Intelligent Transportation Systems Joint Program Office

Strategic Plan 2020-2025

U.S. Department of Transportation

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16. Abstract

The United States Department of Transportation (U.S. DOT) has long been a leader in research, development, and evaluation of technologies for transportation and strong supporter of adoption and use of new and innovative technologies—known as intelligent transportation systems (ITS). Through the leadership of the ITS Joint Program Office (JPO) and modal partners, the U.S. DOT has conducted and sponsored pioneering research and development in technology (RD&T) as well as evaluation of each next generation of ITS. These efforts have enhanced the safety, efficiency, and accessibility of surface transportation for almost three decades—resulting in lives saved, improved access and mobility, and increased economic productivity.

This document serves as the ITS JPO's strategic plan for 2020 through 2025. The plan describes the vision, mission, strategies, and research goals that will guide the ITS JPO in meeting key RD&T priorities for the Department, as described in the U.S. DOT's *Strategic Plan, 2018-2022*[1] and the corresponding *RD&T Strategic Plan*. These Departmental documents provide the basis for the primary direction of ITS research activities. The *Strategic Plan 2020 – 2025* offers greater detail and transparency about the role of the ITS JPO in RD&T within the Department.

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[1] See: https://www.transportation.gov/dot-strategic-plan.

Contents

01 | INTRODUCTION

Source: ITS JPO

The United States Department of Transportation (U.S. DOT) has long led efforts to research, develop, and evaluate transportation technologies. The U.S. DOT has strongly supported adopting and using new and innovative technologies—known as intelligent transportation systems (ITS). The ITS Joint Program Office (JPO) and modal partners have been a crucial component of this effort by fostering pioneering research and development in technology (RD&T) and evaluating each generation of ITS. These efforts have enhanced the safety, efficiency, and accessibility of surface transportation for almost three decades. This work helps save lives, improve access and mobility, and increase economic productivity.

This document serves as the ITS JPO's strategic plan for 2020 through 2025. The purpose of the plan is to describe the vision, mission, and strategies that will guide the ITS JPO in meeting key RD&T priorities for the Department. Its contents will reflect the alignment of the ITS JPO's strategy and activities with the U.S. DOT's *Strategic Plan for FY 2018-2022* and the corresponding U.S. DOT *RD&T Strategic Plan*. These Departmental documents provide the basis for the primary direction of ITS research activities. This *Strategic Plan 2020–2025* offers greater detail and transparency about the role of the ITS JPO within the Departmental RD&T portfolio.

This plan will be appended annually to include the *ITS JPO's Annual Modal Research Plan* (AMRP), which provides details about the projects and initiatives undertaken by the ITS JPO with a 2-year outlook.

This document also contains a list of references and two appendices. Appendix A summarizes the history and legislative authorities that govern the ITS JPO, and Appendix B describes the ITS JPO's current program areas. We anticipate updating and amending Appendix B as program areas shift and evolve over time.

What Is ITS?

ITS improves transportation by integrating advanced information and communications-based technologies (ICT) into transportation infrastructure and vehicles. ITS refers to a system of technologies and operational advancements that, when combined and managed, improve the capabilities of the overall transportation system.

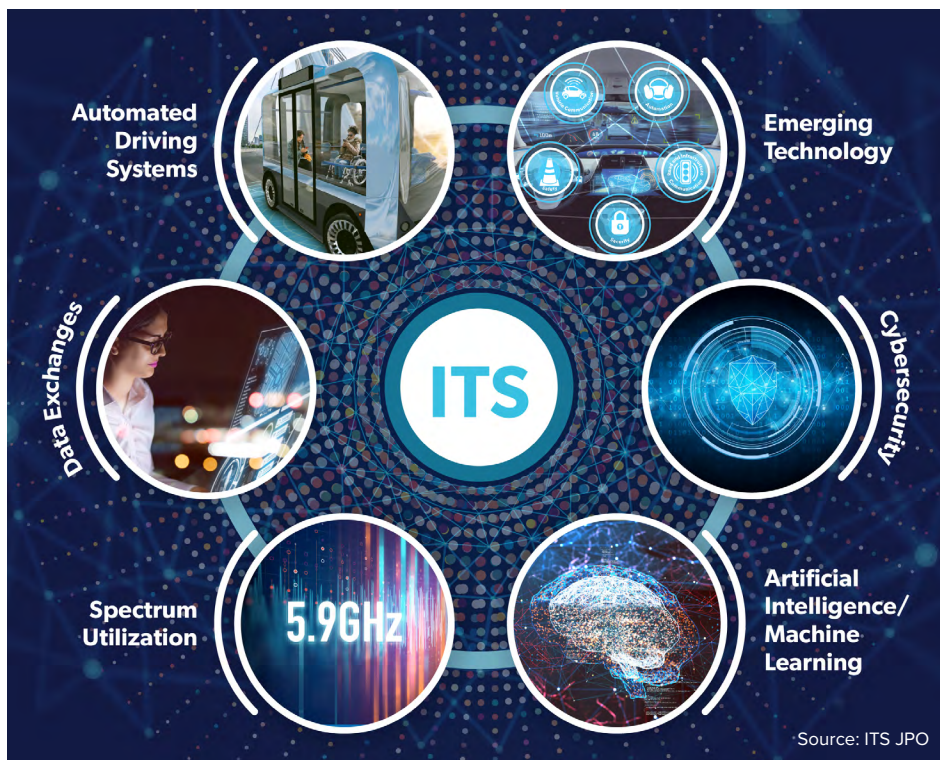**FIGURE 1. ELEMENTS OF ITS**

Source: ITS JPO

FIGURE 1. ELEMENTS OF ITS

Millions of Americans experience ITS every day without even noticing. Figure 1 illustrates some examples of ITS technologies—from sensors and signals that allow vehicles to communicate with each other as well as with roadside devices, to personal device applications that offer custom route planning and mobility enhancements. These technology tools made possible through ITS both increase efficiency for travelers across the nation and increase the value of existing transportation infrastructure. Today's emerging ITS include automated driving systems and data exchanges, support cybersecurity, and utilize spectrum and artificial intelligence to meet traveler's needs. American travelers alone derive substantial economic and societal benefits from ITS, estimated at a value exceeding $2.3 billion annually.[3]

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[2] See: https://www.transportation.gov/dot-strategic-plan.

[3] This estimate is from a key subset of ITS technologies, calculated using data from *ITS Technology Adoption and Observed Market Trends from ITS Deployment Tracking*, U.S. DOT Volpe Center, FHWA-JPO-10-066.

FIGURE 2. ITS JPO MULTIMODAL COORDINATION

As illustrated in Figure 2, the modal administrations are involved in many aspects of the ITS portfolio to ensure that the research matures to meet the public's needs.

ITS JPO Collaboration and Multimodal Coordination

The ITS JPO collaborates across modal administrations to coordinate and plan the U.S. DOT's multimodal ITS technology research program, working toward improving transportation safety, mobility, and efficiency and enhancing productivity through the integration of innovative technologies into the nation's transportation system.

The U.S. DOT also cooperates and collaborates with other federal agencies, public-sector entities, private-sector organizations, and international partners to support the implementation of ITS across the United States and around the world. To accomplish its mission, the ITS JPO coordinates the ITS Program and initiatives among the U.S. DOT modal administrations—Federal Highway Administration (FHWA), Federal Motor Carrier Safety Administration (FMCSA), Federal Transit Administration (FTA), Federal Railroad Administration (FRA), Pipeline and Hazardous Materials Safety Administration (PHMSA), National Highway Traffic Safety Administration (NHTSA), Maritime Administration (MARAD), Office of the Assistant Secretary for Research and Technology (OST-R), and St. Lawrence Seaway Development Corporation (SLSDC).

In addition, the ITS JPO closely collaborates with current industry and academic leaders in technology and innovation. This work supports the targeted identification and evaluation of ITS investments and fosters the coordination of the ITS portfolio across the transportation system.

FIGURE 2. ITS JPO MULTIMODAL COORDINATION

Intelligent Transportation Systems Joint Program Office

U.S. Department of Transportation

- Federal Highway Administration
- Federal Motor Carrier Safety Administration
- Federal Railroad Administration
- Federal Transit Administration
- Maritime Administration
- National Highway Traffic Safety Administration
- Office of the Assistant Secretary for Research and Technology
- Pipeline and Hazardous Materials Safety Administration
- St. Lawrence Seaway Development Corporation

Source: ITS JPO

The ITS Program's success depends on coordination among all these entities and most notably among the modal administrations within the U.S. DOT. The ITS JPO's research leverages multimodal technology, applications, and data, delivering crosscutting communications and technology transfer activities that support the U.S. DOT's ITS portfolio objectives. As research initiatives move from development and testing into technology transfer and implementation support phases, the modal administrations play a critical role in executing long-term deployment, operations, and maintenance support. Modal administrations also conduct independent ITS research on mode-specific issues.

Relationship to U.S. DOT Strategic Plan

The mission of the U.S. DOT is to ensure that our nation has the safest, most efficient and modern transportation system in the world, which improves the quality of life for all American people and communities, from rural to urban, and increases the productivity and competitiveness of American workers and businesses. The ITS JPO supports the Department's mission by pursuing innovative technologies for the nation's transportation system. Through these efforts, the ITS JPO acts as a Departmental leader in addressing the U.S. DOT's Strategic Goal on Innovation.

In addition to the underlying focus on innovation, the ITS JPO's strategies align with each of the U.S. DOT's strategic goals established both in 23 U.S.C. 514(a) and in the *U.S. DOT Strategic Plan for 2018-2022*, as reflected in Table 1.

TABLE 1. ALIGNMENT OF ITS JPO STRATEGIC PLAN GOALS WITH U.S. DOT GOALS

ITS JPO Strategies	U.S. DOT Strategic Goals			
	Safety	Infrastructure	Innovation	Accountability
Identify and assess emerging technologies	✓	✓	✓	
Coordinate and lead ITS research and development	✓	✓	✓	
Demonstrate the benefits of emerging ITS technologies	✓	✓	✓	✓
Promote adoption of ITS technologies, approaches, and policies	✓	✓	✓	✓
Mainstream ITS technologies, approaches, and policies	✓	✓	✓	

Source: ITS JPO and U.S. DOT Strategic Plan

FIGURE 3. U.S. DOT STRATEGIC GOALS AND RELATED RESEARCH TOPIC AREAS

Figure 3 describes the relationship between the U.S. DOT's overall strategic goals—Safety, Infrastructure, Innovation, and Accountability—and the related research topic areas described in the revised U.S. DOT *RD&T Strategic Plan*.

Alignment with RD&T Priorities

The *ITS JPO Strategic Plan* was developed to align with and complement the *USDOT RD&T Strategic Plan*. The ITS JPO's strategies guide ITS Program activities in six strategic program areas, which are discussed in Appendix B. Each research area supports progress toward meeting USDOT strategic goals and research needs within USDOT's topical research areas. This integration allows more effective support to the USDOT's broader research coordination function, increased focus and reduced duplication among modal research activities.

The ITS JPO leads four topic areas—automation, emerging/enabling technologies, cybersecurity, and data. The ITS JPO also participates on other relevant topic areas.

FIGURE 3. U.S. DOT STRATEGIC GOALS AND RELATED RESEARCH TOPIC AREAS

Safety	Infrastructure	Innovation	Accountability
Automation: Enable the safe integration of automated vehicles and unmanned aircraft systems into the transportation system.	**State of Good Repair:** Maintain transportation assets in a state of good repair, ensure resilience to natural and manmade threats, and optimize material cost and durability.	**Emerging/ Enabling Technologies:** Advance the development of emerging practices and technologies.	**Technology Transfer/ Deployment:** Facilitate the deployment and adoption of DOT research products into the transportation system.
Systemic Safety Approach: Use systemic, performance-based approaches to ensuring transportation system safety.	**Environmental Stewardship:** Preserve the environment, ensure the safety and cost-effectiveness of alternative transportation energy sources, and ensure the safe transportation of hazardous materials.	**Mobility Innovation:** Use innovative business models, partnerships, and private-sector solutions to expand mobility options for travelers, including underserved communities such as people with disabilities and rural residents.	**Evaluation/ Performance Measurement:** Monitor and evaluate the contribution of research, development, and technology activities toward the achievement of DOT strategic goals and objectives.
Human Factors: Ensure the integration of human factors into the design of the transportation system.	**Economic Competitiveness:** Stimulate economic growth, productivity, and competitiveness through transportation infrastructure investments.	**Cybersecurity:** Develop approaches for maintaining the cybersecurity of the transportation system.	**Data:** Ensure access to high-quality data to support data-driven technologies, operations, and decision-making.

Source: U.S. DOT RD&T Plan

Execution of the ITS Program

To ensure that the program's goals are met and public benefits are delivered, the ITS JPO employs a set of rigorous processes to direct project decisions and funds toward the most pressing transportation needs.

The ITS JPO employs a goal-oriented, performance-driven, outcome-based program that provides for a high degree of transparency and accountability. This leads to more efficient investment of federal transportation funds. Management processes that support rigorous execution of the ITS Program and evaluation processes that ensure transparency include:

▸ **Multimodal Decision-Making:** Engaging modal partners in decisions regarding ITS JPO project priorities and program engagement varies

▸ **Annual Planning:** Developing and coordinating AMRPs among modal partners that document and align the research area priorities with other modal AMRPs and the Department's RD&T Strategic Plan and Strategic Plan

▸ **Stakeholder Input:** Ensuring consistent outreach to and input from stakeholders to integrate their needs and perspectives into the program

▸ **Project Management:** Administering the program based on industry-accepted project management principles and practices

▸ **Evaluation:** Evaluating ITS deployments and investments to measure progress toward goals and assess the effectiveness and value of program activities

▸ **Promoting Long-Term Achievement:** Identifying and defining the foundational elements of long-term program success and continuously adapting the research to address new departmental and national priorities and emerging technologies.

Multimodal Decision-Making

The ITS JPO also works with the ITS Strategic Planning Group (SPG), a formal coordinating body that serves as a steering committee for ITS research activities. It is comprised of selected Associate Administrators from the surface transportation modes and chaired by the ITS JPO Director. The ITS SPG serves as the forum in which the ITS JPO and modal representatives collaborate on ITS-related issues that pose potential major programmatic impacts or roadblocks.

Each year, the ITS JPO's and modal administrations' research activities are developed into AMRPs. These plans are coordinated through a Research Review Working Group led by the Office of the Assistant Secretary for Research and Technology (OST-R). The working group evaluates programs, project budgets, and priorities for each fiscal year. Each modal administration submits an AMRP to OST-R for review and coordination to identify synergies and reduce duplication.

The ITS JPO AMRP serves as a short-term plan intended to execute this broader strategic plan. The AMRP identifies near-term focused research in areas that foster innovation, enable multimodal efficiencies, and lead to further advancement of interoperable integration of new technologies into the transportation system.

Source: ITS JPO

Public and Private Input

A variety of public and private groups engages with the ITS JPO to provide feedback on the program. This input helps shape the ITS Program's priorities, and assists in identifying deployer needs. It also provides a way to assess the level of deployer readiness and the maturity of ITS solutions. This work is both external and internal to the U.S. DOT and is pursued through a variety of approaches:

- Participation in national and international meetings, conferences, voluntary standards working groups and other relevant activities

- Delivery of interactive training courses—both online and in person—which provides an opportunity to engage with deployers and understand their readiness and needs

- Outreach throughout the technology sector to raise awareness of the opportunities to integrate new and innovative technologies into transportation.

Project Management

The ITS JPO uses a Project Management Office (PMO) to measure each project's performance against long-term goals. The PMO works directly with program managers to ensure that work, results, and project goals progress on schedule. Each project and task includes measures that demonstrate long-term goal achievement such as budget, schedule, and technical outcomes. These measures vary by project due to the nature of the research and development activities that are tailored for each new technology. Measures can also include outcomes such as new deployments being undertaken by non-U.S. DOT groups and the number of research publications, as well as measures involving research being completed on schedule.

The PMO delivers measurements through a regular process and reporting cycle that enables accountability and strategic alignment for resource planning, deliverables, and expenditures. Each PMO report allows the ITS JPO to understand resource requirements, which are also continuously monitored through bi-weekly staff meetings, bi-annual reviews, and ITS SPG meetings. Beyond the baselines and targets identified by each ITS JPO program manager, the reports also support the ITS SPG in ensuring that the ITS Program is progressing on its research agenda.

Evaluation

The ITS Program also undertakes evaluations to ensure the long-term goals of deployment are achieved. Evaluations determine the effectiveness and benefits of deployed ITS and the value of ITS Program investments and ensure progress toward the vision of integrated ITS. Evaluations are performed in six areas:

▸ **ITS Research Evaluation:** Establishes a common point of reference for evaluation and comparison of different research activities. Oversight is provided to ensure methodologies align with federal government guidelines.

▸ **ITS Deployment Tracking Surveys:** Analyzes results of surveys provided every 3 years to deploying agencies. These efforts have established a one-of-a-kind database that supports important longitudinal analysis to gather insights into direct and indirect effects of decisions, incentives, and other types of support.

▸ **ITS Deployment Evaluation:** Uses the data collected from the ITS Deployment Tracking survey to perform analysis for the ITS Program and modal partners. The results assist the ITS Program in making targeted program investments that more effectively support deployment.

▸ **ITS Program Evaluation:** Provides evaluations for major ITS research initiatives such as Connected Vehicle initiatives or Advanced Transportation and Congestion Management Technologies Deployment grants.

▸ **Knowledge Management:** Turns the wealth of insights and results from surveys and evaluations into a broad and deep knowledge base to support current and future ITS deployments.

▸ **Knowledge Transfer:** Develops databases and other easily accessible materials for use in decision making, training, and providing assistance.
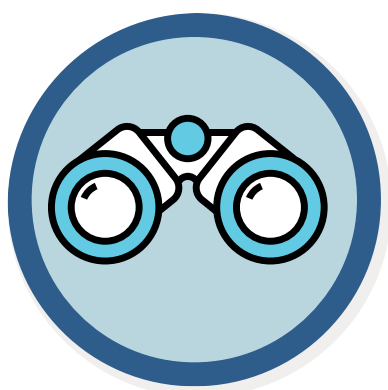
Source: ITS JPO

02 | VISION AND MISSION

Source: ITS JPO

Vision

The ITS JPO's vision is to accelerate the use of ITS to transform the way society moves. The ITS JPO's purpose is to spur the development and use of ITS to move people and goods more safely and efficiently.

The ITS JPO envisions a future in which citizens and communities can enjoy safe and seamlessly integrated transportation services, and where on-demand and real-time user and data needs are met by a wirelessly interconnected transportation ecosystem. The ITS JPO aims to help build an ecosystem that offers intelligent feedback loops for continual system improvements.

Technological advances in hardware and software development, the rapid march toward the Internet of Things, and evolutionary leaps in connectivity of devices, networks, and services present new opportunities to modernize transportation. The merging of digital and physical systems and the explosion in both the volume and types of data and intelligence from users, networks, and devices have yielded both opportunities and risks. The ways in which institutions and technology are managed often cannot adapt to the pace of technological

VISION

Accelerate the use of ITS to transform the way society moves.

change. Innovation demands acknowledging the impacts of disruption and building the ability to adapt quickly to ever-shifting paradigms.

Building on its success in researching and implementing ITS policies and technologies, the ITS JPO has a distinctive vantage point from which to encourage efforts to adapt emerging and future technologies to improve transportation.
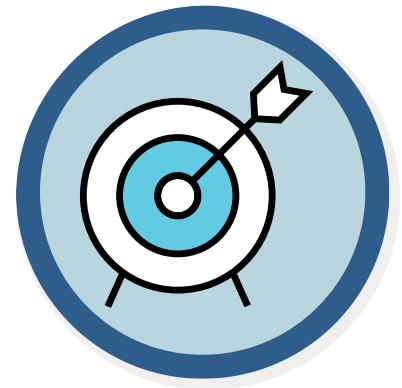
Mission

Improving safety and mobility for all transportation users means that the ITS JPO engages in a rigorous and comprehensive set of processes to adapt and "translate" ITS technologies and advancements into productive applications for the entire transportation system. These activities include:

▶ Partnering across modal administrations to demonstrate and evaluate the effectiveness of next-generation ITS under real-world conditions

▶ Leading crosscutting efforts within the U.S. DOT that encourage the use of innovative ITS

▶ Investigating methods to safeguard and defend ITS implementations and transportation infrastructure against likely risks

▶ Working with industry sectors to help identify, assess, and develop prospective technologies and approaches for transportation use

▶ Investing in and incubating emerging technologies for further development

▶ Facilitating adoption across the entire nation through technology transfer to industry and providing training and guidelines for deployers.

The ITS Program is technology neutral. Specific ITS technologies are evaluated for their ability to perform effectively to solve real-world transportation challenges. The ITS JPO continually assesses the feasibility, maturity, and benefits of ITS and shepherds transportation solutions from inception to implementation. In 2020 through 2025, the ITS JPO will capitalize on past investments in key research areas including automation, connectivity, and data access and exchanges and continue to augment such efforts by focusing on new emerging technologies that show promise.

The ITS JPO focuses on ITS as a system. This system includes all components of transportation infrastructure, vehicles, back offices, services, and other tools and mechanisms that serve all transportation users, including underserved communities and groups, private-sector vendors of technology equipment and applications, and operators and implementers of ITS (e.g., state, local, and tribal governments). Engaging with diverse agency, public, and industry representatives ensures that the ITS JPO does not restrict its efforts to specific technologies, but instead aligns its work to the wider objectives of improving mobility and safety for all users.

MISSION

The ITS JPO leads collaborative and innovative research, development, and implementation of intelligent transportation systems to improve the safety and mobility of people and goods.

Perhaps the most important responsibility of the ITS JPO is its role in facilitating collaboration and coordination among many disparate public and private sector groups in technology and transportation to improve our transportation systems. Technology is becoming more integrated across all industry sectors; connectivity between all modes of transportation is increasing. The ITS JPO strives to examine the system as a whole to bring innovations that will improve transportation.

Relationship to Technology Lifecycle

To understand the ITS JPO strategies, it is helpful to examine how the ITS JPO uses the technology lifecycle (see Table 2) as a framework for its research and program activities that move technology from an innovative idea into mainstream use.

During each technology lifecycle phase, additional high-level interagency and inter-organizational activities occur, such as mobilizing interest and resources from modal partners, the public, and deployers or providing technical assistance and capacity building that help to raise the standards of information technology (IT), technology, and data management at the institutional level. Many of the research and program activities conducted by the ITS JPO span more than one stage of the lifecycle.

Source: ITS JPO

TABLE 2. FRAMEWORK FOR EXECUTING THE ITS PORTFOLIO

Phase	ITS JPO Role
Identify and Assess	In this opportunity- framing phase, the ITS JPO identifies and assesses potential technologies for their feasibility and applicability to the transportation system. The costs and public benefits of such technologies and the potential barriers to deployment may also be determined at this stage.
Coordinate and Lead Research and Development (R&D)	The ITS JPO cultivates multimodal partnerships to research and develop selected technologies for the public interest; it also identifies early adopters for initial demonstrations.
Demonstrate Value	In this phase, prototyping and testing of technologies in controlled and real-world environments occurs, project data and lessons learned are gathered, and results are evaluated.
Support Implementation	After demonstration of the application of particular technologies to transportation, this phase emphasizes the benefits of proven technologies to the public and provides assistance to new deployers.
Maintain ITS Technologies	Scaling the adoption of ITS technologies to realize the full potential of benefits across any given surface transportation modes is the emphasis of this phase. Additionally, the ITS JPO maintains a focus on standards and interoperability in this phase.

ITS STRATEGIES | 03

Source: ITS JPO

To fulfill its mission, the ITS JPO employs a focused set of strategies to lead collaborative research, development, and implementation across U.S. DOT modal administrations and with the private and public sectors. These strategies create a framework in which the ITS JPO can identify and suggest technologies to transform transportation systems for the public good. This strategic framework is complemented by each AMRP, which translates the ITS JPO's strategies into annual research activities and implementation priorities and goals.

ITS JPO Strategies

FIGURE 4. ITS JPO STRATEGIES TO ACHIEVE VISION AND MISSION

Identify and Assess Technologies

Coordinate and Lead ITS R&D

Demonstrate Value

Support Implementation

Maintain ITS Technologies

Source: ITS JPO

Source: ITS JPO
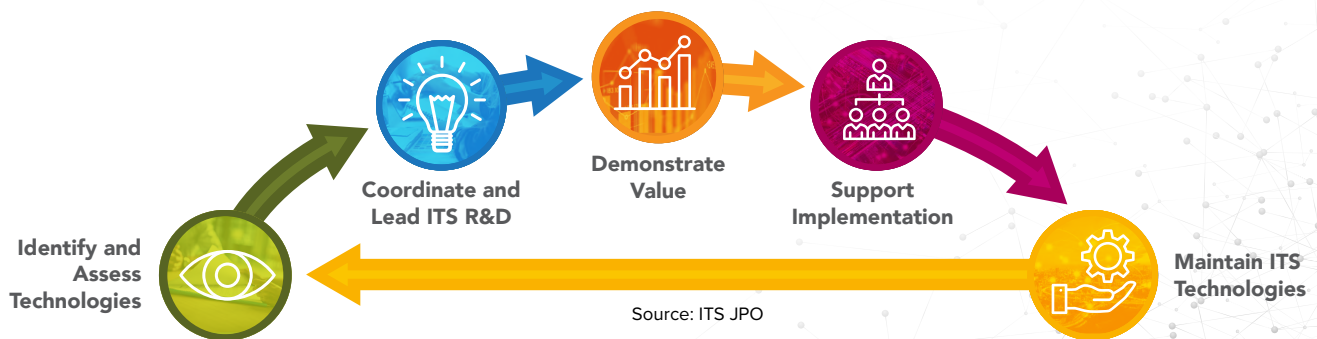
Strategy 1: Identify and assess emerging technology alternatives for the transportation system

To identify and assess technologies, the ITS JPO asks the following questions:

▶ Is the emerging technology feasible?

▶ Is it applicable to the transportation system design?

▶ What will the impact be on the transportation system?

To determine where a federal investment or research project may be helpful, the ITS JPO first plays a role in identifying critical needs and challenges in the transportation system and finding technologies or approaches to address them. The ITS JPO then partners with U.S. DOT modal administrations, state and local governments, industry, and academia to better understand the potential effects of each identified innovation and whether it can be applied to the transportation system.

This strategy includes activities such as:

▶ Collaborating with industry; transportation authorities (e.g., seaports, airports, transit); academic, state, regional, and local government leaders; and emergency first responders to identify technological advancements that could improve safety and mobility across transportation modes

▶ Assessing the feasibility, potential risks, and preliminary costs and benefits of emerging technologies for transportation uses

▶ Identifying and addressing possible failures of the market by developing solutions that leverage technologies for the unique needs and public interest priorities of the transportation environment

▶ Identifying innovative institutional models for governance and operations that will support effective adoption of new technologies in the transportation system

▶ Collaborating with all modes to help understand and address the implications of technological advancements to inform their research and policies.

EXAMPLE: The ITS JPO's Emerging and Enabling Technologies research area focuses on cultivating advances in transportation and communications systems. As the scale of ITS increases, vehicle manufacturers, infrastructure providers, innovators, and entrepreneurs discover new opportunities to use technology and the data it generates. The U.S. DOT needs to track technological advances, disruptive innovations, new applications, and operational concepts to understand technological, market, and demographic

trends throughout the globe and across industries. For example, machine learning and artificial intelligence have the potential to transform ITS at every level of implementation. Monitoring these technologies allows the U.S. DOT to evaluate, and sometimes incubate, emerging capabilities that can potentially transform transportation.

Source: ITS JPO

Strategy 2: Coordinate and lead ITS research and development in the public interest

The ITS JPO serves two distinct roles within the U.S. DOT, acting as both a project lead and a multimodal coordinator, working to ensure effective ITS research and technology deployments. As part of this dual role, the ITS JPO leads research in activities that are not limited to just one mode and undertakes emerging projects that require crosscutting capabilities. Close collaboration with industry and academic leaders in technology and innovation is also a cornerstone of the ITS Program. This cross-sector cooperation provides opportunities for novel research and technology transfer activities.

This strategy includes activities such as:

▶ Collaborating extensively with modal partners, industry and the public to structure and pursue research, development, and testing of next-generation ITS technologies

▶ Strengthening multimodal partnerships within the U.S. DOT to avoid duplicative ITS research and to ensure that resources are efficiently allocated to emerging technology initiatives

▶ Identifying and funding early adopters for initial demonstrations of promising technologies and governance models

▶ Emphasizing a holistic view of the surface transportation system by suggesting how and when ITS technologies can address the needs of all users

▶ Providing leadership and policy direction to state and local agencies on planning, systems engineering, use cases, and interoperability.

EXAMPLE: One major initiative that demonstrates the ITS JPO's leadership role in conducting collaborative early-stage research is the Accessible Transportation Technologies Research Initiative (ATTRI). The ITS JPO, closely coordinating with FTA and FHWA, explores emerging technologies that can enhance travel for people with disabilities. These technologies have included wayfinding and navigation applications, pre-trip concierge and virtualization

Source: ITS JPO

services, improved safe intersection crossing for travelers needing additional help, and assistive robotics and automation applications. Other interagency federal partners that support ATTRI include the Department of Health and Human Services (HHS), Department of Labor (DOL), Department of Defense (DOD), and others. By collaborating with other modes, agencies, and groups at the beginning of the technology lifecycle, the ITS JPO can reduce duplication and meet its strategic goals.

Strategy 3: Demonstrate the benefits of emerging ITS technologies for improving the transportation system

Once the initial research into a technology or operational approach indicates positive impact and public benefit, the ITS JPO and its partners determine the best direction to introduce these benefits into operational environments. The ITS JPO's approach at this stage is tailored to the technology, users, and partners involved.

Often, the ITS JPO funds deployments, pilots, and tests that are conducted by other modal administrations or external stakeholders. In these cases, the ITS JPO functions as a manager, advisor, or evaluator to ensure consistency, facilitate collaboration, and support best practices. Regardless of its role, the underlying goal of the ITS JPO is to validate and prove applicability to transportation problems.

This strategy includes activities such as:

▸ Prototyping and testing technologies and operational approaches in controlled and real-world environments, gathering project data, and evaluating results across modes

▸ Evaluating and documenting demonstration results and conducting outreach campaigns to educate decision makers on ITS benefits, impacts, and options

▸ Developing models for incorporating new technologies into state and local ITS architectures

▸ Delivering technical assistance to new deployers and transportation professionals for early pilots and trials

▸ Facilitating data access across the public and private sectors by providing a common framework to contribute data for multimodal evaluation and analysis.

EXAMPLE: Demonstration projects and pilots are key to expanding the ITS JPO's effectiveness to solve transportation problems. In recent years, the ITS JPO, in coordination with multimodal partners, has administered several large-scale ITS research and demonstration programs and projects, including the Connected Vehicle Pilot Deployment Program, Mobility On Demand (MOD) Program, Freight Advanced Traveler Information System, and Smart City Demonstration, which have provided new alternatives to current capabilities.

Essential to the success of any pilot or deployment is the integrated involvement of the ITS Deployment Evaluation Program, administered by the ITS JPO. This program is engaged in two areas of evaluation:

1. Supporting independent evaluations of ITS JPO-funded model deployments, demonstrations, pilots, and other projects that use ITS JPO funds, including grants

2. Tracking, reporting on, and analyzing the overall effectiveness and impact of the ITS JPO's research and deployment investments across the United States.

These activities help inform the U.S. DOT and its partners about the quantitative and qualitative benefits of ITS and enable public and private entities to make better-informed investment decisions.

Source: ITS JPO

Strategy 4: Support implementation of proven ITS technologies, approaches, and policies throughout the transportation system

The public can benefit from transferring the information and research results to a broader audience. Wider adoption of successful new technologies and approaches is needed to address our many transportation challenges. Evaluations enable industry adopters to refine their training and outreach based on the successes and challenges of others. Technology transfer and capacity-building efforts are key ITS JPO tools, which it uses to coordinate with private industry to commercialize technologies, support state and local agencies to build new skills into the workforce, and inform end users of new and emerging transportation options.

This strategy includes activities such as:

- ▸ Supporting technology transfer from early stage innovators to a broader set of deployers across the transportation system

- ▸ Teaming with modal partners to transfer emerging ITS technologies into ongoing modal programs

- ▸ Partnering with transportation agencies, the public sector, and industry to better understand their challenges and determine how the adoption and use of ITS technologies can address those needs

- ▸ Providing information and tools that educate the public and transportation professionals about technologies and their implementation

- ▸ Using research results to inform policy decisions and actions across the Department.

EXAMPLE: To encourage the adoption of ITS technologies, the ITS Program captures and shares best practices and lessons learned from its projects. The ITS JPO's Professional Capacity Building (PCB) Program helps educate the public sector's transportation workforce about ITS. One of the ITS PCB Program's key aims is to encourage technology transfer and education to accelerate deployment of ITS research and technologies. The program supports activities that deliver multimodal ITS learning opportunities to the transportation workforce in many ways—by coordinating outreach related to the ITS JPO's research initiatives, providing technical assistance to public-sector ITS deployers through webinar programs, and delivering ITS training through modal partners. The ITS PCB Program monitors and tracks attendance, participation levels, and training course reviews to assess the program's efficacy and identify areas for continuous improvement.

Strategy 5: Maintain ITS technologies and policies to realize the full potential of benefits across all surface transportation modes

When a technology or process matures and is deployed in a real-world operational setting, the ITS JPO's role shifts to providing ongoing support through the development and delivery of standards, policy, technical assistance, and other mechanisms. Once technologies are proven, there is an important federal role in ensuring that states and localities have the tools, capacity, and information they need to implement technologies and systems. The ITS JPO coordinates long-term collaborative mechanisms to facilitate the continued integration and deployment of ITS. Interoperability is essential to an intelligent

Source: ITS JPO

national transportation system, and the ITS JPO facilitates cooperation and consistency across jurisdictional boundaries. The full potential and benefits of successful ITS to the American public are realized via scaling and mainstreaming.

This strategy includes activities such as:

▶ Working with standards development organizations to develop standards and guidance on interoperability for national and international ITS users

▶ Supporting the DOT modal agencies in their project and program assistance to state, regional, and local transportation agencies to implement, manage, operate, and maintain each next generation of ITS systems and technologies

▶ Developing and providing reference materials and technical assistance to ensure ongoing success with new technologies

▶ Facilitating federal leadership to identify and assess investment opportunities and support robust private-sector market development

▶ Performing long-term evaluation and analysis of ITS deployments to better understand the return on investments in ITS.

Source: ITS JPO

EXAMPLE: The ITS JPO continues to provide technical assistance and guidance once a technology has matured by developing and maintaining the ITS reference architecture. To facilitate safe, efficient, and interoperable national and, where appropriate, cross-border implementation of ITS technologies, the ITS JPO maintains and updates system architecture toolsets and a reference ITS architecture with over 130 user services. The ITS JPO cooperates with the public to develop needed ITS standards and specify and adapt appropriate ICT standards to support customized local ITS infrastructure implementations. It is also dedicated to the large-scale adoption of automation and connectivity technologies. The ITS JPO works closely with the Office of the Assistant Secretary for Aviation and International Affairs (OST-X) to enable the adoption and use of U.S. architecture and standards products in other nations and to continue support of cross-border and North American interoperability efforts.

04 | REFERENCES

Source: ITS JPO

Overview Documents

▶ **U.S. Department of Transportation Strategic Plan for FY 2018-2022:**
https://www.transportation.gov/sites/dot.gov/files/docs/mission/administrations/office-policy/304866/dot-strategic-planfy2018-2022508.pdf

▶ **Intelligent Transportation Systems (ITS) Strategic Plan 2015-2019:**
https://its.dot.gov/strategicplan.pdf

▶ **U.S. Department of Transportation Annual Modal Research Plan for ITS JPO 2017-2018:**
https://its.dot.gov/about/ITS-JPO_AMRP.pdf

▶ **History of Intelligent Transportation Systems:**
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▶ **U.S. Department of Transportation Research, Development and Technology Strategic Plan:**
https://www.transportation.gov/sites/dot.gov/files/docs/USDOT-RD%26T-Strategic-Plan-Final-011117.pdf

Research Areas

▸ **ITS Research Fact Sheets:**
https://its.dot.gov/communications/its_factsheets.htm

▸ **ITS Research Archive:**
https://its.dot.gov/research_archive.htm

▸ **Accelerating Deployment:**
https://its.dot.gov/research_areas/accelerating_deployment.htm

▸ **Accessible Transportation Technologies Research Initiative:**
https://its.dot.gov/research_areas/attri/index.htm

▸ **Automation:**

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- https://www.transportation.gov/av/3

▸ **Connected Vehicles:**
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▸ **Emerging Capabilities:**
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▸ **Enterprise Data:**
https://its.dot.gov/research_areas/enterprise.htm

▸ **Interoperability:**
https://its.dot.gov/research_areas/interoperability.htm
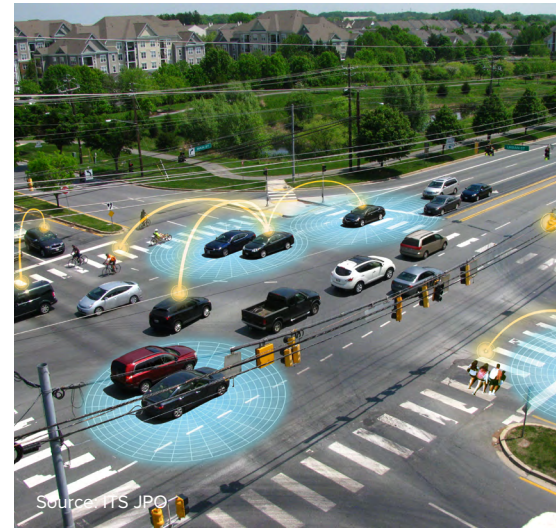
Source: ITS JPO

05 | APPENDIX A – ITS JPO HISTORY

Source: ITS JPO

1998: TRANSPORTATION EQUITY ACT FOR THE 21ST CENTURY (TEA-21)

TEA-21 established policies that recognize the shift in focus from the building of a surface transportation system to the management and maintenance of that system. The act encouraged the development and application of ITS advanced technologies to establish a safer and more efficient transportation system.

History

The ITS Program was created in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) Public Law 102-240 (December 18, 1991). ISTEA established a federal program to research, develop, and operationally test ITS and promote ITS implementation. Subsequent surface transportation laws have supported the continued operations of the ITS JPO for nearly three decades.

Over the past three decades, the ITS JPO has initiated research that has led to numerous successes. Its work has enabled intelligent transportation technology to be integrated into vehicles and infrastructure and has catalyzed existing and planned deployments by government agencies and private entities. As the private sector's role in technology development and implementation has accelerated, the ITS JPO has funded training and outreach activities to develop a modern workforce that can adapt to new technology needs. Coordinating with states, local communities, and the private sector, the ITS JPO continues to help in implementing and evaluating new emerging technologies and collaborating on research advancing interoperability.

Key Outcome
Over 50,000 participants annually enrolled in U.S. DOT-sponsored ITS training, with 90% of those through free eLearning.

Throughout its history, the ITS JPO has adapted to technology advancements and shifting roles of public and private entities. As transportation technology has evolved, so has the ITS JPO's role. Key roles over time have included:

- Conducting initial research, operational tests, and technology transfer activities that focused on how technology could transform transportation operations

- Developing foundational and enabling tools and capabilities (e.g., illustrating a reference architecture, bringing public sector requirements to standards development, or creating planning tools) that support state and local decision makers and deployers

- Testing and piloting connected and automated vehicle technologies.

The ITS JPO's role will continue to evolve as transportation systems become increasingly interconnected and reliant on technology, and as the need for collaboration increases.

2005: SAFE, ACCOUNTABLE, FLEXIBLE, EFFICIENT TRANSPORTATION EQUITY ACT: A LEGACY FOR USERS (SAFETEA-LU)

SAFETEA-LU contained provisions to embed ITS into the mainstream of transportation planning and deployment processes, as well as to increase general awareness of improved operations brought about by the adoption of ITS applications.

2012: MOVING AHEAD FOR PROGRESS IN THE 21ST CENTURY ACT (MAP-21)

MAP-21 continued support of the ITS Program and established a Technology and Innovation Deployment Program. MAP-21 changed the focus of the use of funds for ITS activities by directing the Secretary of Transportation to encourage deployment of ITS technologies to improve the performance of the national highway system.

2015: FIXING AMERICA'S SURFACE TRANSPORTATION (FAST ACT)

The FAST Act continued funding of the ITS Program. The program focuses on significantly reducing crashes through advanced safety systems based on interoperable wireless communications among surface transportation vehicles of all types, traffic signals, other infrastructure systems, pedestrians, wireless devices, and automated vehicle systems.

Key Outcome
More than 30 publicly available open-source applications funded by the U.S. DOT to support future research and commercialization of activities.

Legislative Authorities

Under the FAST Act, the FHWA is charged with carrying out the provisions in Title 23, United States Code, Sections 512-518. The law allocates $100 million for each of fiscal years 2016 through 2020.

The goals of the ITS Program under 23 U.S.C. 514(a) include:

▸ Enhancement of surface transportation efficiency and facilitation of intermodalism and international trade to enable existing facilities to meet a significant portion of future transportation needs, including public access to employment, goods, and services, and to reduce regulatory, financial, and other transaction costs to public agencies and system users

▸ Achievement of national transportation safety goals, including enhancement of safe operation of motor vehicles and non-motorized vehicles and improved emergency response to collisions, with particular emphasis on decreasing the number and severity of collisions

▸ Protection and enhancement of the natural environment and communities affected by surface transportation, with particular emphasis on assisting state and local governments to achieve national environmental goals

▸ Accommodation of the needs of all users of surface transportation systems, including operators of commercial motor vehicles, passenger motor vehicles, motorcycles, bicycles, and pedestrians (including individuals with disabilities)

▸ Enhancement of national defense mobility and improvement of the ability of the United States to respond to security-related or other manmade emergencies and natural disasters

▸ Enhancement of the national freight system and support to national freight policy goals.

Under 23 U.S.C. 514(b), the Secretary is required to implement activities under the ITS Program, at a minimum, to:

▸ Expedite, in both metropolitan and rural areas, deployment and integration of ITS for consumers of passenger and freight transportation

▸ Ensure that federal, state, and local transportation officials have adequate knowledge of ITS for consideration in the transportation planning process

▸ Improve regional cooperation and operations planning for effective ITS deployment

▸ Promote the innovative use of private resources in support of ITS development

- Facilitate, in cooperation with the motor vehicle industry, the introduction of vehicle-based safety enhancing systems

- Support applications of ITS that increase the safety and efficiency of commercial motor vehicle operations

- Develop a workforce capable of developing, operating, and maintaining ITS

- Provide continuing support for operations and maintenance of ITS

- Ensure a systems approach that includes cooperation among vehicles, infrastructure, and users

Key Outcome

Total national investment in deployed ITS already exceeds $25 billion in the 75 largest metropolitan areas.

06 | APPENDIX B – PROGRAM AREAS

Source: ITS JPO

Figure B.1 shows the current ITS JPO's program areas for 2020 through 2025.

FIGURE B.1. ITS JPO PROGRAM AREAS

ITS JPO STRATEGIC PROGRAM AREAS

- Emerging and Enabling Technologies
- Data Access and Exchanges
- Cybersecurity for ITS
- Automation

- Complete Trip – ITS4US
- Accelerating ITS Deployment:
  - ITS Evaluation
  - ITS Professional Capacity Building
  - ITS Architecture and Standards
  - ITS Communications
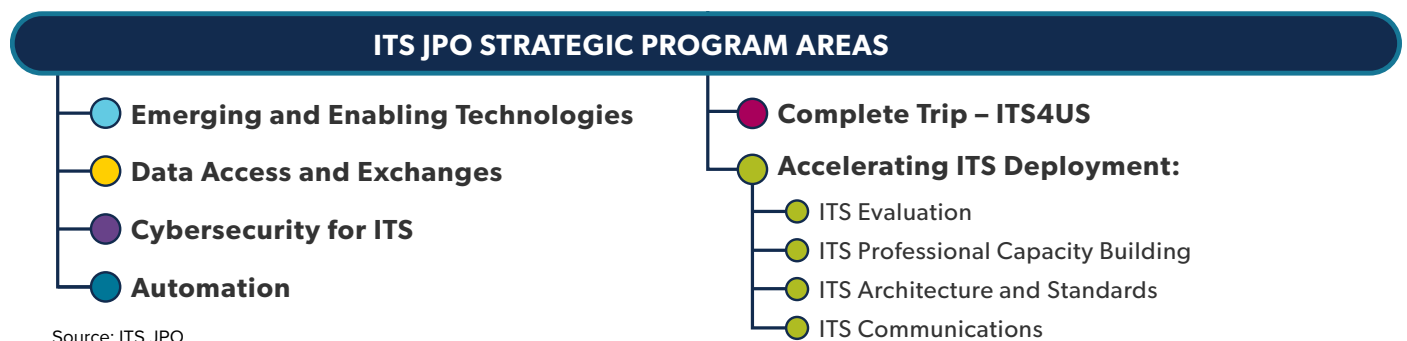
Source: ITS JPO

The following sections describe the overall goal for each program area, including the ITS JPO's role and planned activities.

EMERGING AND ENABLING TECHNOLOGIES

Source: ITS JPO

Goal

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 U.S. DOT with a significant understanding of the potential benefits and disruptions these technologies could represent to the transportation system.

As noted in the *U.S. DOT RD&T Strategic Plan*, the Department seeks to advance the adoption and use of emerging practices and technologies for transportation, particularly where they play a key role in providing public benefit to Americans.

ITS JPO Role

Emerging and Enabling Technologies is a new program area focused on identifying and assessing next-generation technologies. By formalizing these activities into a program, the ITS JPO and modal partners have a mechanism to determine opportunities and risks for introducing promising innovative or disruptive technologies to transportation. Activities include:

▸ Identifying and assessing the potential of emerging technologies (e.g., artificial intelligence, passenger drones, or Hyperloop) for adoption or adaptation to the transportation system

▸ Exploring and developing institutional models and best practices that support system flexibility so that state and local agencies can adopt and use next-generation technologies

▸ Developing roadmaps to track rapidly evolving innovations such as new communications technologies (e.g., 5G).

Planned Activities to Advance Emerging and Enabling Technologies
▶ Identify research needs and opportunities by exploring federal, state and local, private-sector, and academic research on technologies
▶ Research and test communications technology to support transportation connectivity to enable cooperative ITS and connected and automated transportation
▶ Investigate future spectrum use models that support transportation safety and system efficiency
▶ Develop new institutional models to help accelerate adoption of technology innovations
▶ Transfer technologies from exploratory research to development and deployment, whenever appropriate

CYBERSECURITY FOR ITS

Source: ITS JPO

Goal:

ITS will be cyber-resilient. The vulnerabilities that ITS deployments create in the transportation system will be continually and systematically assessed at all levels so that risks associated with malfunction or malfeasance are mitigated to an acceptable level and resiliency plans exist and are in use.

The Cybersecurity for ITS program area was developed in response to the urgent need to protect ITS from cyber-attacks. Securing transportation's critical assets and infrastructure against cyber threats is a shared responsibility of both the public and private sectors. Executive Order 13800 (issued May 11, 2017) makes federal agencies accountable for managing cybersecurity risks to their ecosystem and further encourages them to work with all entities to adopt the National Institute of Standards and Technology (NIST) Cybersecurity Framework.

Identify	Protect	Detect	Respond	Recover
Asset Management	Access Control	Anomalies and Events	Response Planning	Recover Planning
Business Environment	Awareness and Training	Security Continuous Monitoring	Communications	Improvements
Governance	Information Protection and Procedures	Detection Process	Analysis	Communications
Risk Assessment	Maintenance		Mitigation	
Risk Management Strategy	Protective Strategy		Improvements	
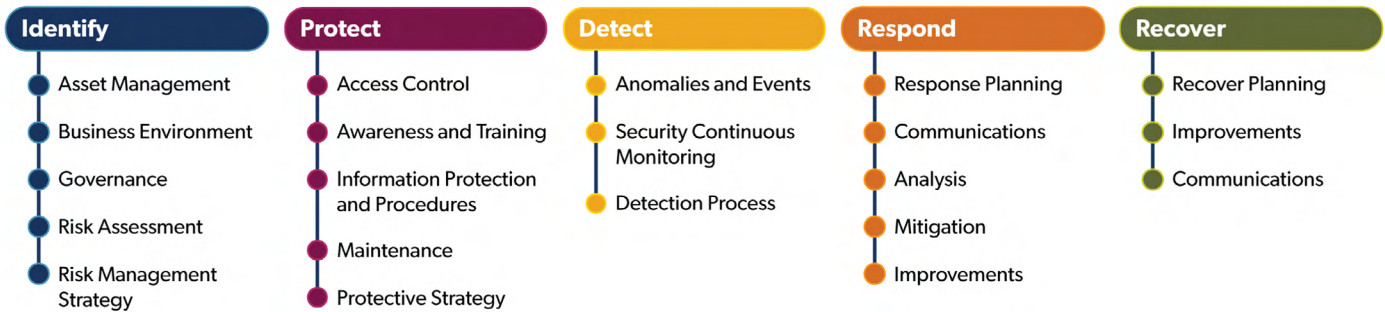
Source: NIST

ITS JPO Role

The ITS JPO is positioned to work across the U.S. DOT modes to develop and coordinate research that addresses cyber vulnerabilities from an integrated, multimodal perspective. This role includes defining shared priorities, developing related policies, identifying and addressing cross-modal cyber issues, and sharing best practices and information. The ITS JPO also offers leadership, information, and resources to state and local agencies that cross modal boundaries and ensure risk management across the transportation system.

TABLE B.2. CYBERSECURITY FOR ITS

Planned Activities to Advance Cybersecurity for ITS
▶ Develop an ITS-specific NIST Cybersecurity Framework companion resource to guide decision-making and identify and mobilize organizational resources
▶ Create a system for sharing lessons learned from cyber incidents and implement processes to rapidly share threats, vulnerabilities, and mitigation strategies throughout the transportation sector
▶ Pursue artificial intelligence strategies to detect and mitigate attacks to help lessen the impacts on critical infrastructure
▶ Develop plans for contingencies to allow for continued operation during a cyber-attack
▶ Increase the number of workers skilled in ITS, information systems, and cybersecurity employed by industry

ITS DATA ACCESS AND EXCHANGES

Source: ITS JPO

Goal:

ITS research will develop mechanisms for jurisdictions to have ubiquitous, consistent, trusted access to ITS data to support accelerated integration of automation, artificial intelligence applications, and transportation service data with other essential public services. Transportation institutions and ITS deployments will adopt innovative, accessible, and secure IT best practices.

The ITS Data Access and Exchanges program area focuses on enabling access to core transportation data across the ITS ecosystem. Access to harmonized data across the nation is essential to the integration of automated vehicles, which are highly data-dependent. This research seeks to foster the adoption of modern technology best practices essential to trusted data exchanges. As vehicles and travelers cross jurisdictional boundaries, exchanges are a key component of data access and are crucial for the next generation of interoperable transportation.

ITS data is a critical tool for public agencies, academic centers, and private companies who are creating new ITS innovations and services. Consistent and timely access to this data increases the return on federal investment in ITS research and demonstration projects and informs future investment decisions, which speeds deployment and produces widespread benefits.

ITS JPO Role

The ITS JPO is positioned to work across the U.S. DOT modes and OST offices to develop and coordinate research, including:

▸ Helping to eliminate data silos and establish interoperable interfaces between infrastructure owners and operators (IOOs), original equipment manufacturers, and data brokers on key elements such as digital maps or system-wide operational data

▸ Facilitating consensus definitions on what constitutes core data

▸ Researching scalable solutions for trusted data exchange across jurisdictional boundaries

▸ Providing technical assistance and funding to IOOs to help them conform to data best practices in collaboration with their Chief Information Officers.

Identify needs for data exchange

Prioritize data exchanges

Address barriers or market failures preventing priority data exchanges

Monitor emergence of market-based solutions

Source: ITS JPO
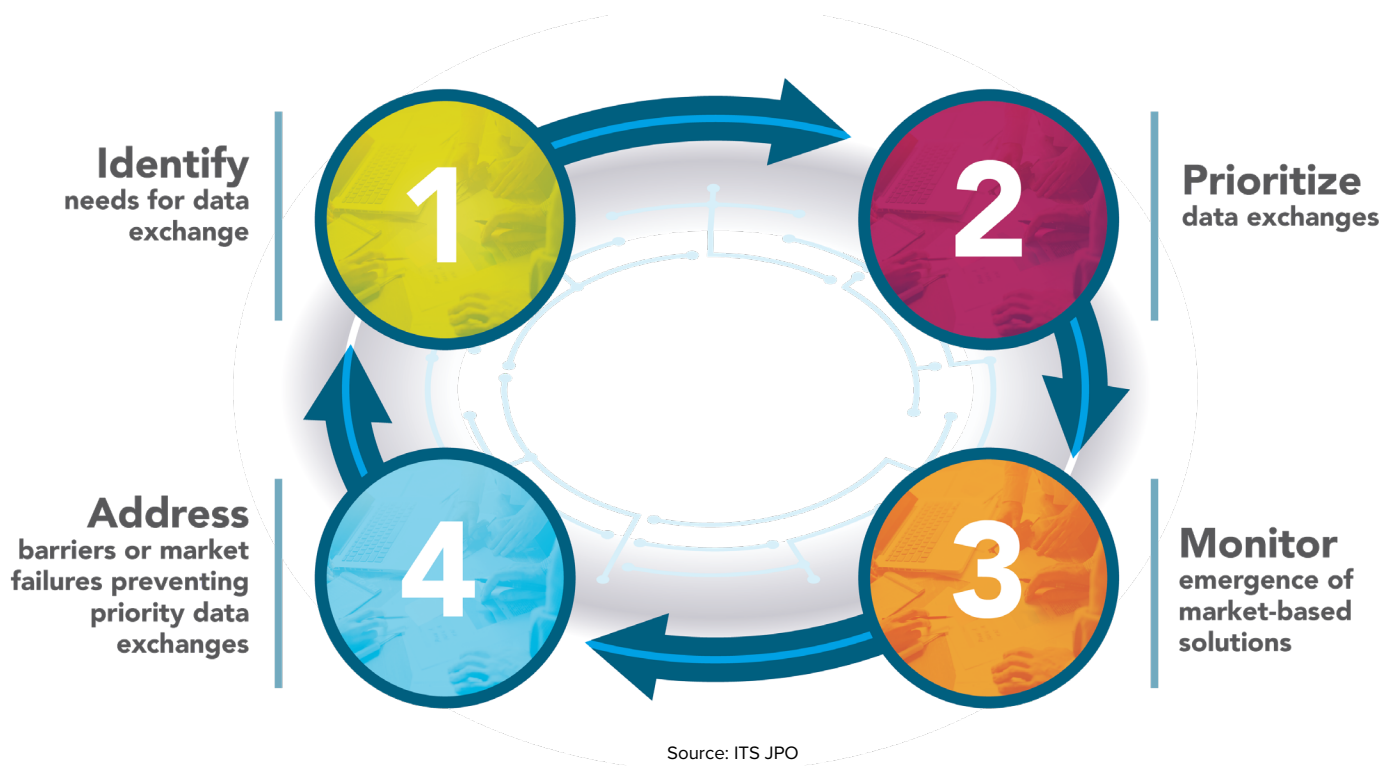
TABLE B.3. DATA ACCESS AND EXCHANGES

Planned Activities to Advance Data Access and Exchanges
▸ Define timely and consistent data access protocols for important areas such as work zone data
▸ Make ITS evaluation data available in a timely and consistent manner to support testing and certification by vendors
▸ Enable data access across jurisdictional boundaries in a trusted and efficient manner; establish scalable mechanisms to update data and specifications in real time
▸ Provide guidelines and demonstrated examples for resolving key institutional adoption barriers such as privacy and cybersecurity

Source: ITS JPO

AUTOMATION

Goal:

ITS research will advance the safe, interoperable, and efficient integration of automation technologies into the transportation system.

Automation has the potential to transform safety, mobility, energy, and environmental efficiency; increase productivity; and facilitate freight movement within our nation's transportation system. The ITS JPO's automation research is a component of the U.S. DOT's vision of supporting the safe, reliable, efficient, and cost-effective integration of automation into the broader multimodal transportation system.

As discussed in *Automated Vehicles 3.0: Preparing for the Future of Transportation*, the public and private sectors must work in partnership to improve the safety, security, and accessibility of automation technologies and address the concerns of the general public. The document describes important roles for the U.S. DOT modal administrations as well as roles for state legislatures; state highway safety officials; IOOs; state commercial vehicle enforcement agencies; public transit; state, local, and tribal governments; transit operators; freight operators; the private sector; academia; and the public.

ITS JPO Role

The ITS JPO's role is to facilitate multimodal automation research and collaboration in safety, infrastructure interoperability, and policy analysis. Responding effectively to automation requires a cross-modal effort, as the expertise on various aspects of automation resides in many parts of the U.S. DOT. Crosscutting tools such as evaluation methods, data access and exchanges, and development of other decision-making tools support these three areas. Finally, addressing cybersecurity concerns is a key role for automation and for ITS generally.

Planned Activities to Advance Automation
▶ Make Human Factors research results on interactions between users/humans and automated technologies publicly available to deployers and policymakers
▶ Identify, research, and document needs related to infrastructure readiness to support automated vehicle testing, deployment, and integration for knowledge transfer
▶ Effectively document and communicate the safety implications of truck platooning through testing and real-world assessment
▶ Identify and document new roles for automation technology to address transportation challenges in accessibility, mobility, and availability of transportation (for instance, in underserved communities)
▶ Use real-world demonstrations of cooperative automation to illustrate system performance benefits and spur public- and private-sector long-term investment, adoption, and use of these technologies

COMPLETE TRIP – ITS4US

Source: ITS JPO

Goal:

ITS research will create new technology and deployment configurations that eliminate "transportation deserts" and create access to effective "complete trips" for consumers.

Complete Trip – ITS4US (Intelligent Transportation Systems for Underserved) Deployment Program is a new research area, co-led by FTA, FHWA, and ITS JPO. It addresses the persistent and serious lack of transportation access or availability for Americans facing economic constraints, living in remote areas, living with disabilities, or seniors. The Complete Trip – ITS4US vision will leverage ITS and facilitate 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.

ITS JPO Role

The ITS JPO plays a role in leading research to understand how technology can enable people to travel independently, regardless of their individual abilities from the start of a trip to the end.

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[5] Foundations for Evidence-Based Policymaking Act (01/14/2019), Public Law No: 115-435) focuses on improving government's capacity to generate and use evidence/data. See: https://www.congress.gov/bill/115th-congress/house-bill/4174/text.

5. Arrival at Destination
Andy safely arrives at his destination, while the **pre-trip concierge application** plans his return trip home.

1. Plan and Book a Trip
Andy uses a **pre-trip concierge application** to plan and book his trip from the doctor's office to the coffee shop.

4. Cross the Street
As Andy approaches an intersection, his **safe intersection crossing application** communicates with the traffic signal to ensure sufficient time for him to safely cross the street, and notifies him when it is safe to begin crossing. The application also communicates with nearby cars to notify them of Andy's presence in the intersection.

2. Travel to Transit Station
An **automated shuttle** (rideshare service) is dispatched to take Andy to the transit station based on his booked trip. Once there, an **assistive robot** helps Andy to his bus platform.

3. Ride the Bus
While on the bus, Andy receives direction on when to pull the Stop Request cord from his **wayfinding and navigation application**. After he departs the bus, the application provides Andy with turn-by-turn walking directions to the coffee shop.

Source: ITS JPO

TABLE B.5. COMPLETE TRIP – ITS4US

Planned Activities to Advance Complete Trip – ITS4US
▶ Work with the multimodal Mobility Innovation Working Group within the U.S. DOT, other federal agencies (Labor, Health and Human Services, and others), and stakeholders to conduct a needs assessment and develop a research roadmap and plan to enable a coalition to develop and deploy technology solutions for underserved communities
▶ Identify high-impact technologies that can benefit multiple underserved communities for integration into a prototype service deployment
▶ Integrate service deployment solutions into the ITS architecture reference so that industry-based standards are available to support accelerated deployment
▶ Evaluate costs and benefits to identify if or where policy solutions are needed to mitigate a lack of private sector investment in the new solutions

ACCELERATING ITS DEPLOYMENT

Source: ITS JPO

Goal:

ITS research will facilitate the transfer of knowledge and technologies into regular practice and help bring the next generation of ITS into interoperable deployment. ITS research will provide foundational information to reduce uncertainty for market investors and minimize industry risk.

As new ITS technologies and systems evolve into market-ready products, the initiatives associated with Accelerating ITS Deployment focus on transitioning federally funded innovations into adoption and widespread use. Adoption is more likely to happen when:

▸ Early adopters communicate positive feedback about technology benefits.

▸ Understanding of the technology extends beyond the initial adopter community.

▸ The value of the technology is clear and has been realized.

▸ Limitations of the technology and costs are clearly understood.

▸ Tactical deployment plans exist and can be shared with additional operators.

▸ Training for the technology exists and is accessible to future operators.

▸ Pilot implementation is feasible, which is an indication of the maturity of the technology.

ITS JPO Role

ITS JPO has four programs under Accelerating ITS Deployment:

▸ ITS Evaluation

▸ ITS Professional Capacity Building

▸ ITS Architecture and Standards

▸ ITS Communications.

By integrating these programs that focus on knowledge and technology transfer into the Accelerating ITS Deployment program area, the ITS JPO has created a "lab-to-market" capability that supports transitioning federally funded innovations into use. By combining these four activities, each of which is described in more detail below, the ITS JPO is better able to coordinate actions and resources to help accelerate the deployment of ITS.

Accelerating ITS Deployment: ITS Evaluation

Goal:

The ITS Deployment Evaluation Program will transform its data and decision-tool products to support evidence-based policy options and decisions that accelerate national ITS implementation. Evaluation data will demonstrate benefits and return on investments, promote effective planning, increase awareness of the "measures of readiness" needed for deployment, and identify effective interventions to accelerate national deployment of the next generation of ITS

The ITS JPO has been collecting ITS deployment data since first authorized by Congress in 1996. The databases serve as the industry standard as well as an international resource on the performance of ITS technologies and their evolution. The data represents, as a whole, the only known longitudinal study on the growth and direction of the ITS market from the beginning and the only known dataset that can measure the return of the Department's investment in ITS research, development, and deployment.

ITS JPO Role

The U.S. DOT measures the effectiveness of ITS through the ITS Evaluation Program. The program helps to determine the effectiveness and benefits of deployed ITS across the nation. It also assesses the value of ITS Program interventions and deployment support activities, even if they are not directly funded by the ITS JPO. The resulting data and analysis support the ITS Program's continual refinement of its strategic plan and direction. The ITS Evaluation Program also actively evaluates the research initiatives of the ITS Program. The program plans to reexamine its role in assessing research effectiveness, particularly with modal partners and across the U.S. DOT. An initial vision is to coordinate across all modes and with the Research Technical Working Groups to provide integrated and leveraged ITS evaluation guidance, best practices, and analysis capability. This coordinated guidance would support the government-wide focus on evidence-based policymaking and evaluation in general and the specific ability to provide quantitative and qualitative analysis on the value of ITS deployments and individual technologies.

Planned Activities to Advance ITS Evaluation
▶ Conduct a program review to revamp key elements of connected and automated technology deployment; including revisions to the deployment tracking survey and the knowledge databases
▶ Develop evaluation plans for ITS research initiatives to track the transfer of results into operation for cybersecurity, data exchanges, complete trip, and new emerging technologies
▶ Explore uses of data visualizations, innovative economic and policy analyses, and new approaches to evidence-based decision-making evaluation
▶ Provide evidence to decision-makers of the value of ITS deployment nationwide, such as socio-economic benefits, job creation, and efficiency gains
▶ Develop a common set of best practices or guidance that deployers can use to facilitate their planning and activities, reduce cost and time to deployment, and gather early-stage benefits

Accelerating ITS Deployment: ITS Professional Capacity Building (PCB)

Goal:

The learning and knowledge transfer process will be developed to ensure that transportation industry professionals are prepared for each generation of ITS. The ITS PCB Program will provide a multimodal and multidisciplinary program for all levels of current and future transportation professionals to accelerate ITS deployment.

The ITS PCB Program was established with the mission to identify and introduce new competencies into the transportation workforce. Over nearly three decades, the program has helped to foster a technology-based workforce that uses and develops systems and applications for real-time operations and management.

ITS PCB Program Partnerships

US Department of Transportation

State, Regional, and Local Associations

Professional Associations

Training and Academic Organizations

Source: ITS JPO

Like the ITS Evaluation Program, the ITS PCB Program must change to address both the new transformations in technologies and the significant changes in how people learn and receive information. The current and near-future generations that will enter the transportation workforce were raised in the era of computers and smart phones and expect the delivery of targeted bits of learning, as needed and on demand.

ITS JPO Role

Through cooperation with modal partners, other federal agencies, public-sector entities, academia, private-sector organizations, professional associations, and other partners, the ITS PCB Program offers a variety of learning opportunities to improve ITS deployments and enable more efficient operations of existing systems. Because the targeted packaging and communication of knowledge is critical, the ITS PCB Program works closely with the ITS Communications Program to support knowledge and technology transfer. The ITS PCB Program also identifies new needs and gaps in training and education from analyses produced by the ITS Evaluation Program. In addition, the ITS PCB Program plays a critical role in working with the modes to mainstream ITS into the different disciplines such as Operations, Infrastructure, Safety, or Planning.

Planned Activities to Advance Professional Capacity Building
▶ Develop modularized courseware to advance knowledge and technology transfer for connected vehicle technologies and applications on smart phones, social media, and other platforms ▶ Facilitate roundtable events and discussions that allow experts to inform interested stakeholders ▶ Expand coordination with other U.S. DOT programs to maintain a multimodal, multidisciplinary focus to transfer knowledge to decision makers ▶ Develop case studies, best practices, and lessons learned that serve current deployers and academic instructors and professors seeking to incorporate real-world, hands-on experiences into community college and university education

Accelerating ITS Deployment: ITS Architecture and Standards

Goal:

ITS Architecture and Standards products will be consistently available early in the technology lifecycle to support applied research, pilots, and expedited integration of emerging technologies into the transportation system, while maintaining appropriate backward compatibility so that legacy systems can remain in service as long as beneficial and the system remains fully accessible to all users.

The ITS Architecture and Standards Program must continually keep pace with evolving transportation ICT as well as user needs to enable interoperable, secure, and efficient ITS safety and mobility services. The ITS Architecture and Standards Program must also support in-service technologies throughout their lifecycle. Technological evolution brings both opportunities for additional beneficial services and additional challenges associated with secure, interoperable integration into existing ITS systems. As the ITS ecosystem evolves into an increasingly complex system of systems, the challenge of providing secure, reliable, and effective ITS services continues to increase.

The Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) is an interactive, flexible tool that describes a means to develop tailored regional and project architectures to meet local needs while supporting interoperability across key system boundaries. It provides multiple viewpoints to support needs of a diverse set of stakeholders. It can act as a resource in state and local investment decisions and help identify points of interoperability across system boundaries within the architecture (e.g., between vehicles and infrastructure) as well as with pivotal points of interoperability to support connection to non-ITS systems.

A critical role of the Architecture and Standards Program is to monitor technological evolution both within and outside

of ITS and ICT and identify opportunities and challenges that warrant updates to architecture reference and software toolsets. For instance, with each new advancement in telecommunications, a traffic management center might benefit from greater speed of data exchange or broader bandwidth for field devices, but these changes may bring about new risks requiring greater connectivity of ITS systems via public networks. This connectivity can alter and often increases security requirements. The Architecture and Standards Program provides analysis into how to adapt or adopt ICT standards to address these types of evolving needs and the different approaches of the various state, regional, and municipal applications of the technology.

The program also works to identify cases that warrant ITS-specific standards development and support adaption or creation of voluntary technical standards to meet ITS needs. The analysis and engagement are based on a lifecycle perspective—typically, with each next generation of architecture and standards, industry involvement is greater when the technology is less mature and industry participants are still defining interests. As industry and implementers cooperate more, they contribute increasingly to Architecture and Standards consensus-based products.

ITS JPO Role

The ITS architecture reference, toolsets, and voluntary technical standards are essential to enhance the success of technology deployments. They help plan for the "unknowns," allow for flexibility and cost-effective designs, and help to manage complexity while mitigating the dynamics of change. The ITS Architecture and Standards Program helps to evolve these critical tools to reflect technological innovations and advancements, while also maintaining the required backward compatibility and interoperability.

In the past, system architecture and especially standards were most often developed once technologies were nearly mature. However, ITS and ICT technologies are now evolving much more rapidly and the development of system architectures and standards is often needed early in the technology lifecycle to support rapid interoperable implementation of new technologies. The Architecture and Standards Program uses the results from each ITS research area and pilot demonstration, work by industry and academia globally, the ITS Evaluation Program, and input from key groups to continuously evolve the Architecture and Standards products. Now, highly knowledgeable users with diverse interests participate as their business interests in ITS grow. The program supports accelerated implementation of new technology innovations by advancing through iterations of the reference architecture, standards, and tools and in parallel with research and development. This process also allows legacy systems that are still functional to operate.

Key Outcome
In cooperation with standards development organizations, supported development of over 90 stakeholder-consensus, ITS-specific, voluntary technical standards, which have been widely adopted both in the U.S. and internationally.

Key Outcome

Developed one of the first comprehensive ITS system architecture references and software toolsets to support effective, interoperable ITS implementation; evolved it to accommodate advancing technology and user needs.

Planned Activities to Advance ITS Architecture and Standards

▶ Make a complete and mature set of ITS standards available to support secure, interoperable integration of connected and automated technologies into the transportation system along with advanced ITS infrastructure services

▶ Identify voluntary technical standards needs and support adaption of suitable ICT standards and development of ITS standards when beneficial

▶ Evolve ITS architecture reference and toolsets supporting wide-scale, cross-border, interoperable deployments of ITS infrastructure as well as connected and automated vehicle deployments

▶ Develop additional architecture functionality to support the needs of the transportation planning community

Accelerating ITS Deployment: ITS Communications

Goal:

ITS Communications initiatives will accelerate deployment through knowledge-sharing opportunities and partnerships to deliver tailored ITS product and capability information to stakeholders throughout the transportation system.

The ITS Communications Program transforms research results, data, and knowledge into information that can be shared with the wider transportation industry and public and private entities. This is a challenging process, as the technologies are complex and highly specialized and the audiences are diverse. This communication function is essential as the transportation enterprise is a crucial element in the daily life, economy, and well-being of American citizens and businesses.

ITS JPO Role

The ITS Communications Program plays a critical role in communicating the value of ITS to the world in a consistent and clear manner. Moving technology into real-world use requires targeting messages that will resonate with the audience and decision-makers, tailoring ITS products to commercial markets, and offering deployers step-by-step guidance to support successful deployments. Effective communication about new ITS innovations establishes public awareness early on; delivers insights into the ITS research areas; and sharpens awareness of the challenges associated with the new technologies.

Additionally, the ITS Program requires new channels and approaches to reach and engage diverse audiences in ITS issues, identify new innovations, and communicate the value of ITS. The ITS Communications Program plays this role, as shown in Figure B.6.

FIGURE B.6. ITS COMMUNICATIONS PROCESS, CHANNELS, AND STAKEHOLDERS
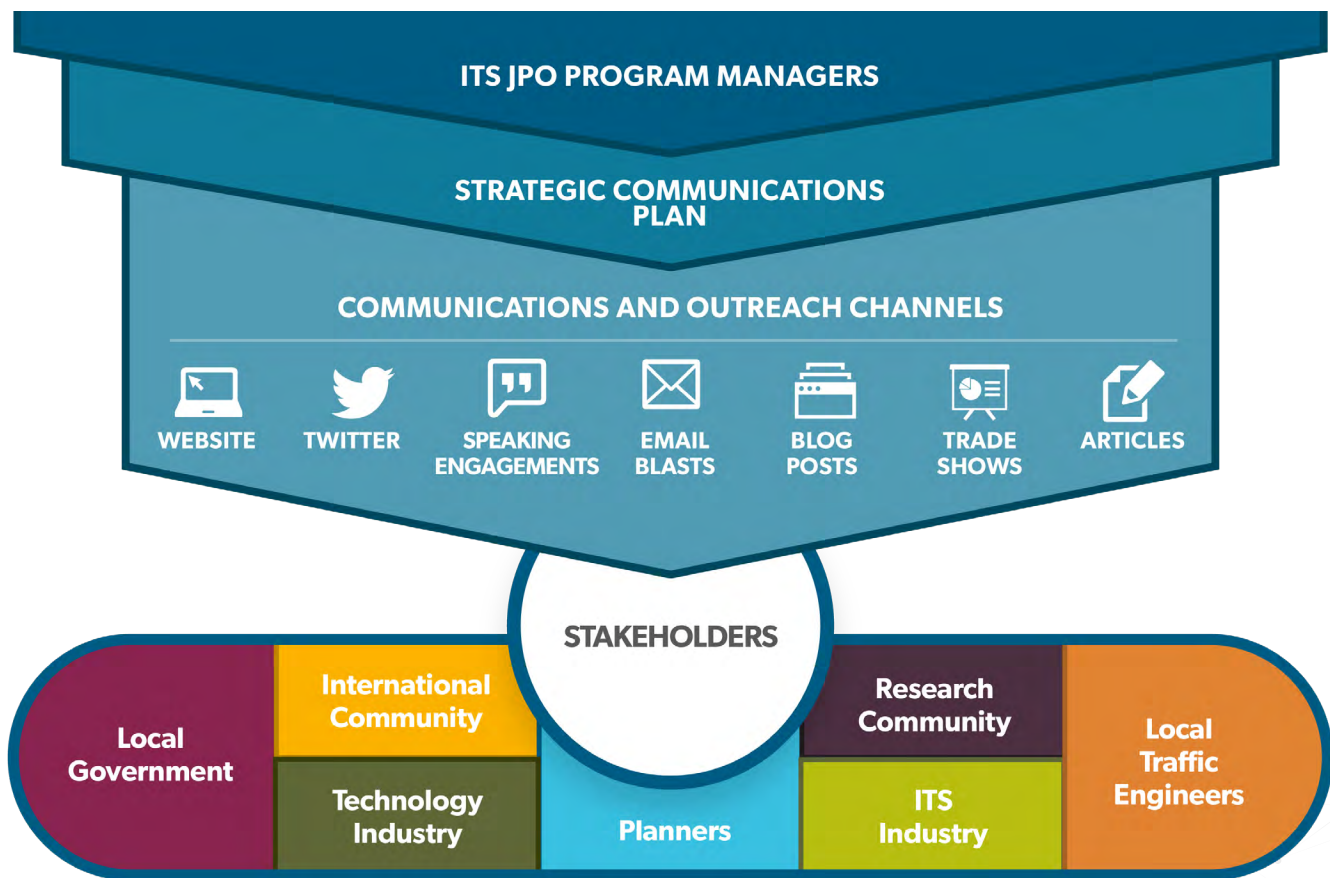
Source: ITS JPO

Key Outcome

More than 2,000 publications in support of research, development, and promotion of ITS, connected vehicles, and automation technologies.

Planned Activities to Advance ITS Communications

▶ Encourage market-based solutions based on U.S. DOT research and products with effective communications

▶ Translate ITS research results into clear, step-by-step guides for deployers

▶ Establish teams with modal partners to promote and mainstream ITS technologies

▶ Develop simplified and targeted communications materials that explain the benefits of and path to implementation of ITS technologies for state and local transportation professionals

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