research and analysis opportunities in partnership with modal partners and stakeholders.

Anticipated Program Activities:
The Emerging and Enabling Technologies Program area is focused on the following planned activities:

- **Identify** research needs and opportunities by exploring federal, state, local, private, and academic research on technologies.
- **Research** and test communications technologies to support transportation connectivity, enabling cooperative ITS and connected and automated transportation.
- **Investigate** future spectrum use models that support transportation safety and system efficiency.
- **Develop** new institutional and technology models to help accelerate adoption of technology innovations.
- **Transfer** technologies from exploratory research to development and deployment when appropriate.

The ITS JPO and its modal partners have been leaders, collaborating on fundamental problems in safety, mobility, productivity, efficiency, equity, and climate change by leveraging emerging technologies and next generation communications technologies.

***Interoperable Connectivity/ Spectrum*:** USDOT monitors and assesses wireless technologies and available devices to determine their capabilities to support a wide range of transportation system communications requirements regarding safety, effectiveness, and other capabilities. These technical research and assessment activities provide data-driven inputs to the USDOT policy decision-makers. Currently, ITS JPO is completing the testing associated with the FCC-mandated 4G LTE-V2X technology to meet the deployment and scalability requirements for Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) safety-of-life and public safety systems. In parallel, the ITS JPO will begin the technical assessment of 5G New Radio (NR) V2X concepts through analysis of emerging specifications and standards. In monitoring these standards developments, the spectrum team is following whether and how the transportation needs, and requirements are being addressed in 5G and working to identify when the standards become stable enough to produce the first working prototypes for 5G New Radio V2X (inclusive of a new emerging capability for 5G New Radio to work as an unlicensed device (5G NRU). Prototypes built as software defined radios (SDRs) are expected to become available from industry later in 2023. When available, ITS JPO will acquire devices to conduct laboratory bench testing and (potentially) small-scale field testing to better understand the changes in the device parameters (i.e., modulation, duty cycles, etc.) as well as measure the new waveform under real-world conditions.

In addition, as the US Government and industry begin their focus on 6G, the ITS JPO's Emerging and Enabling Technologies Program will work with the ITS Standards Program to monitor and assess the changes, challenges, and opportunities associated with 6G. At this time, it appears that a key benefit of 6G includes changes to antenna—in particular, multi-phased array antenna that allow for multi-function radiofrequency communications, potentially allowing far greater efficiency in the limited spectrum assigned to V2X while also potentially supporting different RF communications and applications simultaneously. These rapid evolutions of communications technologies have the potential to disrupt transportation operations (similar to how early 5G network rollouts disrupted transportation operations at airports) but also have the potential to enhance or transform V2X communications for future, more complex and advanced transportation use cases. As such, there is a need to determine the impacts of these changes before they are put into use.

The two main research objectives for FY24 are to: (1) begin analysis of 5G New Radio V2X capabilities, ideally based on measurement of waveforms using prototype devices and beginning development of the RF model to support, laboratory testing and, ultimately, real-world field-testing, (2) procure 5G New Radio V2X devices for testing, and (3) coordinate

with the ITS Standards Program to monitor the emerging 6G concepts. In addition, noting that the current amount of spectrum is likely to be inadequate for future interoperable connectivity use cases, the ITS JPO will work with OST-R to identify whether other spectrum could be made available in conjunction with the National Telecommunications and Information Administration (NTIA) and the White House's new National Spectrum Strategy initiative.

5G New Radio V2XTo support this work, in FY23 and into FY24, this program will begin the process of developing an acquisitions package, incorporating this market research and, further incorporating research into government and military test beds that might also be available. Testing is anticipated to begin in later 2024 and will focus first on performance and whether the technologies are mature and suitable for safety communications, and then further look at interoperability performance, reliability when GPS is unavailable, and sensitivity interference by testing in laboratories in 2023-2024 and then in controlled, small-scale test tracks to test operational performance under real-world conditions when effects such as Doppler, multipath, non-line-of-sight, and other issues effect communications transmissions. If testing shows promise, larger scale, controlled track testing can take place (potentially FY25-FY26) whereby a range of safety-critical scenarios can be performed with hundreds of devices to demonstrate the 5G NR V2X capabilities for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), vehicle-to-pedestrian (V2P), and vulnerable road user safety applications at both small and large scale.

Last, noting that the existing 30 MHz of spectrum in the 5.9 GHz band is likely not enough to support even the existing V2X applications and services, the ITS JPO's Emerging and Enabling Technologies Program has coordinated with the Interoperability Program (notably, the ITS Architecture and Standards Programs) to assess the capability of using unlicensed and licensed spectrum to achieve V2X benefits for transportation. While these types of communications are likely capable of supporting a subset of V2X applications that do not require low latency (and other requirements), because they use different spectrum, they are not interoperable with other V2X communications, thereby limiting their benefits. Research and analysis is using the architecture tool set to explore the potential for some or full interoperability. If feasible, small-scale demonstrations with industry partners may follow-on to demonstrate to SLTT deployers what additional options might be available to them.

***Digital Infrastructure*:** Current State of the Digital Infrastructure from a transportation perspective is stated as "In every area of transportation, we are seeing rapidly increasing amounts of data available from infrastructures of all types with a clear opportunity to optimize outcomes." With that, in FY24, the ITS JPO will collaborate with modal partners, FHWA in particular, to conduct the various research projects. A couple of major efforts are presented below:

- Roadway Automation Concept of Operations Version 2: To update/amend version one taking into account new information about Road/ADS integration especially new information on ADS operational and behavioral characteristics.

- Roadway Digital Infrastructure, Connectivity, and Automation - Towards a Strategy: To build off of Roadway Digital Infrastructure Models, Principles, and Strategies and to enlist stakeholders to identify and discuss digital infrastructure framework elements from policy, institutional, and technical perspectives to envision and develop initial prototype concepts and undertake initial assessments.

Environment and Climate Change: In FY24 the Emerging and Enabling Technologies Program plans to support reengagement with modal partners on research activities in support of Departmental goals related to climate change and the environment. The program expects to leverage past and current ITS-related research in this area into new opportunities for technological innovation In FY24 the program plans to continue development of a roadmap for new environment- and climate-oriented ITS research activities moving forward and, using the baseline State of the Practice/State of the Art Report that was developed in FY23, to articulate important research gaps that the ITS JPO and its modal partners might address in the short- to mid-term in this area.

Potential Program Outputs, Outcomes, and Impacts on Technologies and Practices:
Interoperable Connectivity/ Spectrum: The primary outcome of the interoperable connectivity with wireless communications research is two-fold: ensure suitability and safety for SLTT agencies, vehicle manufacturers, and citizens in adoption of the new technologies; and to continuously advance effective, secure, cost-effective, and available communications solutions for meeting transportation needs, including spectrum availability. Outputs of research included lessons learned from previous deployments, through the work of the program it is now know that the transportation environment introduces unique requirements for telecommunications; for instance, users and equipment move at high speeds—over 80 miles per hour, which has effects on the basic safety message signals and transmissions. Because the communications are used for safety, there are additional requirements associated with the high frequency and high reliability of the signals. Another is that any viable communication technology needs to scale to allow hundreds of nearby devices to communicate without causing channel congestion.

Impacts that will help future wireless communications include the understanding that the telecommunications industry evolves at a rate that is dramatically different from the deployment of these technologies in SLTT transportation system operations. The replacement cycle within the telecommunications industry is typically 18-24 months whereas the replacement cycle within transportation system operations is typically 10-15 years. This disparity impacts how transportation agencies decide to invest in and procure

communications and connectivity in both the near term as well as in their longer-term investment planning.

Digital Infrastructure: After completing the planned activities in FY24, the department will have a clearer idea on where to move forwards to generate positive impacts around safety, economic strength & global competitiveness, climate and sustainability, and equity. Example "potential" use cases for each category are provided below:

- Safety
    - Traffic signal integration to prevent crashes
    - CV data sharing
- Economic strength & global competitiveness
    - Automated air mobility – connect surface to air
    - Develop cybersecure systems
- Climate and sustainability
    - Electrification – Leverage DI to incentivize use of curb space, parking
    - Managing charging stations
- Equity
    - Real-time management of right of way to incentivize transportation in underserved communities
    - Real-time data sharing for reliable public transportation

Environment and Climate Change: With respect to the environment and climate change, the primary near-term output is a (1) baselining effort describing the current state of the practice/state of the art in R&D related to ITS and climate change, (2) describing important high-value research gaps and research questions for consideration, and (3) creation of roadmaps for R&D on this topic moving forward. Longer-term outcomes include undertaking R&D activities with partners and stakeholders, and advancing the state of the practice/state of the art related to the use of ITS technologies to help meet climate change objectives and goals.

Potential Economic or Societal Impacts:
In order to meet the goals of economic strength and global competitiveness, the US needs to stay at the forefront of producing innovations and new emerging technologies, and to ensure that the learning resulting from this work is captured as US-based intellectual property, which typically is incorporated into standards. The testing and analysis of interoperable wireless connectivity technologies translates into leading-edge knowledge about translating communications for a rapidly moving, highly variable transportation environment; and further positions the US to take a lead role in creating or enhancing standards, harmonizing technologies, ensuring open global markets for the transportation industry. The data collected through testing will become publicly available, allowing researchers and innovators to continue to advance the transportation communications

technologies. These communications, combined with advances in data will enhance the beneficial impacts that emerge through roadway digital infrastructure.

Finally, the ITS JPO hopes its climate and environment-related research efforts build on interoperable connectivity, contribute to departmental and national goals related to reducing the emissions impact of the transportation sector and improving transportation system resiliency.

Potential Progress Made Toward Achieving Modal Strategic Goals:
These technologies have the potential to greatly impact transportation operations and create positive outcomes that are aligned with USDOT goals in Safety, Economic Strength and Global Competitiveness, Equity, Transformation, and Climate and Sustainability. In particular, this program recognizes the interdependence among the Department's strategic goals with respect to the introduction of new technologies. For example, this program addresses issues related to climate change and resilience by leveraging past and current research into new opportunities for environmental innovation and how technology can play a role. As such, there is a need to determine technological, market, and demographic trends across the globe and across industries to seek, evaluate and sometimes incubate emerging capabilities that demonstrate the potential to transform transportation. Moreover, it will be critical to evaluate potential risks posed by these emerging technologies, including where risks and/or benefits may inequitably impact citizens of different racial groups, socioeconomic backgrounds, or other demographic characteristics.

The Emerging and Enabling Technologies Program is focused on supporting research, development, and technology efforts. A few examples are highlighted below.

Safety. Secure interoperable communications technologies have become a critical tool in delivering safe, secure, and efficient operations of transportation systems across the nation. New forms of technologies could drastically increase the speed at which information is communicated and the amount of data communicated between vehicles and other entities, like roadside infrastructure, other vehicles, or even pedestrians with smartphone applications.

Equitable Economic Strength and Improving Core Assets. High quality roadways and other core assets that provide adequate transportation options to all users are essential for robust economic activity.

Rebalancing Investments to Meet Racial Equity and Economic Inclusion Goals. An equitable transportation network successfully delivers all roadway users safely, securely, and efficiently to their destinations. To be equitable, the transportation system must be accessible and accountable to users of all abilities and backgrounds, living in all geographic locations. Emerging technologies could potentially enhance the capability of users to

execute independent travel for all links in their travel chain safely and reliably. For example, using advanced, interoperable communications that update and adjust based on real-time changes, and that all citizens have access to, could support trip planning, wayfinding, situational awareness, and intersection crossing especially for underserved communities. This would allow underserved communities greater access to economic opportunities that had previously been unavailable to them.

Climate and Resilience. Emerging technologies in ITS (such as cellular-vehicle-to-everything (C-V2X) and 5G, as well as vehicle automation) could enable and support more efficient, data-driven transportation system and vehicular operations to better optimize multiple objectives related to climate change, including reducing overall fuel use, reducing GHG emissions, and improving air quality. These technologies could also help to improve transportation system resiliency.

Transformation and "Future Proofing." The ramifications of ITS have already begun to transform the transportation sector - new technologies and new data streams have the ability to transform the current technology infrastructure into a scalable, nationwide, connected digital infrastructure that can support new use cases such as cooperative automated driving (CDA). Vehicle manufacturers, infrastructure providers, innovators, academics, entrepreneurs, and other groups are invested in the safe implementation and efficient usage of ITS technologies. ITS can help "future proof" infrastructure and assets so the overall transportation system can adapt to changing circumstances and perform better for longer. ITS offers opportunities to extend the useful life of existing assets in a variety of ways, such as by predicting when preventative maintenance should occur, preventing crashes and damages, and distributing positive impacts to the system more equitably.

Currently, ITS JPO is testing the current generation of V2X communications (LTE-V2X) and preparing for testing the emerging generation (5G New Radio V2X). In 2023, research progress was made in the identification of the maturity of LTE-V2X for use in transportation communications; certain test results have fed into the updates to LTE-V2X devices and into the drafting of the FCC waiver requirements (and are anticipated to support FCC final rules), standards; and real-world and highly variable conditions provided greater insight for industry as to the performance of LTE-V2X and work is ongoing to address issues associated with GPS reliability, antenna integration, coexistence with existing Federal users of the 30 MHz (i.e., military radar), and other updates need to support commercial and widespread scalability of the technology. In addition, the real-world testing at the Tampa, Florida test site provided unexpected insight into how communications are affected by the built environment, including insights into whether glass buildings offer enough transparency to be a problem versus whether concrete buildings ability to present an obstacle to communications; the testing also provided insight into how V2X communications can coexist next to an active radar military site. This

is data that that National Telecommunications and Information Administration (NTIA) has said is needed for better, more accurate signal propagation modeling that informs spectrum rules and decisions.

Collaboration Partners:
The Emerging and Enabling Technologies program engages with private sector, academia, and governments around the world. Efforts related to questions associated with whether new communications technologies can reliably support interoperable, safety-critical applications, provide crash avoidance, and facilitate safe integration of automated vehicles and infrastructure require broad collaboration with stakeholders. Chipset and vehicle manufacturers are working on prototypes to prove out the concept while experts are working to design performance-based test procedures that demonstrate the capabilities as well as the gaps that still need to be addressed. Partners within the USDOT include FHWA, OST-R, and others. Outside partners include the Federal Communications Commission (FCC) and National Telecommunications and Information Administration (NTIA).

One of the lessons learned from previous deployments is that the transportation environment introduces unique requirements for telecommunications; for instance, users and equipment move at high speeds—over 80 miles per hour, which has effects on the basic safety message signals and transmissions. Because the communications are used for safety, there are additional requirements associated with the high frequency and high reliability of the signals. Another is that any viable communication technology needs to scale to allow hundreds of nearby devices to communicate without causing channel congestion.

We have also learned that the telecommunications industry evolves at a rate that is dramatically different from the deployment of these technologies in SLTT transportation system operations. The replacement cycle within the telecommunications industry is typically 18-24 months whereas the replacement cycle within transportation system operations is typically 10-15 years. This disparity is impacting how transportation agencies decide to invest in and procure communications and connectivity in both the near term as well as in their longer-term investment planning. It has created questions for industry as to whether telecommunications updates could be provided as software updates or easy replacement to V2X module parts, as opposed to wholesale replacements which are not only costly for public agencies, but potentially shut down V2X communications during transition, thus negating the crash prevention and other benefits.

With these requirements in mind, USDOT, modal partners, and stakeholder partners (e.g., NTIA) have invested in research and analyses including:

- Development of a spectrally efficient and effective band plan for the 5.9 GHz in the remaining 30 MHz In addition, identification of other spectrum for future low-

latency V2X applications and services that might be requested through the new National Spectrum Strategy.

- Testing of new technologies as they become available to gauge the suitability for high speed, rapidly moving and changing environments that may also be subject to land elevation, urban canyons, and other challenges.

- Assessment of out-of-band and adjacent channel interference from other users of the nearby spectrum to ensure that the transportation safety messages cannot be suppressed with the transmitting device or corrupted in transmission, or that the receiving device cannot hear or receive the messages.

- Analysis of the role of the immediate reporting of timing and location through GPS on devices and assessment of how the communications can continue to operate during any loss of GPS.

With respect to environmental and climate change activities, the ITS JPO expects to engage modal partners across the Department to address this Department-wide priority. The ITS JPO also expects to engage with partners and stakeholders at other Federal agencies, including the Department of Energy.

Accelerating ITS Deployment
($25,000)

Program Description:

As new research products, results, and prototypes evolve into market-ready products, the primary goal of the Accelerating Deployment Program is to provide data, research, analysis, and technical assistance and support services to accelerate adoption and at-scale deployment of secure, and interoperable ITS technologies. The objectives of the Accelerating ITS Deployment Program area are: (1) to accelerate the transformation of ITS research and prototypes into market-ready technologies that are commercially viable and deployed by the transportation community, and (2) to provide the ITS community the tools it needs for successful and interoperable deployment of ITS technologies and systems at scale. The Program area directly supports advancing ITS research and deployment activities through the full ITS deployment lifecycle – from initial deployment planning through to actual deployment and eventual assessment – in coordination with other stakeholders at the federal, state, regional, and local levels.

The Accelerating Deployment Program area provides a wide variety of resources and services to assist the ITS community of practice, including:

- Extensive data on ITS benefits, costs, and levels of deployment, to support data-driven and evidence-based deployment decision-making;
- Communication and education support to facilitate awareness, understanding, acceptance, adoption, and deployment of ITS technologies across stakeholder groups and to ensure that effective partnerships are fostered and maintained at various levels – executive, program, and projects;
- Knowledge transfer, technical assistance, training, and extensive interaction opportunities between and among ITS deployer communities;
- Support for the development and use of ITS-related standards and architectures to ensure the interoperability of ITS deployments;
- Support with data repositories and maintaining the Code Hub; and
- Support and coordination of Analysis Modeling and Simulation activities across the department.

The Accelerating ITS Deployment Program area contains six key activity areas, each considered to be individual Programs themselves:

- Professional Capacity Building Program
- Deployment Evaluation Program

- Communication and Outreach Program
- ITS Architecture and Standards Program
- ITS Data Program
- Analysis Modeling and Simulation Program

Professional Capacity Building (PCB): The ITS PCB Program supports knowledge and technology transfer to assist the ITS community in planning, deploying, operating, maintaining, and assessing the benefits of ITS deployments. To assist the transportation community, in advancing ITS, the ITS JPO will make resources available through the Smart Community Resource Center (SCRC) – an online tool to connect States, Tribal governments, and local communities with resources that can be used to develop intelligent transportation systems and smart community transportation programs.

The ITS PCB Program will share ITS knowledge and lessons learned from emerging transportation technology deployments, as well as from updated legacy ITS applications, with internal and external stakeholders. Knowledge and technology transfer will be provided through a variety of different kinds of webinars, online trainings, fact sheets and other informational or instructional products, workshops, and peer events – offered both in-person and virtually. These initiatives will be delivered in collaborations with the National Operations Center of Excellence (NOCoE), Institute of Transportation Engineers (ITE), ITS America (ITSA), National Association of Development Organizations (NADO), Association of Metropolitan Planning Organizations (AMPO), American Public Transportation Association (APTA) and a host of other stakeholders.

The ITS PCB Program will continue to offer and promote existing web-based trainings (WBTs) as well as in-person trainings. New trainings will be developed to assist the transportation community in advancing interoperable connectivity deployments and helping ITS deployers in conducting foundational planning and systems engineering processes that minimize project risks and increase the likelihood of successful ITS deployments.

The PCB Program also offers the Early Deployer Technical Assistance Cohorts. These cohorts enable communities of practice among active early deployers who opt-in to work iteratively and collaboratively with each other and the USDOT to make their projects successful while incrementally producing detailed documentation and shared software and data that the broader ITS community can use to deploy their own state-of-the-practice, interoperable solutions. Since September 2018, the ITS PCB Program and the FHWA Office of Operations have held monthly cohort group meetings for Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD) Program (formerly Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD)) grant recipients. While the peer-championed ATTIMD Group has proven to be beneficial to

deployers, the ITS PCB Program is looking to sunset the cohort in FY23 and stand up a new cohort providing technical support for USDOT-funded interoperable connectivity deployers. The purpose of the cohort is to share lessons learned and best practices will encouraging nationally interoperable deployments of V2X technologies. Finally, the ITS PCB's Academic Initiatives will continue to engage the academic community to better understand and provide resources to assist: (1) ITS training in community colleges; (2) educator-employer pathway connections; and (3) specialized ITS trainings at historically black colleges (HBCUs), tribal schools, secondary STEM programs (middle schools and high schools), and educational institutions serving rural and small metro areas.

Deployment Evaluation: This Program provides, data-driven, and evidence-based information to ITS decision makers and deployers to help plan, procure, and assess the effectiveness of ITS. This Program tracks the extent of ITS deployment, disseminates data on ITS benefits, costs, best practices/lessons learned, and analyzes data related to ITS deployment trends. This Program is also responsible for conducting the ITS Deployment Tracking Survey.

The Deployment Evaluation Program also develops a variety of products to facilitate knowledge transfer and technical assistance. For example, from May 2022-June 2023 the following resources were developed and posted on the Deployment Evaluation website:

- Twenty-one (21) new infographics
    - Eleven (11) Benefits/Costs/Lessons Learned Infographics: Work Zone Safety, CV Pilots, ATCMTD Overview, Parking Management, Micromobility Services, Traffic Incident Management, Highway Safety, Accessibility, Asset Management, Pedestrian Safety, and Arterial Roadway Safety
    - Ten (10) Deployment Tracking Survey Infographics: Plans for Future ITS Investments, Transit Partnerships, Work Zone Technologies: Arterials, Work Zone Technologies: Freeways, Traveler Information Trends: Transit, Traveler Information Trends: Freeway and Arterial, Freeway System Performance Measures, Arterial System Performance Measures, External Data Sources: Freeway and Arterial, and Data Collection/Use: Transit (6/2022)
- Four (4) Interactive data visualizations: Map of Selected Work Zone Safety Deployments, Timeline of Selected Work Zone Safety Deployments, Map of Selected Pedestrian Detection Technology Deployments, and Timeline of Selected Pedestrian Detection Technology Deployments

- Three (3) New case studies: Piloting Connected Vehicle Technology on Interstate 80 in Wyoming, Improving Work Zone Safety with Intrusion Alarms, and Connecting Travelers to Transit with First-Mile/Last-Mile Solutions

- Five (5) New Executive Briefings: ITS Cybersecurity, Next Generation Traffic Incident Management, Vision Zero and ITS, Data Collection and ITS, and ITS for Transit Asset Management

- One (1) Return on Investment (ROI) Best Practices Guide and five (5) Sample Use Cases (Adaptive Signal Control, Curve Speed Warning, Managed Lanes, Smart Work Zones, and Transit Signal Priority)

Communications and Outreach: This Program provides updates to ITS stakeholders and maintains the ITS JPO website and develops communications channels, including social media, email messaging, meeting planning, website development, trade shows, publications and speaking engagements. It also provides communications support for any ITS JPO-funded research project. This includes presentations, articles, and fact sheets about connected vehicle, automated vehicle and all other ITS activities. These materials are used to educate the public and provide stakeholders with the tools they need to promote deployment of ITS technology. The program also provides communications and outreach support for the V2X deployment campaign and other vehicle policy initiatives sponsored by the OST. A goal of the program is to ensure that the technical research conducted by ITS JPO is easily accessible and understood by stakeholders and the general public through the development of easy-to-understand content that is in plain English.

Smart Community Resource Center (SCRC): The USDOT was directed by Sec. 25002 of H.R.3684 – (the Infrastructure Investment and Jobs Act), to develop and manage the Smart Community Resource Center (SCRC) which will include a compilation of resources and links to resources for States and local communities to use in developing and implementing (1) intelligent transportation system programs; or (2) smart community transportation programs.

This new online resource center is intended to provide the general public with information on ITS and other technologies for smart communities. It is also expected to serve as a resource center for entities with an interest in applying for a USDOT Strengthening Mobility and Revolutionizing Transportation (SMART) Grant Program award or those organizations that have received a SMART Grant, along with ATTAIN Grants, and other ITS-related USDOT Grants. The ITS JPO will ensure the following types of resources are available:

(1) existing programs and resources for ITS or smart community transportation programs, including technical assistance, education, training, funding, and examples

of intelligent transportation systems or smart community transportation programs implemented by States and local communities, available from:

a. the Department

b. other Federal agencies; and

c. non-Federal sources.

(2) existing reports or databases with the results of intelligent transportation system or smart community transportation programs.

(3) any best practices developed, or lessons learned from intelligent transportation system or smart community transportation programs; and

(4) such other resources as the Secretary determines to be appropriate.

ITS Architecture and Standards: This Program provides a reference system architecture (known as the Architecture Reference for Connected Intelligent Transportation, or ARC-IT—the National ITS Architecture) along with voluntary technical standards, tools, and deployment support. These efforts guide safe, secure, efficient, and interoperable deployment of infrastructure, connected, and automated ITS technologies. The ITS reference architecture (www.arc-it.net) provides infrastructure, owners and operators (IOOs) and deployers access to options for deploying more than 130 ITS public-benefit services and applications. The ITS reference architecture is accompanied by software tools for developing and customizing regional and project architectures to meet local needs while also ensuring necessary nationwide interoperability. The reference architecture identifies interfaces for standardization and recommends suitable ICT and ITS standards – identifying and enabling multiple suitable technology choices whenever viable. The standards activities support the development of needed ITS-specific standards as well as evaluation; and when beneficial, customization of ICT standards to most effectively meet ITS deployment needs. The program also conducts extensive technical and implementation support along with systems engineering and architecture implementation workshops to State and local customers nationwide. Additionally, foundational research is funded that advances ITS reference architectures, standards, cybersecurity options, and human factors guidelines that support safe, secure, and interoperable large-scale deployments of ITS; and support regulatory decision-making. Included in this is direct support to and exchanges with next generation wireless research activities as communications and their standards are key enablers of successful ITS deployments. Furthermore, the Interoperability area provides support to deployment test beds and pilot deployments.

ITS Data: This Program facilitates effective generation, acquisition, governance, management, and analysis of ITS data and code across all modes to advance the state of multimodal ITS research and enable deployment of innovations in operations. This, in turn,

increases return on federal investment in research and demonstration projects and accelerates multi-modal, data-driven, trusted evaluations of potential safety, mobility, and other benefits to inform future policy and investment decisions. While enabling broader ITS research and deployment activities, these investments drive implementation of various Federal and USDOT directives on increasing access to data, source code, and federally funded research results.

Analysis Modeling and Simulation: The AMS Program is a suite of tools and technologies that can be used to improve the current practices in understanding, analyzing, planning, designing, and evaluating the ITS implementation. The AMS Program supports a variety of diverse areas including FHWA's Traffic Analysis Tool Program, Connected Automated Vehicle AMS Program, Office of Planning, Office of Policy, Office of Infrastructure, and others. In addition, other modal partners such as NHTSA and FMCSA also have some AMS related activities.

The AMS Program focuses on AMS activities that have ITS components. The main current goals are to develop an AMS Program Plan and to coordinate all the AMS-related activities pertinent to ITS across the whole department.

Major Program Objectives:
The objectives of the Accelerating ITS Deployment Program are to provide the research, analyses, products, tools and services to enable more rapid, secure and interoperable deployment of ITS technologies and services to maximize benefits to the public. The intent is to define and improve evidence-based decision making, collaboration, harmonization, standardization, education, and communication mechanisms to encourage investment in, and deployment of ITS; to develop comprehensive training and analytic tools that allow deployers to understand the financial and operational benefits and costs of new technologies and systems; to maintain data repositories and the Code Hub, and to establish the tools that deployers can use to help make more informed investment and planning decisions regarding ITS deployment. AMS activities related to ITS will be coordinated across the department, and the AMS Program Plan will provide a structured approach.

Anticipated Program Activities:
Professional Capacity Building Activities FY 2024:
One of the ITS JPO's PCB teams' primary objectives is to promote technology transfer and education to accelerate deployment of ITS research and technologies. The ITS PCB Program will continue coordinating with Federal program offices, educational organizations, and professional associations, and active state, regional, and local public agencies, and continue reaching out to build the community. In FY24, the ITS PCB Program will continue delivering multimodal ITS learning opportunities and providing technical assistance resources to practitioners through:

1. Smart Community Resource Center (SCRC)
2. Webinars (e.g., Talking Technology and Transportation (T3) Webinars)
3. Workshops (e.g., ITS State Chapter Workshops)
4. Online Training Modules (e.g., web-based trainings, ITS Standards modules, ITS microlearning vignettes)
5. Technical Assistance (e.g., Interoperable Connectivity Cohort, Connected Vehicle Equipment Loan Program, Connected and Automated Vehicle (CAV) Help Desk, and the ITS PCB Peer Program)
6. Educational Materials (e.g., ITS ePrimer online modules)
7. Academic Support (e.g., ITS University and Community College Focus Groups and Workshops, Academic Competitions, ITS case studies and immersive learning exercises, and other activities identified through engagement with academic stakeholders)

In FY24, the ITS PCB Program will provide support with the continued build out of the Smart Community Resource Center (SCRC) – making more resources readily available to practitioners as they advance their ITS and smart community projects and programs. The ITS PCB Program will also expand its online, on-demand training offerings for both the internal and external transportation workforce. Expanding the topics and types of offerings available will reach a broader audience. Working with the National Highway Institute (NHI), academic community, professional associations, and other training partners, activities will include developing new materials focused on advancing the deployment of interoperable connectivity technologies, supporting ITS deployers with foundational planning and deployments activities, and increasing knowledge of ITS's role in the Safe System Approach, among others. A variety of formats will be considered including the development of in-person, web-based, and micro-learning trainings.

The ITS PCB Program seeks to provide training and educational products augment Department priorities. Safety is always a topic intertwined with most or all ITS PCB products. Many of the ITS applications also promote strategies that reduce congestion as well as transportation's impact on the environment. The training and education products also focus on technologies and applications that improve transportation system operations, which supports the Department's Economic Strength and Global Competitiveness goal included in the USDOT Strategic Plan. Trainings also discuss equity and how ITS technologies can increase accessibility for all users. Ensuring that all products (or events) are free, and the majority are accessible through the ITS PCB website supports the equity priority. The ITS PCB's Academic Initiatives likewise target educational institutions that serve underserved populations or areas (HBCUs, tribal schools, rural-based academic institutions).

Over the last five years, the ITS PCB Program has been directly training staff from FHWA, FTA, FMCSA, and other federal offices on federal policies and programs, and technologies

associated with automated vehicle and vehicle connectivity. This internal training effort enables staff from program and field offices to increase their expertise in these current, high-visibility subjects and be more responsive to the public agency grantees. Consistent with the goal of Organizational Excellence, direct training of federal staff on prominent and timely ITS subjects will continue in FY24.

Deployment Evaluation Activities FY 2024:

Benefits/Costs Databases: The Deployment Evaluation Program will continue to improve the operation and content of the benefits/costs/lessons learned databases and overall Deployment Evaluation Program website and to experiment with new, innovative ways to present these data to the public. This would include:

- Obtaining ITS deployment benefit, costs, and best practices data from new sources;
- Addressing ITS benefit and cost data gaps (particularly in the areas of climate change and equity); and
- Continuing to develop compelling data visualization products and decision-making and planning tools to support ITS stakeholders in their efforts to make evidence-based decisions about ITS investments at all stages of the ITS deployment lifecycle.

ITS Deployment Tracking Surveys: The Program completed its most recent ITS Deployment Tracking Survey (DTS) in CY 2020-2021. The results have been published and are currently publicly available on ROSA-P as well as on the Deployment Evaluation Program website. The Program is also planning the next major ITS Deployment Tracking Survey.

In FY24, the Deployment Evaluation Program will administer the 2023 ITS Deployment Tracking Survey (October through December 2023), analyze DTS data/results (January through April 2024), and prepare four (4) 2023 DTS reports for publication and dissemination (April through August 2024): "Summary of Key Findings" (1 Report) + Individual detailed reports for "Freeway Results", "Arterial Results", and "Transit Results" (3 Reports)

Also, in FY24, the Deployment Evaluation Program expects to undertake the following activities:

- Webinars and presentations in a variety of venues, including a webinar series on ITS Deployment Evaluation
- New set of Annual Executive Briefing Reports on emerging ITS topics
- Presentations at TRB (January 2024) and ITS America (April 2024) annual meetings:
- Updated sample unit cost data set: Convert from complex Excel spreadsheet to web-accessible workable tabular format
- Develop and post additional interactive data visualizations (topics TBD, ongoing)

- Develop and post additional infographics (focusing on results of 2023 DTS) (topics TBD, ongoing)
- Develop and post additional case studies (topics TBD, ongoing)
- Develop and post additional cost plots (topics TBD, ongoing)

Strategic Priorities: The Deployment Evaluation Program is continuing its long-term effort to provide data-driven and evidence-based products and services to the ITS stakeholder community. The Deployment Evaluation Program's strategic priorities are:

- Putting communities and people first by addressing a full spectrum of stakeholder needs related to the foundational elements of successful ITS deployment and the full ITS deployment lifecycle;
- Developing visually appealing and engaging products and tools to (1) serve as a launch point for more engagement with the data, thereby enabling successful, effective, and interoperable ITS deployments and (2) demonstrate that ITS deployment is a sound investment;
- Taking maximum advantage of existing data assets for evidence-based decision support for the ITS community; and
- Providing resources and tools to support effective and meaningful evaluations of ITS deployments, pre- and post-investment.

Communication and Outreach Activities FY 2024:

University Transportation Centers (UTC) Guest Speaker program: The objective of this program is to increase awareness among college student to help them better understand opportunities in the ITS field. The task will require that the contractor identify colleges and universities where USDOT staff and/or contractors can serve as guest speakers. This task differs from the PCB program in that it does not involve training, workshops and other events designed in improving the workforce skills development. It also does not involve developing lesson plans and other materials for teachers.

Event Planning: This task will be used provide program support for major events where USDOT will have a major presence. This includes large events such as SXSW (March 2024), CES (January 2024), and the ITS America Conference and Expo in Phoenix (April 2024). By participating in these events, USDOT is able to connect with non-traditional stakeholders that are outside of the ITS community. This additional outreach will help USDOT to develop new partnership relationships with technology firms and advocacy groups.

New Smart Communities Video: This is a new video that will be on the homepage of the Smart Communities Resource Center (SCRC). It will explain how ITS technology can help in the development of smart communities and promote this online resource.

Smart Community Resource Center: In FY23 the ITS JPO launched the Smart Community Resource Center. Future plans include the continued coordination and content to support the OST-R SMART Grant program. The ITS JPO works collaboratively with the other modal administration to identify the best internal and external resources to be included in the SCRC and identifies internal stakeholders to serve as stakeholders. Working in coordination with the ITS JPO, these internal stakeholders serve as working partners in the review of wireframes, mockups and beta testing activities.

Intersection Safety Challenge: In FY23 ITS JPO and OSTR launched the Intersection Safety Challenge to garner the latest technical solutions to prevent crashes involving Vulnerable Road Users. The communications and outreach team will continue to provide strategic communications support, graphic design, social media and other services for this program.

Interoperable Connectivity Deployment: A primary focus for FY24 is to jumpstart the deployment of Roadside Units and other devices that can assert the deployment connected vehicle technology. The communications and outreach team has supported the first of many V2X summits where USDOT can tap into the knowledge of stakeholders who can help us expand the use of this technology. In FY24 the team expects to continue to provide webinar support, graphics, social media, and technical writing services for this campaign.

ITS Architecture and Standards Activities FY 2024:

In FY24, architecture and standards activities will include continued evolution in the content of the ITS reference system architecture and ITS standards, along with continued efforts to adapt and leverage interoperable security best practices to benefit the unique requirements of ITS. This evolution will reflect advances in key technologies emerging within the ITS marketplace, including vehicle automation, alternative connectivity services, and new ICT technologies such as 5G. Activities will identify and fill-in gaps, and support the implementation of best practices across ITS deployments. Cooperating internationally, further work will be undertaken to specify access controls for ITS environments for effective cybersecurity; and to develop and evolve voluntary technical standards and candidate system architectures to support the secure communication of road signage and regulatory information to automated and connected vehicles (i.e., digital infrastructure and message authentication). Interface standards to support V2X and cooperative automation are underway and will be continued. Standards for improved connectivity services, including those needed for Roadside Units (RSU) as well as the interoperable broadcast of traffic signal phase and timing (SPaT) information, are expected to be evolved to address validation of initial guidance along with initial analyses to support improving security of legacy ITS infrastructure equipment installations. Work will also be conducted to develop interoperable guidance that deployment agencies and the connected vehicle community can utilize to ensure the safe and interoperable deployment of work zone data nationwide.

Program efforts will continue to be informed by extensive collaboration with stakeholder groups and Standards Development Organizations (SDO) to assure that products that are developed meet stakeholder needs in broadly acceptable way to facilitate voluntary deployments.

ITS Data Activities FY 2024:

The ITS JPO remains committed to providing access to data and source code generated through its investments, including the various projects described throughout this and past AMRPs, in accordance with the Department's public access guidance. In FY24, the ITS JPO will continue to refine its data and source code policies, drive implementation among ITS JPO-funded projects in various modes, advise program managers on project-specific data requirements and best practices, promote the availability of ITS JPO-funded data and source code for analysis and reuse, and generate best practices for the broader research and deployment communities. The ITS JPO will also contribute to the broader USDOT research, policy, and technology communities through existing internal and external multi-modal forums and collaborative intermodal projects. The Assets and Governance sub-program will pay for ITS JPO-funded projects' use of the assets described below, including use by modal partners managing ITS JPO-funded projects, and work with any shared service providers to define and deliver ITS JPO-specific requirements that meet the needs of the ever-evolving ITS research portfolio.

The Assets and Governance sub-program area will manage and/or fund the following systems and teams in FY24:

- ITS DataHub. ITS DataHub provides a single access point for USDOT's ITS research data via integration with the Department's open data portal (data.transportation.gov) and repository and open science access portal [ROSA-P] (rosap.ntl.bts.gov), and augments these shared services with cloud storage (ITS Data Sandbox) to support more advanced ITS research requirements, such as large volumes of data and data formatted in a non-tabular way. The ITS DataHub user interface is a simple web portal that could be replicated by other groups within the Department and the source code is available on ITS CodeHub.

- ITS CodeHub. ITS CodeHub provides a single access point for USDOT's ITS source code and enables code collaboration and re-use. In FY22, ITS JPO began the process of streamlining how the source code is stored within repositories and that work is expected to continue into FY24. The ITS CodeHub user interface is a simple web portal that could be replicated by other groups within the Department and the source code is available on ITS CodeHub.

- USDOT Secure Data Commons (SDC). The SDC enables collaborative research and analysis involving moderate sensitivity level datasets, and currently hosts ITS JPO-funded project data containing personally identifiable or confidential business information. Originally developed by the ITS JPO, the Office of the Chief Information Officer took over as SDC manager in FY21 and ITS JPO continues to provide funding for ITS JPO-funded projects using this shared service.

- Public Access Implementation Support Team. To enhance access to results from the Department's research investments, including data, source code, and reports, this team provides consultative support to USDOT program managers and project delivery teams at key parts of the program design, procurement, execution, and close-out processes. In FY24, the National Transportation Library (NTL) – the implementing organization for the Department's Public Access Plan – will start providing templates and trainings tailored to the needs of high value, high risk projects such as those funded by the ITS JPO.

- ITS JPO's Professional Capacity Building (PCB). The *Assets and Governance* sub-program will also work with the ITS JPO's PCB program to develop publicly available knowledge and technology transfer materials, such as a training module on the ITS JPO Data Management Plan template, as well as other core data and code management and governance documents that deployers would benefit from creating, whether they are USDOT or locally funded project.

Analysis Modeling and Simulation Activities FY 2024:

The AMS Program has two major goals in FY24: 1) to develop an ITS JPO AMS Program Plan, and 2) to continue supporting and coordinating the AMS activities across the department.

Specific activities planned for FY24 are presented below:

- ITS JPO AMS Program Plan Development. There is an existing project initiated in 2022 and managed by the ITS JPO AMS Program manager. The effort to develop an ITS JPO AMS Program Plan has been going on for a while as part of this project. With that, the goal of FY24 is to complete a first version of the program plan.
- Support and coordination of the AMS projects conducted by modal partners. ITS JPO currently sponsors more than ten projects and will continue to support these efforts while coordinating the scopes and results sharing so that the gaps and overlaps can be minimized. A list of representative activities is presented here:
    - Emerging Data Cleaning and Fusion for Traffic Model Calibration
    - Advanced Driver Assistance Systems Microsimulation Model Development and Validation

- Analysis, Modeling, and Simulation (AMS) Framework for Automated Trucks
- Complete Streets - ITS Comprehensive
- Complete Streets - System Dynamics Modeling and Integrated Operations

Potential Program Outputs, Outcomes, and Impacts on Technologies and Practices:
The Accelerating Deployment program area cuts across all aspects the ITS JPO's research agenda and supports all the programs in the ITS JPO. The Accelerating Deployment Program supports a variety of efforts related to evidence-based decision making and focuses on questions of investment choices, value, and awareness of technologies and their application in the real world. The program also supports efforts to provide technical assistance to ITS deployers through knowledge and technology transfer efforts. It also includes initiatives to prepare the current and future workforce by providing training and collaborating with academia.

Professional Capacity Building Program: Training and educating current and future transportation professionals is an ongoing task that lends it efforts to ever-changing outputs, outcomes, and impacts as the users change and the technologies and systems evolve. In FY24, the ITS PCB Program is focused on providing technical support to help agencies successful advance the deployment of ITS and emerging transportation technologies. FY24 outcomes aim to increase the scope and reach of the ITS PCB Program, meaning more practitioners are aware of technical resources and educated on a wider ITS topics, once again leading to improved ITS products or transportation operations. The ITS PCB Program will advance the development of the Smart Community Resource Center (SCRC) by compiling and making key USDOT resources readily available to deployers. The addition of new courses, as well as the conversion of existing courses, workshops and training materials to an online delivery format will make the training resources available to the larger transportation workforce community. New trainings will be developed for interoperable connectivity, foundational planning activities to support delivery of grants and ITS projects, systems engineering, and cybersecurity. The ITS PCB Program is also updating its website to make it easier for users to discover and access available trainings. Finally, the program will deliver in-person trainings in coordination with ITS America and ITS State Chapters.

The ITS PCB Academic Team has a robust catalog of training resources. Over the last decade, there has been increased collaboration with university, college and community college professors and instructors as well as transportation agency hiring officials who regularly participate in the ITS PCB Academic Workshops. Leveraging these partnerships and partnering with the Turner-Fairbank Highway Research (TFHRC) ensure that materials, resources and prototypes (i.e., the CAVe-in-a-Box) developed will be of value to professors and instructors at a variety of levels educational levels. Through the Academic Team, the program will continue to collaborate with this larger group to best identify the

most useful resources for professors and students, aiding in increased ITS interest in transportation careers and enhancing the capabilities of future transportation professional.

Deployment Evaluation Program:

Outputs include:

- Benefits, costs, and lessons learned databases, online and available to the public 24/7. The databases are constantly updated with recent publicly available evaluation data and are fully searchable.
- ITS Deployment Tracking Survey Data Repository, where raw data and survey instruments for every ITS Deployment Tracking Survey since 1999 are online and available to the public for download 24/7.
- Decision Support Resources site, where the Program provides data visualizations and infographics, interactive cost data plots, and an ROI Best Practices Guide with sample use cases.
- Executive Briefings and case studies developed annually and posted on the website.

Outcomes: Outcomes of this program include providing the data resources, tools, and analytics to support data - driven and evidence- based ITS deployment investment. Making these data available to anyone, anywhere in the world, is another key outcome of this Program. The Deployment Evaluation Program's efforts to support ongoing Department-wide activities that will accommodate innovation in evidence-based decision-making is another positive outcome that can result in:

- A focus on data-driven support for stakeholders that addresses the full lifecycle of ITS deployment to accelerate and improve stakeholder investment in ITS technologies, applications, and services.
- Assistance for stakeholders that will help them to make better quantitative and qualitative decisions about investing in and deploying ITS - from pre-deployment/investment planning through to performance measure setting, data collection and management, evaluation, and transfer of results and best practices.

Impacts: The Deployment Evaluation Program's long-term impact will be to accelerate the deployment of ITS technologies that work to improve the nation's safety, mobility, economic competitiveness, and environment in a measurable way.

Communications and Outreach Program has a number of outputs, outcomes and impacts in FY24 that are designed to increase the profile of the ITS JPO. Outcomes include:

1. Creation of a new SCRC video that will explain how ITS technology can benefit smart communities, provide examples of how the technology is used in the everyday life of Americans and how ITS improves safety and mobility.
2. Establishing USDOT's booth presence at the large events such as the Consumer Electronics Show *or* SXSW.
3. Smart Community Resource Center expected outcomes include the development and deployment of the SCRC, along with internal and external resources for States and local communities to use in developing and implementing of intelligent transportation system programs and smart community transportation programs.

ITS Architecture and Standards Program: Expected outcomes of the architecture and standards-related efforts include continued success of effective, interoperable, secure and safe ITS deployments due to the availability of an evolving reference system architecture and software toolsets, updated to accommodate additional automation-related services; new and enhanced ITS standards that support greater security; and enhanced cybersecurity practices; along with deployment support to developers of regional and project architectures. New and updated standards products will support secure evolution of legacy ITS equipment, standardized ITS connectivity equipment (including roadside units as well as interoperable Signal Phase and Timing (SPaT) broadcast services) along with additional cooperative automation standards content. The existing family of ITS standards will be further updated to meet evolving needs, the architecture reference will be updated to reflect appropriate uses of evolving 5G and other ICT standards. These interoperability standards and toolsets will enable more secure, safer, and interoperable deployments across the nation (and North America). They further provide the world with leading-edge standards that can be adopted by other Nations and help ensure harmonization for ITS technologies in a manner that opens global markets to American transportation technology manufacturers. A desired outcome of the interoperable security work is to support the efforts of the broad stakeholder community in their implementation of, secure nationally interoperable ITS systems that ensure broad access to the safety and mobility benefits of ITS while remaining resilient to quickly address threats and attacks, minimizing any disruptions to services and system performance.

ITS Data:

Outputs: ITS JPO expects that the following outputs will be produced by the ITS Data program in FY24. These outputs can be leveraged by modal administrations and other offices to accelerate their own public access efforts.

- Updated data access guidelines for ITS JPO-funded projects and related templates, such as Data Management Plan (DMP) and Privacy Management Plan (PrMP)

- Updated source code access guidelines for ITS JPO-funded projects and related templates, such as source code management plans
- Updated procurement language examples for contracts and grants to ensure public access to ITS JPO-funded research products
- PCB course for data management, with a specific focus of data management plans and privacy management plans.

Outcomes: ITS JPO expects these investments will result in faster access to higher quality data and source code from the Department's ITS research portfolio. This will increase the quality and timeliness of project evaluations and other analyses which support decision-making within the Department and in the deployment community, and enable external researchers to perform their own analyses, driving additional knowledge-building and economic activity. It will also enable greater re-use of source code generated through the Department's ITS research portfolio, which will reduce costs while improving interoperability and accelerating deployment. These investments will also increase access to data in the deployment community by lowering barriers to voluntary data exchanges.

The ITS Data Program supports USDOT research areas. The development of data systems to support data-driven technologies and decision making in real time is one of the overarching themes of USDOT RD&T efforts.

Impacts: Advances in data processing are enabling governments, transportation operators, and private companies alike, to improve the safety, mobility, efficiency, and resiliency of the transportation network and better target investments. These improvements will enhance the safety of the Nation's surface transportation system, in addition to reducing the transportation system's impact on the climate.

Analysis Modeling and Simulation Program: Before the ITS JPO AMS Program launched in the Fall of 2022, there was not much coordination among AMS related activities within USDOT. Some sorts of AMS activities, especially related with ITS, were being carried out "independently" by various offices within FHWA and others, including HRT (HRSO), HOP (HOTM, HOFM), HEP (HEPH), HPL (HPTS), Volpe, and so on. As a result, there existed gaps and overlaps which kept the department from conducting research projects in a more efficient and coordinated way. With that, the biggest impact of the ITS JPO AMS Program is that it serves as a focal point for all the ITS related AMS activities for better coordination and collaboration towards a unified vision.

Another outcome is to develop a comprehensive AMS program plan (or roadmap), focused on ITS, to guide the AMS stakeholders and their efforts across USDOT. This single program vision would help improve AMS tools and models by incorporating advanced emerging technologies in ITS (e.g., ADS and CDA) and then to be able to provide *the necessary AMS*

tools and guidance so public agencies can make the best possible transportation investment decisions.

Potential Economic or Societal Impacts:
The potential socio-economic impact of the Accelerating Deployment Program is best expressed in (1) the positive economic value that accrues to local communities as ITS investment funding is spent locally and with a good return on investment and (2) the positive socio-economic impact of improvements in peoples' safety and mobility (and improvements in a community's economic competitiveness) as businesses and citizens experience reduced traffic congestion and improved road safety, and as associated improvements in quality of life and economic development are realized.

The goals of the Accelerating Deployment Program are to (1) provide research, analytics, data resources, and services that support adoption and deployment of ITS technologies, (2) improve the rate of transformation of ITS research and prototypes into market-ready technologies that are commercially viable and adopted by the transportation community, and (3) provide the tools needed for interoperable deployment of ITS technologies and systems across the nation. These three goals can have a tremendous societal and economic impact leading to more secure, safe, and interoperable deployments at scale thereby increasing the confidence and rate of adoption of ITS technologies. Additionally, as a result of harmonization and interoperability work and research, the marketplace for these technologies will broaden the marketplace both domestically and internationally, allowing US vendors to maintain competitiveness in foreign markets.

Under the ITS PCB Program's Academic Initiatives, the ITS PCB Program has reached out to Historically Black Colleges and Universities (HBCUs) and tribal schools to expand ITS training into these underserved academic communities. The ITS PCB Program has also linked with the Conference of Minority Transportation Officials (COMTO) to cooperatively expand ITS knowledge sharing to its members and member organizations (especially HBCUs and tribal schools). This cooperative effort will continue and expand in FY24 (and beyond).

Potential Progress Made Toward Achieving Modal Strategic Goals:
The Accelerating Deployment Program is a crosscutting program that supports nearly all of the USDOT RD&T Strategic Goals, including Safety; Economic Strength and Global Competitiveness; Equity; and Transformation.

The Accelerating Deployment Program aligns with and supports the following USDOT goals:

- **Safety*:*** Make our transportation system safer for all people. Work toward a future where transportation-related serious injuries and fatalities are eliminated. Through the ITS PCB Program, for example, safety is shared through knowledge transfer and lessons

learned from ITS and emerging transportation technology, including AV and CV, deployments to internal and external stakeholders. The Deployment Evaluation area provides resources, tools and analysis to support data- driven and evidence-based research and deployment investment.

- ***Economic Strength and Global Competitiveness:*** Grow an inclusive and sustainable economy. Invest in our transportation system to provide American workers and businesses reliable and efficient access to good-paying jobs, resources, and markets. The Deployment Tracking data provide snapshots of how ITS deployment is occurring in the US and allows analysis relating to market development, economic impact, performance assessment, feasibility assessment, and impact assessment.

- ***Equity:*** Create an equitable transportation system that provides safe, affordable, accessible, and convenient mobility options for all users. Through work in the PCB and outreach to all travelers, efforts are underway to ensure equity is embedded in all ITS JPO activities. The communication and outreach area creates new resources and mediums to explain and educate the uses and benefits of ITS technology.

- ***Transformation:*** Design for the future. Invest in purpose-driven research and innovation to meet the most obvious goals impacted through the challenge of the present and modernize a transportation system of the future that serves everyone today and, in the decades, to come. Architecture and Standards initiatives enable safe, secure, and interoperable large-scale deployments of ITS through foundational research that advances ITS reference architecture and standards, cyber security options, and human factors guidelines, support regulatory decision-making.

The Accelerating Deployment program area has several points of impact on transportation safety, economic strength and global competitiveness, and transformation. Through the ITS PCB Program, for example, safety insights are shared through knowledge transfer and lessons learned from AV/CV deployments to internal and external stakeholders. The Deployment Evaluation Program provides resources, tools, quantitative data, and analysis to support evidence-based research and deployment investment, particularly with respect to benefit/cost analysis and return on investment (ROI) analysis. The ITS Deployment Tracking data provide snapshots of how ITS deployment is occurring in the US and allows analysis relating to market development, and economic impact. The communication and outreach area creates new resources and mediums to explain and educate the uses and benefits of ITS technology. Finally, Interoperability initiatives (1) drive innovation, safety, and economic and global competitiveness, climate and sustainability, and organizational excellence are likewise supported by expanding the marketplace through competition between vendors, (2) enable safe, secure, and interoperable large-scale deployments of ITS through foundational research that advances ITS reference architecture and standards,

cyber security options, and human factors guidelines, and (3) support regulatory decision-making.

Collaboration Partners:
Each of the elements of the Accelerating Deployment Program area are crosscutting and, as such, have at their core the objective of reaching out to all types of stakeholders, and across all modes. To ensure that these stakeholders and communities of practice are given necessary data, knowledge sharing, and technology sharing support, the Program works in partnership with the USDOT surface modes, professional associations, universities, state, regional and local public agencies, standards development organizations, and others to engage the broad technical and organizational expertise needed to accelerate ITS deployment. Stakeholder cooperation includes activities via associations such as AASHTO as well as with individual State, local, tribal, and territorial (SLTT) ITS deployers. Extensive cooperation is conducted with other ITS JPO Programs as well.

Cooperation and coordination also occurs with other Federal program offices, educational organizations, and professional associations who act as a sounding board from which the Accelerating Deployment Program receives information on ITS community needs related to supporting ITS deployment, and serve as distribution channels through which the Accelerating Deployment Program disseminates various products and services.

Within USDOT collaboration extends to modal partners with ITS interests as well as security, policy, research and international programs organizations in the Office of the Secretary of Transportation (OST). Intergovernmental Federal cooperation includes the Department of Homeland Security and NIST via direct relationships and well as participation in standards coordination activities of the National Security Council.

The ITS Architecture and Standards Program and their broad stakeholder groups of researchers, deployers, industry and academia to assure that standards products meet security needs, and the reference architecture appropriately encompasses cybersecurity. International cooperation opportunities are leveraged when beneficial to US interests via intergovernmental cooperation as well as cooperation via SDOs. Creating, maintaining, and expanding effective partnerships will remain a critical component of the Program's strategy.

Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD) ($21,000)

(Instructions: Provide content for each program listed in the tables on the previous page, including responses under each of the following headings. If there is a question that cannot be answered or is not applicable to the program, please state that in your response.)

Program Description:

The ATTIMD is statutorily required in the Infrastructure Investment and Jobs Act (IIJA) Section 13006, 23 U.S.C. 503(c)(4). The ATTIMD grants are managed by FHWA and the ITS JPO contributes a mandated percentage of funding through FHWA to annually satisfy the requirement.

The USDOT provides a total of $60,000,000 for ATTIMD, with $39,000,000 coming from FHWA and $21,000,000 from the ITS JPO.

The language provided here duplicates the language provided in the FHWA AMRP for consistency.

The Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD) Program is intended to provide funding for eligible entities to develop model deployment sites for large scale implementation and operation of a diverse set of technologies in various geographic regions. As the program is aimed at the rapid deployment of advanced technologies, limited expenditures for infrastructure construction is anticipated in grant application. The stated purpose is to reduce costs and increase return on investments; deliver environmental benefits through increased mobility; enhance transportation system operations; improve safety; improve collection and dissemination of real-time information; monitor transportation assets; deliver economic benefits; and accelerate deployment of connected and automated vehicle technologies. Successful proposals will contain quantifiable system performance objectives, use innovative technologies and strategies, and a plan for long term operation and maintenance of the deployed technologies. The U.S. Department of Transportation (USDOT) encourages partnering among the private sector, public agencies, research institutions, technology leaders, and other transportation stakeholders.

Major Program Objectives:

The USDOT's vision for the ATTIMD initiative is the deployment of advanced technologies and related strategies to address issues and challenges in safety, mobility, efficiency, system performance, intermodal connectivity and infrastructure return on investment that are confronted by transportation systems owners and operators. The advanced technologies are integrated into the routine functions of the location or jurisdiction and play a critical role in helping agencies and the public address their challenges. Management

systems within transportation and across other sectors (e.g., human services, energy, and logistics) share information and data to communicate among agencies and with the public. These management systems provide benefits by maximizing efficiencies based on the intelligent management of assets and the sharing of information using integrated technology solutions. USDOT shares the advanced technology solutions and the lessons learned from their deployment with other locations, scaled in scope and size, to increase successful deployments and provide widespread benefits to the public and agencies.

Anticipated Program Activities:
In FY24, the ATTIMD program will request proposals for new grant awards, completed the awards under the previous solicitation, and managed the existing grant awards made through the formerly named Advanced Transportation and Congestion Management Technologies (ATCMTD). Additionally, the program published the ATCMTD annual report as mandated by the FAST Act.

Key FY24 ATTIMD Program Activities.

Activity	Period of Performance
Selection of FY24 grant awards and timely implementation of projects.	2024
Continue award of FY24grants and manage FY16-22 projects.	On-Going
Publish ATCMTD annual report as mandated by the FAST Act.	2024

Potential Program Outputs, Outcomes, and Impacts on Technologies and Practices:

Outcomes: The ATTIMD Initiative will develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. Each ATTIMD project will consist of model technology deployments to help demonstrate how emerging transportation technologies, data, and their applications can be effectively deployed and integrated with existing systems to provide access to essential services and other destinations. This also includes efforts to increase connectivity to employment, education, services and other opportunities; support workforce development; or contribute to increased mobility, particularly for persons with visible and hidden disabilities and elderly individuals.

Outputs: Each grantee is required to submit a report that that describes:

- Deployment and operational costs of the project compared to the benefits and savings the project provides; and

- How the project has met the original expectations projected in the deployment plan submitted with the application, such as-
    - Data on how the project has helped reduce traffic crashes, congestion, costs, and other benefits of the deployed systems;
    - Data on the effect of measuring and improving transportation system performance through the deployment of advanced technologies;
    - The effectiveness of providing real-time integrated traffic, transit, and multimodal transportation information to the public to make informed travel decisions; and
    - Lessons learned and recommendations for future deployment strategies to optimize transportation mobility, efficiency, multimodal system performance, and payment system performance.

Impacts: Grants may be awarded for various types of deployments, but it is anticipated that each will have one or more of the following impacts:

- Reduced traffic-related fatalities and injuries;
- Reduced traffic congestion and improved travel time reliability;
- Reduced transportation-related emissions;
- Optimized multimodal system performance;
- Improved access to transportation alternatives;
- Improved integration of payment systems;
- Provided the public with access to real-time integrated traffic, transit, and multimodal transportation information to make informed travel decisions;
- Provided cost savings to transportation agencies, businesses, and the traveling public; or
- Provided other benefits to transportation users and the general public

Potential Economic or Societal Impacts:

Potential economic and societal impacts will be achieved individually be each of the ATTIMD grantees. Examples of impacts will include the improvement of mobility and goods; improvement of the durability and life of transportation infrastructure, reduction in costs and improved returns on investment; protection to the environment; reductions in the severity of traffic crashes; increases to safety, improved use of real-time data, and

broad economic benefits related to reductions in delays, improvement of system performance and efficient and reliable movement of goods and services for all Americans.

Potential Progress Made Toward Achieving Modal Strategic Goals:

Since 2017 the ATTIMD (formally ATCMTD) Program has provided grants to eligible entities to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment.

Collaboration Partners:

ATTIMD is not a research program, rather it is a discretionary grant program established in the Infrastructure Investment and Jobs Act, however, public and stakeholder input is considered in the development of the annual Notice of Funding Opportunity (NOFO).

To be selected for an ATTIMD award, an applicant must be an eligible applicant. Eligible applicants are State or local governments, transit agencies, metropolitan planning organizations (MPO) or other political subdivisions of a State or local government (such as publicly owned toll or port authorities), or a multijurisdictional group or consortia of research institutions or academic institutions. Partnership with the private sector or public agencies, including multimodal and multijurisdictional entities, research institutions, organizations representing transportation and technology leaders, or other transportation stakeholders, is encouraged.

Typically, a consortium is a meaningful arrangement with all members involved in planning the overall direction of the group's activities and participating in most aspects of the group; the consortium is a long-term relationship intended to last the full life of the grant. Any application submitted by a sole research or academic institution and that is not part of a consortium will not be considered for selection.

USDOT encourages partnerships with the private sector or public agencies, including multimodal and multijurisdictional entities, research institutions, organizations representing transportation and technology leaders, or other transportation stakeholders.

Numerous ATTIMD awardees include non-governmental partners that traditionally have provided non-Federal matching funds in the form of technical services, hardware, and software.

Program partners (both government and non-government), benefits derived from partnerships, and partner contributions are summarized in in the table below.

Benefits of Partnership and Partner Contributions to FHWA ATTIMD Program.

Partner Organization	User Perspective on Needs	Industry Perspective	Standard / Goal Setting	Field Trials	Deployment	Research Collaboration	Specialized Expertise or Capabilities	Donation of Material or Services	Funding	Stakeholder Advice	Education and Awareness
ATTIMD partners are the individual grant recipients (benefits of partnerships are identified in IIJA Section 13006 and 23 U.S.C. 503(c)(4)). Benefits of partnership and partner contributions are detailed in IIJA-mandated Secretary's report.					X				X		

Small Business Innovation Research (SBIR)
($2,500)

(Instructions: Provide content for each program listed in the tables on the previous page, including responses under each of the following headings. If there is a question that cannot be answered or is not applicable to the program, please state that in your response.)

Program Description:
The SBIR program is administered by the Volpe Transportation Center and managed by the FHWA with funding from the ITS JPO. The SBIR activity is a highly competitive, awards-based activity that encourages domestic small businesses to engage in R&D addressing high-priority research areas within USDOT. SBIR favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, State DOTs, USDOT, or other Federal agencies. Funding amounts for SBIR activities are established by law, as noted in the Defense Reauthorization Act (Sec. 5102(a)(1)). Each year, Federal agencies with extramural R&D budgets at the Department level that exceed $100 million are required to allocate 3.2 percent of their R&D budget to these programs.

The SBIR Program Office publishes one or two solicitations each fiscal year for proposals on specific research topics of interest to USDOT operating administrations.

Major Program Objectives:
The objective of the SBIR Program is to encourage small businesses to engage in research and development (R&D) that has the potential for commercialization and meets federal R&D objectives. The SBIR program is uniquely positioned to support both the interests of the USDOT as well as the small business. In this respect, the SBIR programs aims to provide essential funding to small businesses with aim toward commercialization of products that align with ITS JPO, FHWA and Departmental Strategic goals. Given that the SBIR program is available to all ITS JPO and FHWA RD&T programs, all USDOT Strategic goals are supported as a result.

The SBIR program offers unique services to the small businesses to aid in their technical and commercial development. Specifically, the SBIR program offers a Commercialization Assistance Program to provide consulting services to the SBIR participants to help conduct market research, commercialization plans, and other services. In addition, in FY24 the SBIR program will continue with a Technology Readiness Level (TRL) assessment program to help the Small Businesses conduct an independent assessment of the technological status of the innovations developed through the SBIR program.

Anticipated Program Activities:
In FY24, the Small Business Innovation Research program will participate in the annual solicitation of topics and support current Phase I, II, and IIB projects. Additionally, the SBIR

program will continue with the Technology Readiness Level (TRL) Assessments throughout Phase II and IIB projects.

Key FY24 SBIR Program Activities

Activity	Period of Performance
Technology Readiness Level (TRL) Assessments	2024
Annual Solicitation of Topics	2024

Potential Program Outputs, Outcomes, and Impacts on Technologies and Practices:
USDOT strives to advance technologies and make problem-solving innovations available to the end user. The SBIR Program will work towards accomplishing this by identifying the most promising new innovations, advancing Phase I and Phase II projects that have a clear path to commercialization, and focusing on market-driven needs. This creates a win-win-win opportunity for the Federal Government, the small business, and the traveling public.

Potential Economic or Societal Impacts:
The SBIR activity provides economic opportunities for domestic small businesses by providing seed funding to invest in the development of innovations that will benefit the traveling public. It is often difficult for small businesses to establish themselves in the crowded transportation R&D market because of the high startup costs and the lack of nontechnical resources such as commercialization support and business services. The SBIR activity offers critical support in these areas and provides dedicated funding streams to alleviate some of the initial risk.

Potential Progress Made Toward Achieving Modal Strategic Goals:
The SBIR activity provides opportunities to support all of the USDOT strategic goals. The selection of topics and projects is driven by the opportunity to advance the Department's goals. In particular, the SBIR activity leads to transformation through investment in innovations that can also improve safety, advance economic strength, ensure equity, support climate sustainability, and develop organizational excellence.

Collaboration Partners:
The SBIR program is coordinated internally within USDOT, and methods and practices are shared with other modes through the Volpe center, which administers the SBIR programs for USDOT.

Chapter 2 – FY 2025 RD&T Programs

The AMRP FY 2025 outlook year chapter in the annual plan is not developed in alignment with the President's budget request of the same year due to the AMRP development schedule per 49 U.S.C. Chapter 65 Sec. 6501 Research Planning.

ITS Deployment Program

Program Description:
The ITS Deployment Program works in coordination with multimodal partners, including the Office of the Secretary of Transportation (OST), Federal Transit Administration (FTA), Federal Motor Carrier Safety Administration (FMCSA), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA); National Highway Traffic Safety Administration (NHTSA); Maritime Administration (MARAD), and Pipeline Hazardous Materials Safety Administration (PHMSA) to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and other emerging technology deployments.

Included within the program are four key program areas: ITS4US, Scalable Technology for Actionable Transportation Solutions (STATS); the Interoperable Connectivity Program (ICP); and the Intersection Safety Challenge.

ITS4US. The ITS4US Deployment Program is a multimodal effort led by the Intelligent Transportation Systems Joint Program Office (ITS JPO) through partnership with the Office of the Secretary of Transportation (OST), Federal Transit Administration (FTA), and Federal Highway Administration (FHWA). The Program makes $40 million available to enable communities to deploy innovative technologies, partnerships, and practices that promote independent mobility for all, regardless of location, income, or disability. The program is designed in three phases (planning, design and testing, and operation and evaluation) to bring publicly and privately sponsored research together to create large-scale, replicable, and integrated ITS and other emerging technology deployments to address the challenges of planning and executing all segments of a complete trip. The Program leverages innovative technologies that improves mobility options for all travelers, including travelers with disabilities, travelers from rural areas, and lower income travelers.

The ITS4US Deployment Program is funding multiple large-scale, replicable deployments of integrated innovative technologies to address the challenges of planning and executing all segments of a complete trip. The program is conducting deployments through a phased approach with decision gates at the end of each phase. The four deployment projects in Phase 2 are:

- University of Washington (UW) - Transportation Data Equity Initiative

- Heart of Iowa Regional Transit Agency (HIRTA) - Health Connector for the Most Vulnerable
- Niagara Frontier Transportation Authority (NFTA)/Buffalo - Complete Trip Deployment in Buffalo
- Georgia Department of Transportation (GDOT) - Safe Trips in a Connected Transportation Network

STATS. Scalable Technology for Actionable Transportation Solutions (STATS) is a USDOT multimodal initiative, led by ITS JPO with support from OST and USDOT modal administrations. This program explores emerging technology deployments that support an equitable transportation system that provides safe, affordable, accessible, and convenient mobility options for all users. Aligning with the USDOT's 2022-2026 Strategic Plan and the RD&T Strategic Plan's focus on equity, the STATS program aims to support "a more just and equitable transportation system by investing in historically underserved communities to connect them with jobs, resources, and opportunities, and empowering them to build generational wealth." Leveraging recent successes in other deployment programs, ITS JPO will model STATS off a proven playbook for successful deployment programs but with a new focus on developing technology solutions that can address some critical equity challenges in our transportation system.

STATS is being designed as a phased deployment program with a pre-solicitation strategic planning phase, multiple deployment phases (planning, concept development, design & testing, and deployment) and a post-deployment operations phase. In FY23, the STATS program is in the strategic planning phase. In this phase, the federal team is organizing a multimodal team of USDOT experts; drafting program messaging, including vision, mission and goals; conducting a gap analysis; and engaging with stakeholders. The program is also preparing a procurement strategy for an upcoming solicitation of technology deployments to address transportation equity challenges.

Interoperable Connectivity Program (ICP). The Interoperable Connectivity Program (ICP) is a new program area dedicated to accelerating the adoption and deployment of interoperable connectivity nationwide. USDOT will pursue opportunities to support Interoperable Connectivity Accelerator(s) through this program. By presenting opportunities to deploy, operate, and showcase integrated, advanced deployments featuring applications enabled by interoperable connectivity that substantially and quantitatively improve system safety (particularly the safety of vulnerable road users); enhance traveler mobility; improve the efficiency of goods movement; address disparities in transportation equity, and demonstrate a significant return on (public and private) investment.

Intersection Safety Challenge. The USDOT Intersection Safety Challenge aims to transform intersection safety by incentivizing the innovative application of new and emerging technologies to identify and mitigate unsafe conditions involving vehicles and vulnerable road users at intersections. The Challenge complements other Federal efforts to improve intersection safety, with the Challenge specifically focused on the use of technology. Further, the intersection environment itself is well-suited to innovative mitigative approaches leveraging, utilizing, and potentially repurposing existing traffic control and support infrastructure.

Major Program Objectives:
The Deployment Program has developed four Guiding Principles for deployers to consider while planning and designing ITS deployments:

1. ***Integrated, Innovative and Emerging Technologies:*** Design flexible and integrated systems with innovative and emerging technologies that combine multiple technologies, modes, operators and payment systems to facilitate an ITS vision of efficient and optimized travel, for spontaneous or planned trips.

2. ***Inclusive Design:*** Plan, design and deploy for the mobility and safety needs of all travelers. Ensure that all technologies, systems, modes, and infrastructure are universally accessible, affordable, and user friendly.

3. ***Long-term Viability and Partnerships****:* Develop robust, replicable business models and identify funding sources that allow successful deployments to continue beyond the pilot phase. Encourage strong partnerships, both public and private, to expand opportunities for innovation and integration.

4. ***Open and Secure Data and Standardization:*** Establish or enhance public access to open data platforms. Encourage civic engagement and development of third-party solutions along with ensuring the security of sensitive information. Adopt the use of standards, specifications, and best practices for implementation of infrastructure and technologies.

Anticipated Program Activities:
ITS4US: In FY25 ITS4US will conclude Phase 2: Design and Testing, and successful Phase 2 teams will be eligible to move to Phase 3 (Operations and Evaluation). Phase 2 is the design, build, and testing phase. Phase 2 also includes the planning for evaluation of the deployment. The sites will focus on testing and operational readiness, and planning for maintenance and operations, as well as conducting training for staff and participants. In anticipation of Phase 3, sites will be fine tuning performance measurement and working with the IE. Teams will continue with active participation in system engineering roundtables to discuss and share technical issues and solutions. Outreach performance measurement and other roundtables may be scheduled and conducted to support cross-

team information sharing and discussion. Many of the sites are using open standards and are required to openly share code developed with federal funds. Sites will be participating in standards development organizations. The USDOT program leadership and technical services support will provide review and comment on program documentation. Technical services support is envisioned to last the duration of the Program.

In FY25, the program will continue stakeholder engagement and sites will continue outreach activities. The program will also develop and conduct robust communications and outreach efforts, including maintaining a website, factsheets, program video, and social media content; hosting deployment site public webinars; and public and industry engagement through conferences, presentations, and articles.

STATS: Starting in FY25, the program will start the first phase of the deployments which includes organizing deployment teams and developing the operational concepts after releasing and awarding a solicitation for procuring the work for the first phase of the program in late FY24. In out years, the successful deployment sites will have an opportunity to move into the following phases of design and testing and subsequently into operations and evaluation phases (with potential cost sharing).

The program will continue stakeholder engagement and outreach activities as well as technical services activities. Technical services activities include assisting USDOT in managing and integrating the portfolio of deployment projects ensuring that the projects produce actionable results while remaining on schedule and on budget. This includes, but not limited to, performing technical program management functions, including roadmap development, meeting coordination and note taking, quick-response scanning and on issues and challenges, assistance in stakeholder coordination and collaboration, validation and verification of other project deliverables, white paper development, drafting responses to data calls, and procurement life-cycle support. This technical services support is needed to assist in oversight and management due to the complex technical nature of this program. Technical services support is envisioned to last the duration of the Program.

The program will also develop and conduct robust communications and outreach efforts, including maintaining a website, factsheets, program video, and social media content; hosting deployment site public webinars; and public and industry engagement through conferences, presentations, and articles.

Interoperable Connectivity Program (ICP): In FY25 the ICP area will continue development of a National Interoperable Connectivity Deployment Plan. This Plan will be developed in coordination with OST-R and FHWA, in order to provide a framework for deployers. A key input to the National Interoperable Connectivity Deployment Plan is the solicitation for an 'Accelerator Deployment Concept', which will spur widespread deployment of connectivity, and serve as demonstrations of connectivity. The USDOT is

planning for a two-phase initiative – Phase 1 as a Design, Build and Test, with Phase 2 an Operate and Evaluate. The USDOT will select multiple deployment sites that are able to demonstrate the following:

1. Immediate and measurable impact related to critical needs within the transportation system where applications are deployed, particularly safety-related needs.
2. Conformant, effective utilization of the 5.9 GHz spectrum reserved for ITS applications.
3. Innovative utilization of other forms of communications outside of the reserved 5.9 GHz spectrum
4. Demonstrable standards-enabled interoperability.
5. Successfully implement and support interoperable security credential management.

Intersection Safety Challenge: The Challenge was announced in April 2023. It includes a two-part prize competition:

- **Stage 1A: Concept Assessment —** Participants submit an Intersection Safety System Concept. Up to ten (10) well-formed, differentiable concepts scoring highest against a set of uniform judging criteria will receive a Challenge prize and may advance to the next part of the Stage 1 Prize Competition.

- **Stage 1B: System Assessment and Virtual Testing.** Participants develop, train, and improve algorithms for the detection, localization, and classification of vulnerable road users and vehicles using USDOT-supplied sensor data collected at a controlled test intersection. Further, participants will use these data and algorithms in real-time to predict future intersection conditions and identify potentially unsafe conditions and events. Entries will be scored using a rubric testing the accuracy of algorithms against observed ground truth conditions. USDOT will provide information regarding the perception and prediction competition of Stage 1B after Stage 1A awards are made.

Automation Program

Program Description:

Driving automation is one of the major transportation industry trends of this decade. Through close collaboration and monitoring of current industry and academic technology innovators and leaders in automation, the ITS JPO continues the pursuit of an automation program that will support the safe deployment of an automated future. Advanced Driver Assistance Systems (ADAS) with automation of lateral or longitudinal controls are widely available in passenger vehicles, although their development and refinement continue. Automated Driving System (ADS)-equipped vehicles are being piloted in passenger vehicles, commercial motor vehicles, and transit buses. While driving automation research has been, to some degree, mainstreamed across the Department's Operating Administrations, research needs are evolving alongside the technology. The technological and practical challenges of translating research breakthroughs into daily transportation are significant and often are not fully understood at the outset. Many foundational questions around ADS and ADAS cannot be resolved until more and better data are available. The ITS JPO Automation Program's collaborative and multi-modal research portfolio provides cross-cutting support across the USDOT.

Major Program Objectives:

Automation is a key component of the ITS JPO's Strategic Plan. The Program's goal is to enable safe, efficient, and equitable integration of automation into the transportation system. Research in FY25 will continue to support the federal role in automation by funding cross-modal research to facilitate the planning and execution of research on topics that span the information needs, capabilities, and interests of multiple operating administrations, as well as topics that are important to USDOT as a whole, but may not fit cleanly into the mission of a single agency.

Anticipated Program Activities:

Building on the FY24 research, the Automation Program will continue to coordinate automated vehicle cross-modal research in the following:

- Business Intelligence and Emerging Issues Analysis on Automated Driving System Testing and Deployment Tracking and Emerging Issue Analysis
- Research Coordination and Information Exchange through Automation Research Working Group Facilitation and Management, Research Product Dissemination, and External Engagement.
- Cross-Modal Research on Cooperative Driving Automation (CDA), Human Factors, Advanced Driver Assistance Systems (ADAS), Commercial Vehicle Automation Research, Vulnerable Road User Safety and Complete Streets.

Emerging and Enabling Technologies Program

Program Description:

The Emerging and Enabling Technologies Program focuses on cultivating the next generation of transportation systems. As the scale of Intelligent Transportation Systems (ITS) increases and expands to become part of other industry IoT environments (i.e., smart cities), vehicle manufacturers, infrastructure providers, innovators, and entrepreneurs discover new opportunities to use technology and the data that will be generated. These technological advances, along with new functionality, new applications, new operational concepts, and disruptive innovations, need to be tracked and planned for by the USDOT. Current examples of these Emerging and Enabling technologies include Interoperable Connectivity through V2X Communications (including the emerging 5G variations), digital infrastructure, quantum computing, blockchain, Artificial Intelligence (AI), and others.

The USDOT will be positioned and engaged as a partner to guide research, development, and technology adoption in a systematic manner. The USDOT recognizes the need to advance the adoption and use of emerging practices and technologies for transportation—particularly, where they play a key role in providing public benefits to Americans. The ITS JPO will coordinate and conduct investigations and exploratory research into emerging technologies across government, academia, and the private sector. This research will provide the USDOT with a significant understanding of the potential benefits and disruptions these technologies could represent to the transportation system. Through multi-modal coordination, the ITS JPO works to avoid duplicative ITS work and to ensure the efficient allocation of ITS resources.

Major Program Objectives:

Interoperable Connectivity/ Spectrum: This research program focuses on advancing the next generation of transportation systems. As emerging technologies offer the potential to enter the transportation environment, ITS JPO will evaluate their fit in meeting transportation needs and work with agency modes to extend resulting benefits from these technologies across the transportation system.

Given the magnitude of impacts that transitioning to the next generation communications can have on transportation, the ITS JPO proposes the establishment of a focused research initiative. Four proposed research objectives will continue to guide the program into the future, (1) institutional adoption of next generation communication technologies, (2) safety and security framework development, (3) public sector representation, and (4) climate change.

Digital Infrastructure: Once the majority of the foundational work is completed in FY25, the ITS JPO will shift the focus to actually implement the Digital Infrastructure Strategies in collaboration with the Infrastructure Owners/Operators (IOOs) and other stakeholders. Specific topics to address will be identified through various stakeholder engagement efforts and the identified topics will be formulated as actual projects with the JPO sponsorship.

Environment and Climate Change: The ITS JPO is working to leverage past and current ITS and environmental research into new, innovative research and analysis opportunities in partnership with modal partners and stakeholders.

Anticipated Program Activities:

Interoperable Connectivity/ Spectrum: USDOT monitors and assesses wireless technologies and available devices to determine their capabilities to support a wide range of transportation system communications requirements regarding safety, effectiveness, and other capabilities. These technical research and assessment activities provide data-driven inputs to the USDOT policy decision-makers. In FY25, the ITS JPO will seek to acquire the first set of 5G New Radio V2X prototypes and begin laboratory and small-scale testing. Notably, 5G itself may enable latency-tolerant V2X communications to be delivered through a broader set of technologies and processes including the use of multi-access edge computing (MEC), small cell infrastructure, new robotics, and other evolutions on the vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-vulnerable road user (VRU) exchanges. ITS JPO expects that the industry partners creating these varying, emerging beta-version technologies will seek participate in the 5G New Radio V2X laboratory and field testing, giving the USDOT and deployers a broader set of options regarding how connectivity might be defined for transportation and allowing the USDOT to determine whether and how greater interoperability can be created to better service the cooperative nature of V2X applications and services.

In developing our emerging technology research initiatives, we will continue looking at technology neutral approaches to support fair market competition, understand the liability implications, consider privacy, bias and ethics, and impacts on the workforce.

Digital Infrastructure: Building on foundational work from FY24, the ITS JPO will focus on implementing the developed Digital Infrastructure Strategies. In doing so, we will attempt to better address the following specific items:

- Increased need to communicate with diverse digital devices (machines)
- New availability of digital information from diverse devices
- New need to provide digital services as an agency
- Evolving private sector infrastructure and services overlapping with traditional IOO scope
- Increasingly complex set of interactions between private and public sector infrastructures

For this, specific research topics will be identified and formulated as actual projects which will then be conducted with the ITS JPO funds.

Environment and Climate Change: Based on the strategic priorities outlined by the Office of the Secretary, development and testing of innovative and transformational

transportation technologies to address climate change goals will also be a focus of this program.

Accelerating ITS Deployment Program

Program Description:

As new research products, results, and prototypes evolve into market-ready products, the primary goal of the Accelerating Deployment Program is to provide data, research, analysis, and technical assistance and support services to accelerate adoption and at-scale deployment of secure, and interoperable ITS technologies. The objectives of the Accelerating ITS Deployment Program area are: (1) to accelerate the transformation of ITS research and prototypes into market-ready technologies that are commercially viable and deployed by the transportation community, and (2) to provide the ITS community the tools it needs for successful and interoperable deployment of ITS technologies and systems at scale. The Program area directly supports advancing ITS research and deployment activities through the full ITS deployment lifecycle - from initial deployment planning through to actual deployment and eventual assessment - in coordination with other stakeholders at the federal, state, regional, and local levels.

The Accelerating ITS Deployment Program includes work in six key areas:

- Professional Capacity Building
- Deployment Evaluation
- Communication and Outreach
- ITS Architecture and Standards
- ITS Data
- Analysis Modeling and Simulation

Major Program Objectives:

The objectives of the Accelerating ITS Deployment Program are to provide the research, analytics, products, tools, security, and services to enable more rapid, interoperable deployment of ITS technologies and services to maximize public benefits. The intent is to define and improve evidence-based decision making, collaboration, harmonization, standardization, and communication mechanisms and targets to encourage public and private investment in ITS; to develop comprehensive training and analytic tools that allow deployers to understand the financial and operational benefits and costs of new technologies and systems; and to establish the tools that deployers can use to help make more informed investment and planning decisions regarding ITS deployment.

Anticipated Program Activities:

Professional Capacity Building Activities FY 2025. The ITS PCB Program area will continue to expand the online, on-demand training offerings for both the internal and external transportation workforce. Expanding the offerings available will reach a broader audience. Working with the National Highway Institute (NHI), academic community, and other training partners, activities will include converting in-person ITS workshop materials

and existing courses to online opportunities in a variety of formats (i.e., microlearning). Expanding the online presence of the ITS PCB Program will increase learning opportunities for the current and future transportation workforce including student, rural, and tribal audiences. The ITS PCB Program will continue to build community building efforts in that additional cohorts are developed, and peer exchanges are offered for the purpose of information exchange and a forum in which to provide technical assistance.

Deployment Evaluation Activities FY 2025. The Deployment Evaluation Program area will continue to improve the operation and content of the benefits/costs/lessons learned databases and experiment with new, innovative ways to present these data to the public. This would include continuing to create and develop compelling data products and decision-making and planning tools to support ITS stakeholders in their efforts to make evidence-based decisions about ITS investments at all stages of the ITS deployment lifecycle. The Deployment Evaluation Program will complete the FY23 Deployment Tracking Survey and continue outreach on results.

The Deployment Evaluation Program will also continue its long-term strategic effort to provide data-driven and evidence-based products and services to the ITS stakeholder community and continue to address a full spectrum of stakeholder needs related to the foundational elements of successful ITS deployment and the full ITS deployment lifecycle

Communication and Outreach Activities FY 2025. Planned activities in the Communications and Outreach Program area include in-person meetings and events, and the kickoff of a new transportation technology educational program aimed at today's college students.

ITS Architecture and Standards Activities FY 2025. The ITS Architecture and Standards Program area activities will include continued evolution in the content of the ITS reference system architecture and ITS standards. Interoperable security efforts will provide the tools for widespread implementation to provide the capabilities for deployers to assure that ITS deployments remain secure.

ITS Data Activities FY 2025. ITS JPO will continue to refine its data and source code policies, drive implementation among ITS JPO-funded projects in various modes, advise program managers on project-specific data requirements and best practices, promote the availability of ITS JPO-funded data and source code for analysis and reuse, and generate best practices for the broader research and deployment communities.

Analysis Modeling and Simulation Activities FY2025. The ITS JPO AMS Program will continue to support and coordinate AMS activities with the ITS focus. In particular, ITS JPO will collaborate with FHWA (Traffic Analysis Tool Program, Connected Automated Vehicle AMS Program, Office of Planning, Office of Policy, Office of Safety, and Office of

Infrastructure), NHTSA, and FMCSA as appropriate. In the end, the main target is to improve the AMS capabilities, tools, and technologies in understanding, analyzing, planning, designing, and evaluating the ITS implementation.

Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD)

Program Description:

The ATTIMD is statutorily required in the Infrastructure Investment and Jobs Act, Section 13006, 23 U.S.C. 503(c)(4). The ATTIMD grants are managed by FHWA and the ITS JPO contributes a mandated percentage of funding through FHWA to annually satisfy the requirement. The language provided here duplicates the language provided in the FHWA AMRP for consistency.

The Advanced Transportation Technologies and Innovative Mobility Deployment Initiative (ATTIMD) Program is intended to provide funding for eligible entities to develop model deployment sites for large scale implementation and operation of a diverse set of technologies in various geographic regions. As the program is aimed at the rapid deployment of advanced technologies, limited expenditures for infrastructure construction is anticipated in grant application. The stated purpose is to reduce costs and increase return on investments; deliver environmental benefits through increased mobility; enhance transportation system operations; improve safety; improve collection and dissemination of real-time information; monitor transportation assets; deliver economic benefits; and accelerate deployment of connected and automated vehicle technologies. Successful proposals will contain quantifiable system performance objectives, use innovative technologies and strategies, and a plan for long term operation and maintenance of the deployed technologies. The USDOT encourages partnering among the private sector, public agencies, research institutions, technology leaders, and other transportation stakeholders.

Major Program Objectives:

The USDOT's vision for the ATTIMD initiative is the deployment of advanced technologies and related strategies to address issues and challenges to safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment that are confronted by transportation systems owners and operators. The advanced technologies are integrated into the routine functions of the location or jurisdiction, and play a critical role in helping agencies and the public address their challenges. Management systems within transportation and across other sectors (e.g., human services, energy, and logistics) share information and data to communicate among agencies and with the public. These management systems provide benefits by maximizing efficiencies based on the intelligent management of assets and the sharing of information using integrated technology solutions. USDOT shares the advanced technology solutions and the lessons learned from their deployment with other locations, scaled in scope and size, to increase successful deployments and provide widespread benefits to the public and agencies.

Anticipated Program Activities:
In FY25, the ATTIMD program will request proposals for new grant awards, complete the awards under the previous solicitation, and manage the existing grant awards.
Additionally, the program will publish the ATTIMD annual report as mandated by the IIJA.

Small Business Innovation Research (SBIR)

Program Description:

The SBIR program is administered by the Volpe Transportation Center and managed by the FHWA with funding from the ITS JPO. The SBIR activity is a highly competitive, awards-based activity that encourages domestic small businesses to engage in R&D addressing high-priority research areas within USDOT. SBIR favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, State DOTs, USDOT, or other Federal agencies. Funding amounts for SBIR activities are established by law, as noted in the Defense Reauthorization Act (Sec. 5102(a)(1)). Each year, Federal agencies with extramural R&D budgets at the Department level that exceed $100 million are required to allocate 3.2 percent of their R&D budget to these programs.

Major Program Objectives:

To encourage small businesses to engage in research and development (R&D) that has the potential for commercialization and meets federal R&D objectives. The SBIR program is uniquely positioned to support both the interests of USDOT as well as the small business. In this respect, the SBIR programs aims to provide essential funding to small businesses with aim toward commercialization of products that align with ITS JPO, FHWA and Departmental Strategic goals. Given that the SBIR program is available to all ITS JPO and FHWA RD&T programs, all USDOT Strategic goals are supported as a result.

The SBIR program offers unique services to the small businesses to aid in their technical and commercial development. Specifically, the SBIR program offers a Commercialization Assistance Program to provide consulting services to the SBIR participants to help conduct market research, commercialization plans, and other services. In addition, in FY25 the SBIR program will continue with a Technology Readiness Level (TRL) assessment program to help the Small Businesses conduct an independent assessment of the technological status of the innovations developed through the SBIR program.

Anticipated Program Activities:

In FY25, the SBIR program will participate in the annual solicitation of topics and support current Phase I, II, and IIB projects. Additionally, the SBIR program will continue with the Technology Readiness Level (TRL) Assessments at the end of Phase II.

For More Information on DOT's Research see
https://researchhub.bts.gov/search