United States Department of Transportation
Annual Modal Research Plans FY 2022
Program Outlook FY 2023

FEDERAL TRANSIT ADMINISTRATION
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Karina Ricks

Executive Summary

The mission of the Federal Transit Administration (FTA) is to improve public transportation for America's communities. FTA's support of public transportation in the United States (US) consists primarily of technical and financial assistance for capital investment and operations. A series of three Federal pandemic relief funding packages provided a financial lifeline for transit agencies to sustain payroll and provide essential transportation service during the COVID-19 pandemic. As America transitions to a post-pandemic future, research and innovation will play an increasingly important role in helping public transit reinvent itself and adapt to new work and travel patterns while tackling historic inequities, reducing greenhouse gas emissions, and accelerating equitable economic growth.

In many ways, the COVID-19 pandemic accelerated innovation. Investing in research that provides information and solutions for public transit agencies' decision-making related to operations, infrastructure, and mobility is essential as agencies meet the needs of today and tomorrow. Thus, FTA's research mission is to enable a robust public transportation network that connects communities and protects the environment. This research mission is achieved by developing, demonstrating, evaluating, and deploying transformative technologies and processes that enable connected, climate friendly communities. The strategic research goals for FTA are to facilitate equitable accessible mobility, support the deployment of environmentally sustainable systems, and enable a safe and secure public transit system. These goals support the U.S. Department of Transportation's (DOT) strategic goals to ensure a safe national transportation system, economic strength, equity, climate sustainability, and transformation.

Figure 1. FTA research focused around areas of impact that will improve public transportation for America's communities.

FTA's research activities are authorized by Federal public transportation law (49 U.S.C. § 5312(b)(1)), which provides that the Secretary of Transportation "[m]ay make grants and enter into contracts, cooperative agreements, and other agreements for research, development, demonstration, and deployment projects, and evaluation of research and technology of national significance to public transportation, that the Secretary determines will improve public transportation."

This FTA Annual Modal Research Plan is a dynamic document noting strategic directions for research investments including the major program areas FTA expects to fund, and the level of that funding for FY 2022. Each program aligns with one primary DOT strategic goal; however, some programs also may advance multiple goals. FTA's level of investment for each of these programs by primary strategic goals is noted in Table 2. FTA's programs build upon past research in mobility innovation, safety, and infrastructure. In FY 2021, FTA released over $60 million for competitive research programs in safety, COVID-19 response, mobility innovation, integrated payment, automation, and asset management. From a safety perspective, recent research and demonstration projects provided the transit industry with innovative tools and practices (such as track worker warning systems) to operate transit systems in a safer manner and with an improved safety culture. Mobility innovation research leveraged new technologies and operational methods to promote seamless travel and more mobility options for all travelers, including travelers with disabilities, travelers from rural areas, and lower income travelers. Infrastructure research launched efforts to use advanced technologies for asset management.

Below is a list of FTA's FY 2022 major research programs categorized by the DOT strategic goal they align toward:

Safety

Safety NeXt – to research new technologies, solutions, and practices to reduce injuries and fatalities and to improve safety culture with the use of technological advancements and innovations.

Safety - Transit Cybersecurity – to operate transit systems in a safer manner through the application of advanced technologies and innovative practices that reduce transit system cybersecurity risks, threats, and vulnerabilities.

Transformation and Equity

Mobility NeXt – to advance public transportation equity, efficiency, and effectiveness, and accelerate the exploration, development and deployment of the most promising technologies, practices and strategies to accelerate the transformation of public transportation and personal mobility – preparing for the future.

Mobility Innovation Transit Automation – to advance the research, development, and deployment of transit bus automation. Research activities are organized around three complementary work areas – Enabling Research, Integrated Demonstrations, and Strategic partnerships.

Climate and Sustainability

Environmental Sustainability and Resiliency – to assist public transportation agencies reach zero-emissions targets by 2050, and to foster sustainable and resilient transit systems through fleet transition and electrification/charging systems that are carbon neutral, and less vulnerable to natural and human-made disasters by preparedness planning and vulnerability assessments to ensure the reliability of transportation infrastructure and operations.

Economic Strength and Modernization

Infrastructure Bus Technologies and Testing – to improve the efficiency, effectiveness, and quality of the FTA Bus Testing Program through adaptation of new bus technologies and testing methodologies.

Small Business Innovation Research Program (SBIR) – a statutory program where FTA, like all DOT operating administrations, applies 3.2 percent of discretionary research funds for research in products and services needed by FTA that small businesses can develop and make commercially available.

One of FTA's statutory programs – the *Transit Cooperative Research Program (TCRP)* – aligns closely with multiple DOT strategic goals, especially the goals of equity, economic strength, climate sustainability, and transformation. TCRP, as authorized by Federal public transportation law (49 U.S.C. § 5312(i)), funds applied research with near-term, practical results that address key challenges facing the public transportation industry.

Organizational Excellence

Technology Transfer, Performance, and Dissemination– to deploy proven research solutions to improve transit service delivery. In addition, the program will continue to facilitate the implementation of research and technology development and to advance the interests of public transportation, monitor, report on, and improve outreach efforts to drive research to practice.

Critical Programs

As FTA rolls out these programs, a few new ones are crucial to advancing some of the Administration's goals to address climate change and respond to the increased concern across the country regarding racial equity. These critical programs are Mobility NeXt and the Environmental Sustainability and Resiliency programs. Mobility NeXt is the next logical step in mobility research that will delve deeper into the issues that affect equity in mobility and enhance travelers' ability to make climate-smart decisions. This research will also examine economic inclusion as well as transformation and "future proofing." As public transit agencies seek to understand how the historic events of the last year will shape demand, they also have an opportunity to address unmet equity concerns. As transit agencies reinvent themselves to accommodate the long-term effect of the COVID-19 pandemic, FTA can help develop various operational concepts of what a transit-led integrated mobility ecosystem may look like, how it may function, demonstrate the technical and institutional feasibility of these concepts, and measure impacts, including equity and climate outcomes. Much of this work may build upon outcomes from the mobility innovation projects awarded in FY 2021. FTA's new Mobility NeXt

program will work to deliver new tools, solutions, and analytical techniques to help agencies transform and future proof their systems.

The Environmental Sustainability and Resilience Program will field innovative development and demonstration research to assist the public transit industry to modernize and meet the goal of becoming carbon-neutral by 2050. Moving to zero-emissions fleets requires public transit agencies to rethink and retool maintenance systems, bus routes, and build out new charging infrastructure. In many cases, these changes will also require organizational structure shifts, retraining/reskilling workers, and building larger partnerships with utility companies. This program builds upon the results of previous low or no emissions research, including the $76 million Low or No Emission Vehicle Deployment Program (LoNo) Program. Additionally, FTA will explore how advanced technologies such as digital twining, artificial intelligence (AI), modeling/simulation, robotics, and the use of unmanned aerial systems can help public transit agencies build back better, and help expand American businesses to drive economic growth across the US so that the nation has the private sector infrastructure to deliver on the climate change goals. All of these research investments will support the Administration's climate, resilience, equitable economic strength, and improve core assets strategic goals.

Partnerships

Diverse internal and external partnerships are major enablers of FTA's research activities. Though the primary customer for FTA's research activities are public transportation agencies, FTA's research stakeholders are a broad constituency. Public transit stakeholders include people and organizations from the nonprofit sector, academic, private sector, local/state/Federal governmental entities, and, especially, individuals who use or come into close contact with public transportation systems. FTA highly values collaborative partnerships with these stakeholders in its research programs. Coordinating with partners helps to extend research, build upon previous research findings, bring a multi-modal focus, and reduce duplication.

FTA also works closely with external partners. Academic, association, and nonprofit partners play a key role in helping develop standards, provide technical assistance to the research office on mobility innovation, and sometimes they are recipients of research funding to do various studies for FTA. Partners like Auburn University; The Ohio State University; and the Altoona Bus Testing Center at Penn State University lead low or no emission component testing and bus testing centers. Consulting organizations such as the Center for Transportation and the Environment (CTE), and CALSTART provide critical research in electrification and carbon-emissions research. Key association partners include the American Public Transportation Association (APTA); the Conference Of Minority Transportation Officials (COMTO); and the Community Transportation Association of America (CTAA). Academic centers working closely with FTA in safety research and standards work are the Center for Urban Transportation Research (CUTR) at the University of South Florida, the Virginia Tech Transportation Institute, and the Texas A&M Transportation Institute.

Another important partner for FTA is the Transportation Research Board (TRB) of the National Academy of Sciences, Engineering, and Medicine (NASEM). TRB not only hosts the TCRP program, but FTA works closely with TRB on a number of other important activities. Yearly, FTA participates in the TRB Annual Conference, and sometimes funds special projects with TRB. As an example, FTA's research office funds TRB to lead the Transit Research Analysis

Committee (TRAC) that provides a venue for the exchange of research ideas and perspectives, and to gather input from the industry. FTA has also been an active participant in the TRB Executive Committee and sometimes sponsors various ad hoc conferences that TRB holds.

FTA works with a large network of internal and external partners. FTA's close internal DOT partners include the Federal Highway Administration (FHWA), Office of the Assistant Secretary for Research and Technology (OST-R), the Intelligent Transportation Systems Joint Program Office (JPO), the National Highway Traffic Safety Administration (NHTSA), the Federal Aviation Administration (FAA), the Federal Motor Carrier Safety Administration (FMCSA), the Federal Railroad Administration (FRA), and the Volpe Center. Examples of research collaboration areas across DOT operating administrations include accessibility research, human factors research, mobility research, automation research, safety research, and the use of unmanned aerial systems.

FTA also benefits from interagency partnerships that further accessibility, alternative fuels, and workforce development. The Accessible Transportation Technology Research Initiative (ATTRI) partners closely with the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). For electrification, alternative fuel buses and carbon emission research, the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and Vehicle Technology Office are critical partners. Agencies collaborating with FTA in COVID-19 related research are the Environmental Protection Agency (EPA) and the Department of Homeland Security (DHS). FTA also has a complementary program funded out of the Technical Assistance and Workforce Development Program (49 U.S.C. § 5314) that supports important parts of FTA's research. The public transit agencies' premier training center funded by FTA is the National Transit Institute (NTI) at Rutgers University, which complements research activity findings to ensure that appropriate training courses exist as new technologies may require new skills in the public transit workforce. In addition, FTA will implement its first Transit Workforce Center (TWC) to help public transit agencies build their workforce for today and tomorrow. The U.S. Department of Labor (DOL) will be an important facilitator of workforce development activities across the US and partner to FTA as we build and sustain the TWC. Finally, the most important external partners for FTA's research are its customers – public transit agencies, their workforce, and the people they serve.

Technology Transfer, Deployment, Organizational Excellence, and Performance Measurement through Robust Data Analytics

FTA will continue research dissemination activities to educate public transportation agencies on proven research solutions to improve transit service delivery. In addition, a new technical assistance program funded under the Technical Assistance and Workforce Development Program (49 U.S.C. § 5314), will facilitate the deployment and implementation of research and technology development, and to advance the interests of public transportation through a robust research to practice initiative. FTA's goal for this initiative is to execute the implementation plan for FTA to share solutions and research results with public transit agencies in ways that meet their needs and time. FTA will continue to produce FTA final reports and publications and ensure they are 508 compliant and accessible to the public transportation industry and the public.

Assessing the best ways to measure success at multiple levels of FTA's research activities – project level evaluation, program evaluation, research goal measurements, and public

transportation innovation impacts – was a three-year effort for FTA that concluded in FY 2021. In FY 2021, FTA finalized a set of performance measures for its research goals and a set of data analytic activities to provide a quarterly scorecard of trends to measure the reach and utility of research investments. FTA created an inventory of datasets that include transit service provided (i.e. from FTA's National Transit Database (NTD)), travel patterns (using data from the Census and the National Household Travel Survey), the location of transit service (using the National Transit Map), and data that relates transit usage, racial equity, climate change, jobs creation and health outcomes.

Additionally, data analytic measures were identified to help FTA track organizational excellence in how programs and projects are tracked, and managed. FTA's research office developed a set of standards to measure to monitor the effectiveness and efficiency of research activities. Program management activities such as timely close-outs, ensuring milestone reports are submitted, and ensuring that project milestones are achieved, are important organizational excellence process measures. And, to track the efficacy of FTA research, new indices are derived from measuring the level of research investment versus the level of program investment in areas like mobility innovation and low or no emission vehicle economic growth. Lastly, FTA continues to find ways to improve the quality and timeliness of statutorily required Congressional Reports on FTA's research results.

FTA also developed a technology inventory of 155 technologies that FTA's research has funded and the implementation status of each technology. Implementation status phases include: the project is started, the demonstration is underway, the demonstration is completed, and the evaluation is completed. FTA tracks the implementation status of technologies on a quarterly basis and monitors whether the technology is being adopted by the project sponsors. Industry stakeholders have embraced the technologies developed through FTA's research projects. In FY 2020, almost half of the industry stakeholders who demonstrated FTA-sponsored technology reported that they plan to adopt it into their ongoing operations. The public transit industry is also working to increase the use of data science methods to analyze and understand their activities. For demonstration programs, FTA continues its statutorily required independent evaluations of the program within two years of implementation. Finally, all projects funded by FTA's research must have public data access plans and discrete performance measures that are reported at least yearly. FTA's research data scientist provides technical support and assistance to research recipients in the development of public data access plans; and research program managers work with each cooperative agreement partner at the statement of work stage to ensure performance measures are SMART – specific, measurable, achievable, relevant, and timely.

One of the resources developed through FTA's data analytic program is a business intelligence database that acts as a repository of important information and as a resource for further FTA research analysis. The latest data analytic activity is utilizing natural language classifiers across all FTA funded projects to predict whether a project has innovative or conventional technology and evaluating the accuracy of the predictions. As this capability evolves, it will enable FTA to gain an even deeper understanding of the impact of research by seeing how many projects funded from other discretionary or formula grants are implementing solutions that began as FTA research projects. With this information, over time, FTA will be able to create an index for research investment and deployment noting how much money was spent deploying projects that

began as research activities. This will be a major step forward to measure an overall return on investment for FTA's research program.

In FY 2022, FTA's performance measures will map to the new FTA research priorities of equitable accessible mobility; the deployment of environmentally sustainable systems; and a safe and secure public transit system. FTA drafted measures of efficiency, effectiveness, and quality for each priority to track anticipated outcomes. The primary anticipated outcomes for FTA's research are the specific objectives noted in each program section in this AMRP. However, at a high level, FTA anticipates that by fielding high quality, timely research, development, deployment, demonstration, and evaluation projects, FTA will enhance public transportation operations; reduce costs; improve travelers' accessible and equitable mobility; support achieving a carbon neutral public transportation system; reduce injuries and fatalities; help public transit agencies transform, build back better and future proof their systems after the COVID-19 pandemic; and advance the economic vitality of America's communities. The performance measures follow FTA's nested research framework approach where the results of specific projects feed into measures for broader research topics.

FTA Participation in OST-R Activities Including Topical Working Groups

FTA is an active participant of the OST-R cross-modal meetings and activities and seeks to ensure that in all DOT research related to public transportation, that other modes understand the public transportation perspective. In FY 2022, FTA will continue its participation in the cross-modal topical research working groups organized by OST-R. The working groups bolster cross-modal coordination, reduce duplication, and leverage related cross-modal research activities. Table 1 provides examples of FTA's participation in these working groups.

Table 1 – FTA Participation in the Topical Research Working Groups

Working Group	FTA Participation
Automation: Enable the safe integration of automated vehicles, vessels, and unmanned aerial systems into the transportation system.	FTA is active in this working group as automation is a key area of research for FTA.
Systemic Safety Approach: Use systemic, performance-based approaches to ensuring transportation system safety.	FTA is actively involved in this working group as safety research is a key area of focus for FTA.
Human Factors: Ensure the integration of human factors into the design of the transportation system.	An FTA staff member chairs this working group and FTA is building out a cross-cutting human factors research program.
State of Good Repair: Maintain transportation assets in a state of good repair, ensure resilience to natural and man-made threats, and optimize material cost and durability.	FTA is active in this working group as state of good repair is a major area for FTA activities and publishes a biennial report with FHWA on the conditions and performance of roads, bridges, and transit.
Economic Competitiveness: Stimulate economic growth, productivity, and	FTA has not historically been active in this working group.

Working Group	FTA Participation
competitiveness through transportation infrastructure investments.	
Emerging/Enabling Technologies: Advance the development of emerging/enabling practices and technologies.	FTA is active in this working group as enabling technologies, such as AI and machine learning, hold promise for improving public transportation.
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.	FTA chairs the Mobility Innovation working group and hosts monthly working group meetings. FTA established and maintains a SharePoint site to facilitate communications and information sharing. A standing agenda item of the monthly working group meeting is a DOT-wide accessibility related topic. Mobility Innovation is one of FTA's three major programs and areas of inquiry.
Cybersecurity: Develop approaches for maintaining the cybersecurity of the transportation system.	FTA is active in this group sharing information regarding cyber-security issues in public transportation
Technology Transfer/Deployment: Facilitate the deployment and adoption of DOT research products into the transportation system.	FTA is active in this working group and is building a strong research to practice initiative.
Evaluation/Performance Measurement: Monitor and evaluate the contribution of research, development, and technology activities toward the achievement of DOT strategic goals and objectives.	FTA is active in this working group sharing how FTA implements demonstration evaluations.
Data: Ensure access to high-quality data to support data-driven technologies, operations, and decision making.	FTA is active in this working group providing input through new data science activities and helped to lead several joint data science information sharing meetings.

In addition to FTA's participation in the working groups described above and in monthly RD&T Planning meetings to learn about the research work in other modes, TRI also coordinates a yearly process within FTA to develop research ideas that are unique to FTA. Research strategic areas of emphasis are determined by the FTA Administrator, then requests for projects are sent out to the leadership of all FTA Offices. Once a set of ideas are proposed, those ideas are reviewed for eligibility of research funding, then summarized and presented to the FTA Administrator who makes the final decisions on what research is selected. FTA's research office then tracks and reports the results in FTA's Annual Report on Public Transportation Innovation Research Projects each fiscal year as required by Federal public transportation law (49 U.S.C. § 5312(f)).

	FY 2021 Enacted ($000)	FY 2022 Pres. Budget ($000)	FY 2022 Bipartisan Infrastructure Law ($000)*
R&DT Program Total	30,000	58,000	$36,840,115

**The recently enacted Bipartisan Infrastructure Law (BIL) authorized R&DT totals differ from the detail in this AMRP. The total funding amounts are shared in this table while a continued effort is underway to assess and implement use of these funds.*

Table 2 - FY 2022 RD&T Program Funding Details

RD&T Program Name	FY 2022 Pres. Budget ($000)	Applied ($000)	Technology Transfer ($000)	Facilities ($000)	Experimental Development ($000)	Major Equipment, R&D Equipment ($000)
Public Transportation Innovation Fund ($28 million)						
Mobility Innovation Transit Automation	3,000				3,000	
Small Business Innovation Research (SBIR)	640				640	
Transit Cooperative Research Program (TCRP)	5,000	5,000				
Infrastructure Bus Technologies and Testing *(includes Low or No Emission Component Testing Statutory $3M program)*	13,360	10,360			3,000	
Safety - Transit Cybersecurity	5,000	5,000				
Technology Transfer, Performance, and Dissemination	1,000		1,000			
Sub-total	28,000	20,360	1,000	0	6,640	0
Transit Research Fund - $30 million*						
Transit Research	29,040	25,000	0	0	4,040	0
Safety NeXt	[5,000]	[5,000]				
Mobility NeXt	[14,040]	[10,000]			[4,040]	

Environmental Sustainability and Resiliency	[10,000]	[10,000]				
Small Business Innovation Research Program (SBIR)	960				960	
Sub-total	30,000	25,000	0	0	5,000	0
Totals	**58,000**	**45,360**	**1,000**	**0**	**11,640**	**0**

** For Programmatic presentation purposes, the Transit Research category includes Safety NeXt, Mobility Next, and Environmental Sustainability and Resiliency Programs.*

Table 3 – FY 2022 RD&T Program Budget Request by DOT Strategic Goal

RD&T Program Name	FY 2022 Pres. Budget ($000)	Safety ($000)	Economic Strength and Modernization ($000)	Equity ($000)	Climate and Sustainability ($000)	Transformation ($000)	Organizational Excellence ($000)
Public Transportation Innovation Fund ($28 million)							
Mobility Innovation Transit Automation	3,000					3,000	
Small Business Innovation Research (SBIR)	640		640				
Transit Cooperative Research Program (TCRP)	5,000					5,000	
Infrastructure Bus Technologies and Testing *(includes Low or No Emission Component Testing Statutory $3M program)*	13,360		3,000		10,360		
Safety - Transit Cybersecurity	5,000	5,000					
Technology Transfer Performance and Dissemination	1,000						1,000
Sub-total	28,000	5,000	3,640	0	10,360	8,000	1,000
Transit Research Fund - $30 million*							
Transit Research	29,040	5,000	0				
Safety NeXt	[5,000]	[5,000]					
Mobility NeXt	[14,040]			[10,000]		[4,040]	

Environmental Sustainability and Resiliency	[10,000]				[10,000]		
Small Business Innovation Research Program (SBIR)	960		960				
Sub-total	30,000	5,000	960	10,000	10,000	4,040	
Totals	**58,000**	**10,000**	**4,600**	**10,000**	**20,360**	**12,040**	**1,000**

* *For Programmatic presentation purposes, the Transit Research category includes Safety NeXt, Mobility Next, and Environmental Sustainability and Resiliency Programs.*

Chapter 1 – FY 2022 RD&T Programs

Mobility Innovation Transit Automation
$3,000,000
(Public Transit Innovation Fund)

Program Description:

Advancements in technology are rapidly transforming the transportation industry and provide the potential to improve public transit systems. Transit bus automation could deliver many potential benefits, such as improved safety, increased efficiency and productivity, and expanded service hours and area, but transit agencies need additional research and policy guidance to make informed deployment decisions. Although funding and policy constraints may play a role, there is also a reasonable unwillingness from transit agencies to risk public funding or to undertake new operational models without a full understanding of the approach or without Federal leadership and guidance. To address these transit industry issues, concerns, and needs, FTA developed a Strategic Transit Automation Research (STAR) Plan to advance the research, development, and deployment of transit bus automation. Research activities are organized around three complementary work areas – Enabling Research, Integrated Demonstrations, and Strategic partnerships. Collectively, the research results address these industry challenges. In addition, the Program's continued emphasis on stakeholder engagement, knowledge transfer, and technical assistance ensures that complementary work being done by the public sector, the private sector, and academia is effectively communicated and leveraged.

Anticipated Program Activities:

STAR Demonstrations and Evaluations: Demonstrate and evaluate selected advanced driver assistance systems (ADAS) (SAE L1-2) and Automated Driving Systems (ADS) (SAE L3-5) technologies for transit specific use cases to achieve greater safety and mobility performance.

STAR Enabling Research: Conduct research on transit automation accessibility and business models, assess gaps in technical standards, and coordinate with key public and private entities, such as APTA and SAE.

STAR Strategic Partnerships: Leverage research projects and investments led by other agencies. FTA funding and technical assistance will supplement partners' deployment and evaluation activities, so research topics of interest to FTA may be cost-effectively added and research findings can be disseminated.

Expected Program Outcomes:

1. Number of STAR projects across the US within the next two years.
2. Number of technical, institutional, and regulatory issues identified and addressed related to planning and deployment of proven transit bus automation technologies and operations within the NeXt five years.
3. Number of transit agencies or communities that pilot transit bus automation technologies to enhance accessibility and mobility, with consideration to equity and climate impacts, within the NeXt five years.

4. Number of research reports, webinars, and presentations related to STAR projects within five years.

Collaboration Partners:

- *Internal partners*: Several DOT operating administrations have vehicle automation research programs, including NHTSA, FHWA, FMCSA and the JPO. Additional modes are commencing research programs or are in the process of increasing their research efforts, such as FRA and the U.S. Maritime Administration (MARAD).
- *Other Federal partners*: DOL, DOE, National Park Service (NPS).
- *External partners*: Research universities, bus manufacturers, technology providers, and trade associations (e.g., APTA), and public transit agencies implementing their own automation projects.

Small Business Innovation Research Program (SBIR)
$1,600,000
(Transit Research and Public Transit Innovation Funds)

Program Description:

FTA's SBIR program is a highly competitive program that encourages small businesses to engage in Federal research and development (R&D) with the potential for commercialization. The goal of FTA's SBIR program is to help small businesses grow by funding product development research in strategic areas such as Safety, Economic Strength, Equity, Climate Sustainability and Transformation. Research projects are solicited annually based on areas of importance to the Department. FTA's SBIR program is supporting the transit industry's recovery from COVID-19 by focusing on the safety of the nation's public transit systems through the adoption of innovative technologies and developing innovative solutions that solve complex challenges that may present themselves in the future. FTA's SBIR program is also focused on ensuring transit comes back stronger, more efficient, and more equitable by promoting racial and social equity, innovation, and entrepreneurship by supporting projects led by women and socially and economically disadvantaged persons. The program helps invest in promising early-stage innovations that may otherwise be too high of a risk for private investors.

Program Objectives:

- Stimulate technological innovation.
- Meet Federal research and development needs.
- Foster and encourage participation in innovation and entrepreneurship by women and socially or economically disadvantaged persons.
- Increase private-sector commercialization of innovations derived from Federal research and development funding.

Anticipated Program Activities:

The SBIR program is administered by each DOT modal agency with guidelines established by Federal law. FTA designates R&D topics for annual solicitations and accepts proposals from small businesses through a competitive review process. FTA's SBIR program is structured into two phases: In Phase I, FTA works with the small business as they develop a proof-of-concept and commercial potential for one of FTA's strategic areas or other topics important to transit. Phase I grants do not exceed $150,000 and cover six months. Phase I anticipated activities include:

Proof-of-concept for Phase I projects on COVID-19 research on the topics of Robots for Unmanned Disinfection and Decontamination of Transit Assets, and Using AI to Inspect, Repair and Sanitize Transit Vehicles.

Submission of Phase II proposal for both Phase I topics listed above.

In Phase II, Phase I R&D efforts are further refined by the small business. For Phase II investments, FTA expects the small business will derive future revenues, and a lucrative commercially available product or solution. Phase II grants are typically around $750,000 and usually have a duration of two years. Phase II anticipated activities include:

Independent Travel Aid Solution for travelers with functional limitations will be developed. The final product will be a mobile application deployed on a cellphone or tablet.

Research efforts will be in final stages for cost allocation technology for non-emergency medical transportation (NEMT). The final product is expected to be completed in FY 2023.

Expected Program Outcomes:

In FY 2022, FTA expects Phase II research and development to be completed for SBIR's independent travel aid solution for persons with functional limitations. The final product will be a mobile application deployed on a cell phone or tablet that provides door-to-door support using public transportation systems, including trip planning, travel to public transportation stations and/or other destinations of interest, station/stop use and transferring, vehicle boarding, and vehicle use; with the potential for future deployment on smart-glasses.

FTA expects Phase II research and development for SBIR's cost allocation technology for a NEMT project to be in the final stages of R&D. Upon completion of Phase II R&D, a commercialization strategy will be completed, and a commercially viable product will be finalized for industry rollout. The final product envisioned will be a web-based solution involving the licensing of the technology to other market segments, such as transportation brokers, NEMT service providers, and existing scheduling technology companies. The solution will be for NEMT that accounts for divergent Federal requirements and funding sources by passenger trip.

In FY 2022, Phase I research efforts addressing COVID-19 will be underway on the topics of Robots for Unmanned Disinfection and Decontamination of Transit Assets and Using AI to Inspect, Repair and Sanitize Transit Vehicles. The goal of these Phase I research efforts will be to develop a proof-of-concept by establishing technical merit, feasibility, and commercial potential of the proposed research/research and development (R/R&D) efforts. FTA will evaluate the quality of performance of the small business prior to determining whether the small business will receive Federal support for Phase II.

Collaboration Partners:

- *Internal partners*: OST-R, FRA, NHTSA, FHWA, JPO, and the Volpe Center.
- *Other Federal partners*: Small Business Administration.
- *External Partners*: Transit agencies and other industry stakeholders.

Transit Cooperative Research Program (TCRP)
$5,000,000
(Public Transportation Innovation Fund)

Program Description:

The TCRP is authorized in Federal public transportation law (49 U.S.C. § 5312(i)) and operated through the Transportation Research Board (TRB). TCRP provides applied research with near-term, practical results addressing key challenges facing the public transportation industry. Recently published research reports address critical issues such as bus service reliability, equity analysis in regional transportation planning, data sharing, tax increment financing for transit projects, and attracting, retaining, and advancing women in the public transportation workforce. The TCRP Oversight and Project Selection (TOPS) Committee is supported through a panel of expert practitioners from the industry and managed by TRB staff.

In FY 2022, TCRP will implement the Department's priorities of Safety, Economic Strength, Equity, Climate Sustainability, and Transformation through TCRP project solicitations and evaluations. TCRP research aligns well with the Departmental priorities and complements existing efforts.

Program Objectives:

- Identify transit problems in need of research and development (R&D) investigation; and to establish a priority ranking for them.
- Provide an opportunity for transit operators, local government officials, and many other constituents - including construction organizations, financiers, real estate developers, and community representatives - to identify problems and participate in developing appropriate solutions.
- Improve communications, technical information transfer, and dissemination.
- Provide a means of addressing a variety of near-term transit problems in cooperation and in coordination with Federal public transportation research.

Anticipated Program Activities:

Solicit research ideas from practitioners and the public: Issue a broad call to public transportation and related industries for members of the public to identify challenges common in practice.

Research Project Selection: Screening Committee conducts an initial review of proposed projects. Those that merit further consideration move to the TOPS Committee for final review, ranking, and selection.

Research Project Panel Development and request for proposals from research organizations: TRB staff solicit volunteers to serve on expert practitioner panels and identify liaisons from FTA.

Conduct Research: Research project panelists review proposals and select contractors to produce individual research deliverables.

Dissemination: APTA carries out dissemination under the direction of TRB and, in cooperation with partners, shares research results through events, bulletins, webinars, and email blasts.

Expected Program Outcomes:

1. Efficiency Measures
    - Percent of new panels formed within 6 months of project selection
    - Percent of new projects under contract within 12 months
    - Percent of research projects completed on schedule
2. Effectiveness Measures
    - Percent of problem statements rated 3.5 or higher by the screening panel and TOPS
    - Percent of increase in total downloads and by TCRP product type since 2017
    - Percent of increase in number of webinar participants: NTI and TRB
    - Percent satisfactory score (only TRB)
    - Percent increase in the number of social media posts (TRB and APTA)
    - Presentations on TCRP deliverables at conferences and meetings with estimated number of attendees
3. Diversity
    - Panel diversity and inclusiveness by gender and race
    - Percent of panelists representing public transportation agencies
4. Quality
    - Panel satisfaction with participation in TCRP
5. Impact
    - Customer satisfaction with TCRP deliverables (follow-up survey to downloaded materials)

Collaboration Partners:

- *Internal partners*: FTA program and regional offices and FTA Office of the Administrator. FTA's Research office informally shares information about TCRP with other DOT operating administrations as appropriate.
- *Other Federal partners*: When appropriate, Coordinating Council on Access and Mobility partners, FHWA.
- *External partners*: APTA, COMTO, and NTI. When appropriate, FTA Technical Assistance Centers.

Infrastructure Bus Technologies and Testing
$13,360,000
(Public Transportation Innovation Fund)

Program Description:

FTA's Bus Testing Program was created many years ago during the time when buses used internal combustion engines and primarily used diesel fuel. Today, public transit agencies are fielding buses with many different fuel types – compressed natural gas, diesel hybrid, battery electric, hydrogen fuel cell, and automated vehicles. The historic goals of the FTA Bus Testing Program are to test new bus models for maintainability, reliability, safety, performance (including braking performance), structural integrity, fuel economy, emissions, and noise. Any bus purchased with FTA funding must achieve a pass rating at one of FTA's bus testing centers. In the three decades since the creation this program, hundreds of new bus models have been tested, resulting in thousands of documented failures, dozens of which could have resulted in serious injuries or significant property damage had they occurred in revenue service. Today, FTA must assess the current set of bus testing protocols to establish whether new testing protocols are needed for features like automation, concerns related to cybersecurity, and to find ways to modernize bus testing taking into consideration new advanced bus technologies, time to market for innovation, a potential role for transit vehicle manufacturer self-certification, and techniques in modeling and simulation.

Bus technology has achieved considerable technological advancements in recent decades, with transformative changes to vehicle propulsion, transportation operations, and service delivery. This new bus testing research program aims to modernize and refresh FTA's Bus Testing Program and safely facilitate the introduction and use of new vehicle innovations and solutions. This program supports the Department's economic strength, climate sustainability and transformation priorities.

Program Objective:

- To improve the efficiency, effectiveness, and quality of the FTA Bus Testing Program through adaptation of new bus technologies and testing methodologies.
- Support transit vehicle manufacturer low or no component innovation.

Anticipated Program Activities:

Rider Safety: Study embarking and disembarking of passengers and use of technological innovations to ensure safety and security of riders. Develop a proof of concept and systems requirements.

Advanced Testing Capability: Assessment of bus testing needs and methods including use of simulation and modeling, digital twins and environment, component envelopes and categories, self-certification, or other certifications, for NeXt generation transit buses.

Bus Testing Learning Laboratory: Development of a plan to utilize findings from bus testing and drive the use of new advanced technologies such as modeling and simulation to support transit vehicle manufacturer bus innovations that will enhance the ability for public transit agencies to be carbon neutral by 2050. This research supports DOT's economic growth goals.

Low or No Emissions Component Testing Program: Statutory program to provide transit vehicle manufacturers a voluntary opportunity to test low or no emissions components through FTA funded testing centers. Currently, FTA has two competitively awarded centers – one at Auburn University, and one at Ohio State University.

Expected Program Outcomes:

1. Number of innovative technologies identified that improve rider safety within two years.
2. Number of additional bus testing protocols identified that are necessary to deploy public transit vehicles – including vehicles with features that allow it to operate in an automated manner within two years and a final report with recommendations within three years.

Collaboration Partners:

- *Internal partners*: OST-R, FAA, FHWA, NHTSA, FRA, the Volpe Center, and the JPO.
- *Other Federal partners*: DHS, DOE.
- *External partners*: TRAC, TRACS, Transit agencies, TRB, APTA, and other trade associations, academia, and for profit and non-profit organizations.

Safety - Transit Cybersecurity
$5,000,000
(Public Transportation Innovation Fund)

Program Description:

Safety issues related to cybersecurity threats are on the rise, and there are significant consequences, as was evident from the recent cyber-attack on the Colonial Pipeline that led to the shutdown of a major US fuel pipeline, causing fuel shortages and price increases. Just within the past year, ransomware cyberattacks also caused significant disruption to the operations of the Southeastern Pennsylvania Transportation Authority (SEPTA) and the Massachusetts Steamship Authority. While wireless and/or wired connectivity through centralized computer networks and cloud computing has brought significant overall benefits, it has also introduced security concerns that previously were limited to classical computer and information systems. Transit agencies and riders are relying on various communication methods to transmit information such as Global positioning systems (GPS), wi-fi, and cellular and dedicated short range communication (DSRC) to send data and provide connectivity. According to a 2020 Mineta Transportation Institute report titled "Is the Transit Industry Prepared for the Cyber Revolution? Policy Recommendations to Enhance Surface Transit Cyber Preparedness," data and the connected nature of transit networks were cited as vulnerabilities that exacerbate transit systems' cybersecurity exposure.

The Transit Cybersecurity Program seeks to identify transportation cyber security vulnerabilities, threats, and risks; assess how to address these risks; then develop solutions based on initial research findings with applications that public transit agencies can implement. This program supports the Department's safety and security strategic goal.

Program Objective:

- To operate transit systems in a safer manner through applying advanced technologies and innovative practices that reduce transit system cybersecurity risks, threats, and vulnerabilities.

Anticipated Program Activities:

Vulnerability Assessment: Identify transportation cybersecurity vulnerabilities, threats and risks on transit systems, applications, and operations.

Explore Vulnerabilities: Once vulnerabilities are identified, develop use-case scenarios including concept of operations to address them for large, small, and rural transit agencies.

Expected Program Outcomes:

1. Number of cyber security vulnerabilities, threats, risks, and mitigations identified in public transportation operating environments within two years.
2. Number of applications developed to address cyber security vulnerabilities within three to four years.

Collaboration Partners:

- *Internal partners*: OST-R, FAA, FHWA, NHTSA, FRA, and the JPO.
- *Other Federal partners*: DHS, NIST, and DOE.
- *External partners*: TRAC, TRACS, transit agencies, TRB, APTA, and other trade associations, academia, and for profit and non-profit organizations.

Technology Transfer, Performance, and Dissemination Program
$1,000,000
(Public Transportation Innovation Fund)

Program Description:

This program will build from results and lessons learned from previous years. The program will assist public transportation agencies in applying proven research solutions to improve transit service delivery. In addition, the program will continue to facilitate the implementation of research and technology development and to advance the interests of public transportation, monitor, report on, and improve outreach efforts to drive research to practice. The program will also enhance the ability of transit agencies to deploy the results of research and technology investments and assess any governance barriers identified in demonstration programs. The program will serve as a framework through which the outreach and implementation of research and technology development in the areas of Safety, Economic Strength and Modernization, Equity, Climate Sustainability, Transformation, and Organizational Excellence are utilized and communicated.

Program Objective:

- Continue the outreach to enable public transit agencies to effectively utilize promising research findings in their operations.

Anticipated Program Activity:

Outreach and Dissemination Project: Produce FTA final reports and publications and ensure they are 508 compliant and accessible to the public transportation industry and the public.

Expected Program Outcomes:

1. Ensure research reports are published on FTA's website and in DOT's National Transportation Library (NTL) Repository & Open Science Access Porta (ROSA-P) and the findings are marketed through appropriate means.
2. Track and report the deployment of new innovations.

Collaboration Partners:

- *Internal partners*: FTA program offices, OST-R, and NTL.
- *External partners:* APTA, CTAA, TRB, and CUTR.

Safety NeXt
$5,000,000

(Transit Research Fund)

Program Description:

The latest data on injuries and fatalities shows an increase despite lower traffic volumes. Though public transit is one of the safest modes of travel, FTA and the transit industry continue to work to implement mitigations and strategies to reduce the number of fatalities and injuries as much as possible. Many cities and states have adopted the Vision Zero framework, aiming to achieve zero fatalities and serious injuries on their roads. There are still safety areas that require focus to ensure the highest levels of safety for workers and passengers, as well as pedestrians and bicyclists who are near buses and rail. As an example, when a large bus turns left, there is a line of vision that is compromised due to bus pedestals and other factors that reduce a bus operator's visibility – advanced technologies can help address this issue.

Thus, the Safety NeXt program seeks to advance transit safety at all levels by leveraging innovative technologies such as AI, sensors, and machine learning to monitor, predict and plan ways to reduce worker injuries and fatalities; advanced technologies that can increase rider, bicyclist, and pedestrian safety. Additionally, maintaining transit vehicles in a state of good repair through asset management practices increases safety. This program will also explore the utility of unmanned aircraft systems (UAS) and robotics to conduct surveys, inspections and repairs using advanced mapping and video analytics. The Safety NeXt Program supports the Department's Safety priorities and builds upon previous FTA safety research demonstration programs and other related efforts.

Program Objectives:

- Support research to reduce fatalities and injuries.
- Improve safety culture with the use of technological advancements and innovations.

Anticipated Program Activities:

Worker Safety: Roadway transit worker safety research including a state of the practice and innovation scan along with a needs assessment.

Rider Safety: Continue to utilize advanced technologies to ensure rider safety building upon lessons learned from the COVID-19 research demonstration program and FY 2022 research into ways to ensure safe embarking and disembarking from transit vehicles.

Pedestrian and Bicyclist Safety: Pedestrian and bicyclist safety research including a state of the practice and innovation scan along with a needs assessment.

Public Transportation Maintenance Unmanned Aerial Systems (UAS): UAS and robotics application for operations and maintenance including conducting a literature review and concept development.

Expected Program Outcomes:

1. Number of innovative technologies identified to monitor, predict, and plan operations and maintenance that increase rider, pedestrian and bicycle safety and reduce worker injuries and fatalities within two years.
2. Number of design performance specifications related to system accuracy identified for worker, pedestrian and bicycle safety applications within three years.
3. System reliability, as measured by stakeholder feedback on the technology demonstrated through qualitative and quantitative data within four years.

Collaboration Partners:

- *Internal partners*: OST-R, FAA, FHWA, NHTSA, FRA, and the JPO.
- *Other Federal partners*: DHS, DOE.
- *External partners*: Transit Research Analysis Committee (TRAC), Transit agencies, the Transit Advisory Committee for Safety (TRACS), TRB, APTA, and other trade associations, academia, and for profit and non-profit organizations.

Mobility NeXt
$14,040,000

(Transit Research Fund)

Program Description:

FTA''s Mobility NeXt program is a new FTA innovative mobility research program focused on uncovering the next iteration of the most promising technologies, practices, and strategies to accelerate public transportation transformation – preparing for the future. The Mobility NeXt program builds upon significant FTA and private sector investments in mobility innovation through efforts such as the Mobility on Demand (MOD) Sandbox, the Accessible Transportation Technologies Research Initiative (ATTRI), the Integrated Mobility Innovation (IMI) Demonstration, and Accelerating Innovative Mobility (AIM) Challenge Grant Initiatives, as well as others. In the near term, this new program aims to rapidly adapt to the new norms of mobility demand and supply following the COVID-19 pandemic. In a longer-time horizon, the program strives to mobilize Federal and private sector investments in mobility research to advance new models of how transportation is delivered and consumed, leveraging technologies and solutions, supporting public transportation to achieve equitable and climate smart mobility outcomes.

Program Objectives:

- Smart Operations: To research future public transportation service models that accelerate transformation of public transportation providers as integrated mobility managers, that connect all modes and services for enhanced mobility of all travelers.
- Smart Travelers: To explore enabling technologies and policy tools to improve personal mobility through environmentally sensitive, personally optimized mobility decisions based on curated choices provided to travelers tailored to their individual preferences and circumstances.
- Smart Partnerships: To improve public transportation equity, efficiency, and effectiveness, and accelerate transformation by leveraging public and private resources and technologies.

Anticipated Program Activities:

Mobility NeXt Operational Concept Development: Develop comprehensive public transportation operational concepts, such as integrated mobility manager service models, that guide transit agencies to adapt to meet evolving traveler expectations.

Mobility NeXt Enabling Research: Conduct exploratory research on transformational mobility data analytics and technological solutions and their potential to significantly enhance travelers' mobility, including but not limited to, AI, modeling and simulation, and blockchain, that promote user-centric mobility innovation, such as using AI to fuse archived and real-time data to support the more tailored system operations, modeling and simulation tools to estimate mobility outcomes based on various pricing scenarios, and blockchain to support secured transactions and more efficient allocation of mobility resources, including vehicle capacity and curb space.

Mobility NeXt Knowledge Transfer: Facilitate knowledge transfer and the widespread deployment of the most promising mobility innovation technologies, tools and approaches.

Expected Program Outcomes:

1. Number of promising technologies and service models piloted with transit agencies that enhance traveler mobility and improve effectiveness of public transportation in the evolving mobility marketplace within three years.
2. Number of transit agencies that coordinate a range of mobility solutions, and have expanded their traditional transit management role to include integration of personal mobility transportation solutions in a shift toward being managers of personal mobility in their operating region, within three years.
3. Number of transit agencies or communities that use novel mobility modeling and simulation and other advanced data analytical tools to make decisions on how they coordinate and operate transportation services that enhance traveler mobility, with consideration to equity and climate impacts, within the next five years.
4. Adoption rate of smart trip planning tools that empower travelers to make personalized mobility decisions that consider environmental outcomes, within five years.
5. Number of new mobility innovation trends where FTA investments are a contributing factor, and the extent to which these innovative public transportation practices are being deployed in US communities within five years.
6. Number of research reports, webinars, and presentations rated to Mobility NeXt projects within five years.

Collaboration Partners:

- *Internal partners*: OST offices, FHWA, NHTSA, FMCSA, FRA, FAA, the Volpe Center, and the JPO.
- *Other Federal partners*: DOL, NIDILRR and the DOE's Vehicle Technology Office.
- *External partners*: Private sector mobility providers and technology developers, Shared Use Mobility Center, TRB, APTA, CTAA, Mobility on Demand Alliance (MODA) by Intelligent Transportation Society of America (ITSA), CUTR, Texas Transportation Institute (TTI), Other Academic and Research Institutions, and private sector consulting firms.

Environmental Sustainability and Resiliency
$10,000,000
(Transit Research Fund)

Program Description:

Climate change is a significant and growing risk to the safety, reliability, and sustainability of transportation infrastructure and operations. The greenhouse gases (GHGs) produced by the transportation sector in the US has surpassed the power sector as the largest emitter at 29 percent of total emissions, and 24 percent globally[1]. The emergence of battery electric technologies and electrical propulsion systems that are zero-emissions along with innovation in alternative renewable energy sources and cleaner electrical grids, offer increased opportunities to make public transportation carbon neutral.

The vision of this program is to make public transportation systems more sustainable and resilient by harnessing novel renewable energy methods and advancing innovations in climate solutions to reduce carbon footprint and ensure reliability of transportation systems during natural and human-made disasters. The Environmental Sustainability and Resiliency program supports the Department's economic growth, climate sustainability and transformation priorities. It also builds upon previous FTA research and demonstration programs such as the LoNo Vehicle Deployment Program, which concluded in 2015 and was reauthorized by Congress as a standalone FTA funding program under the FAST Act.

Program Objective:

- Field research activities that help public transit agencies become zero-emission by 2050 and foster sustainable and resilient transit systems through fleet transition and electrification/charging systems that are carbon neutral, and less vulnerable to natural and human-made disasters (fire, flooding, superstorms etc.) by preparedness planning and vulnerability assessments to ensure the reliability of transportation infrastructure and operations.

Anticipated Program Activities:

Transit Electrification: Assessment of transit electrification needs and development of user scenarios for charging infrastructure including exploring novel ways to charge and optimize charging costs and operations.

Ancillary Power Consumption: Develop power consumption and optimization strategies for ancillary components and systems using simulation and modeling.

Bus Exportable Power Systems (BEPS): Develop and demonstrate innovative bus energy systems to utilize bus energy systems for power during an emergency and to increase resiliency of transit/city infrastructure.

Transit Vehicle Manufacturer (TVM) Economic Development: Conduct a policy and institutional barriers study for transit fleet transition to battery electric and hydrogen fuel cell zero emission

[1] *Bloomberg Sustainable Energy in America Factbook:* https://www.bcse.org/factbook/

buses including charging, operation and maintenance of zero emission fleets, common vehicle specification, procurement, deployment and demonstration for large, small and rural transit agencies.

Expected Program Outcomes:

1. Number of transit electrification user scenarios developed and solutions identified to optimize charging costs and operations within two years.
2. Number of power consumption and optimization strategies developed to address ancillary power consumption within two years.
3. Number of innovative technologies introduced to utilize bus energy systems for power during an emergency within three years.
4. Number of project research reports and guidance documents/standards developed within four years.

Collaboration Partners:

- *Internal partners*: OST-R, FAA, FHWA, NHTSA, FRA, and the JPO.
- *Other Federal partners*: DHS, DOE.
- *External partners*: TRAC, TRACS, TRB, APTA, and other trade associations, academia, and for profit and non-profit organizations.

Chapter 2 – FY 2023 RD&T Programs

Safety NeXt

Program Description:

In 2023, the Safety NeXt program will continue to advance transit safety at all levels by leveraging innovative technologies such as AI and machine learning to monitor, predict and plan operations and maintenance that can reduce worker injuries; advanced technologies that can increase rider, bicyclists, and pedestrian safety; and assess the utility of UAS and robotics to conduct surveys, inspections and repairs using advanced mapping, and video analytics.

Program Objective:

- Safety NeXt will support research to reduce fatalities and injuries and improve safety culture with the use of technological advancements and innovations.

Anticipated Program Activities:

Worker Safety: Apply roadway transit worker safety research findings and undertake application development and demonstration.

Rider Safety: Continue to utilize advanced technologies to ensure rider safety building upon lessons learned from the COVID-19 research demonstration program and FY 2022 research into ways to ensure safe embarking and disembarking from transit vehicles.

Pedestrian and Bicyclist Safety: Apply pedestrian and bicyclist safety research findings and undertake application development and demonstration.

Public Transportation Maintenance Unmanned Aerial Systems (UAS): Apply UAS and robotics application for operations and maintenance research findings and undertake application development and demonstration.

Cybersecurity

Program Description:

In FY 2023, the Transit Cybersecurity Program will continue to explore transportation cybersecurity vulnerabilities, threats and risks; assess how to address these risks; and develop solutions based on initial research findings with applications public transit agencies can implement.

Program Objective:

- To operate transit systems in a safer manner through applying advanced technologies and innovative practices that reduce transit system cybersecurity risks, threats and vulnerabilities.

Anticipated Program Activities:

Cyber-Apps: Build applications to monitor cybersecurity public transit threats and protect them from such threats including conducting a field test or a pilot demonstration or deployment.

Mobility NeXt

Program Description:

In 2023, FTA's Mobility NeXt program will continue to focus on uncovering the NeXt iteration of the most promising technologies, practices and strategies to accelerate public transportation transformation – preparing for the future. The program will continue to seek opportunities to mobilize Federal and private sector investments in mobility research to advance new mobility concepts, technologies and solutions, and support public transportation to achieve equitable and climate smart mobility outcomes.

Program Objectives:

- Smart Operations: To research future public transportation service models that accelerate transformation of public transportation providers as integrated mobility managers, that connect all modes and services for enhanced mobility of all travelers.
- Smart Travelers: To explore enabling technologies and policy tools to improve personal mobility through environmentally sensitive, personally optimized mobility decisions based on curated choices provided to travelers tailored to their individual preferences and circumstances.
- Smart Partnerships: To improve public transportation equity, efficiency, and effectiveness, and accelerate transformation by leveraging public and private resources and technologies.

Anticipated Program Activities:

Mobility NeXt Enabling Research: Continue exploratory research on transformational mobility data analytics and technological solutions that enable smart transit operations through integrated mobility, and smart travelers through personalized mobility.

Mobility NeXt Demonstration: Prepare for demonstrations of public transportation transformation, while achieving climate smart and equitable mobility outcomes.

Mobility NeXt Knowledge Transfer: Facilitate knowledge transfer and the widespread deployment of the most promising mobility innovation technologies, tools and approaches.

Strategic Transit Automation Research (STAR)

Program Description:

In 2023, the program will continue the advancements in technology that are rapidly transforming the transportation system and will continue to provide the potential to improve transit systems. STAR will continue to advance the research, development, and deployment of transit bus automation. Research activities will be organized around three complementary work areas – Enabling Research, Integrated Demonstrations, and Strategic Partnerships. Collectively, the research results address these industry challenges. In addition, the Program's continued emphasis on stakeholder engagement, knowledge transfer, and technical assistance ensures that complementary work being done by the public sector, the private sector, and academia is effectively communicated and leveraged.

Program Objectives:

- To improve safety, including the deployment of automated vehicles and integration of automated technologies.
- To increase efficiency and productivity of transit operations.
- To enhance customer experience and satisfaction through improved service frequency and flexibility.

Anticipated Program Activities:

STAR Deployment Guidance: Develop a series of policy and guidance documents building on earlier research findings and relevant findings from the demonstrations. Topics may include, but not be limited to, human factors, labor, and training issues; customer communication; maintaining consistency in the passenger experience; and transit service planning.

STAR Enabling Research: Conduct research on the potential impacts of automation related changes to transit service patterns and user acceptance, such as an increase in point-to-point service using smaller vehicles, and plan for future services.

STAR Strategic Partnerships: Continue to leverage research projects and investments led by other agencies. FTA funding and technical assistance will supplement partners' deployment and evaluation activities, so research topics of interest to FTA may be cost-effectively added and research findings can be disseminated.

Environmental Sustainability and Resiliency

Program Description:

In FY 2023, this program will continue to make public transportation systems more sustainable and resilient by harnessing novel renewable energy methods and advancing innovations in climate solutions to reduce carbon footprint. The program will build from lessons learned in FY 2022. The Environmental Sustainability and Resiliency program supports the Department's economic growth, climate sustainability and transformation priorities.

Program Objective:

- Field research activities that help public transit agencies become zero-emission by 2050 and foster sustainable and resilient transit systems through fleet transition and electrification/charging systems that are carbon neutral.

Anticipated Program Activities:

Transit Electrification: Develop and refine user scenarios into concept of operation, prototype development, testing and demonstration on novel ways to charge and optimize charging costs and operations.

Ancillary Power Consumption: Apply promising findings on optimization strategies, develop applications and test and analyze such systems.

Bus Exportable Power Systems (BEPS): Select and award BEPS Notice of Funding Opportunity (NOFO) projects, and manage the projects and their recipients.

Transit Vehicle Manufacturer Economic Development: Identify recommendations, next steps and actions from the policy and institutional barriers study for transit fleet transition to battery electric and hydrogen fuel cell no emission buses including common vehicle specification and procurement for large, small and rural transit agencies.

Bus Technologies and Testing

Program Description:

In FY 2023, Bus Technologies and Testing will continue to modernize and refresh the Bus Testing Program and safely facilitate the introduction and use of new vehicle innovations and solutions. The program will build from lessons learned in FY 2022, and will continue to seek innovative technologies to improve rider safety. The program will also provide a set of recommendations for the redesign of the bus compartment to improve bus operator safety and satisfaction.

Program Objective:

- To improve the efficiency, effectiveness, and quality of the FTA Bus Testing Program through adaptation of new bus technologies and testing methodologies.

Anticipated Program Activities:

Rider Safety: Develop a proof of concept and field testing or a pilot demonstration or deployment.

Bus Compartment Redesign: Develop and issue Bus Operator/Passenger Compartment Redesign NOFO with a focus on rapid reconfiguration of seating and other elements, operator/rider safety and convenience.

Advanced Testing Capability: Identify recommendations, next steps, and actions from the assessment of bus testing needs and methods including use of simulation and modeling, digital twins and environment, component envelopes and categories for next generation transit buses.

Bus Testing Learning Laboratory: In FY2023, FTA will launch a new laboratory that will utilize findings from bus testing and drive the use of new advanced technologies such as modeling and simulation to support transit vehicle manufacturer bus innovations that will enhance the ability for public transit agencies to be carbon neutral by 2050. This research supports DOT's economic growth goals.

Transit Cooperative Research Program (TCRP)

Program Description:

This statutory program will remain unchanged in FY 2023. TCRP will continue to provide applied research with near-term, practical results addressing key challenges facing the public transportation industry. TCRP will continue to publish research reports to address critical issues such as bus service reliability, equity analysis, data sharing, tax increment financing for transit projects, and women in the public transportation workforce. The TCRP Oversight and Project Selection (TOPS) Committee is supported through a panel of expert practitioners from the industry and managed by TRB staff.

Program Objectives:

- Identify transit problems in need of research and development (R&D) investigation; and to establish a priority ranking for them.
- Provide an opportunity for transit operators, local government officials, and many other constituents - including construction organizations, financiers, real estate developers, and community representatives - to identify problems and participate in developing appropriate solutions.
- Improve communications, technical information transfer, and dissemination.
- Provide a means of addressing a variety of near-term transit problems in cooperation and in coordination with Federal public transportation research.

Anticipated Program Activities:

Solicit research ideas from practitioners and the public: Issue a broad call to public transportation and related industries for members of the public to identify challenges common in practice.

Research Project Selection: Screening Committee conducts an initial review of proposed projects. Those that merit further consideration move to the TOPS Committee for final review, ranking, and selection.

Research Project Panel Development and request for proposals from research organizations: TRB staff solicit volunteers to serve on expert practitioner panels and identify liaisons from FTA.

Conduct Research: Research project panelists review proposals and select contractors to produce individual research deliverables.

Dissemination: APTA carries out dissemination under the direction of TRB and, in cooperation with partners, shares research results through events, bulletins, webinars, and email blasts.

Small Business Innovation Research Program (SBIR)

Program Description:

The SBIR Program will build on the momentum of FY 2022. In FY 2023, the program will prioritize the goals of the Biden-Harris Administration by funding product development research in strategic areas such as climate, environmental sustainability, and resilience. FTA's SBIR program will seek technological innovations that incorporate green technologies and help combat the negative impacts of climate change. In addition, FTA's SBIR program will continue to promote racial and social equity by fostering and encouraging participation in innovation and entrepreneurship by women and socially and economically disadvantaged persons. The goal of FTA's SBIR program is to help small businesses grow by funding product development research in strategic areas such as safety, infrastructure, mobility, and other topics important to transit. The program supports innovative solutions that help solve complex challenges and invests in promising early-stage innovations that may otherwise be too high of a risk for private investors.

Program Objectives:

- Stimulate technological innovation.
- Meet Federal research and development needs.
- Foster and encourage participation in innovation and entrepreneurship by women and socially or economically disadvantaged persons.
- Increase private-sector commercialization of innovations derived from Federal research and development funding.

Anticipated Program Activities:

In FY 2023, there is potential for FTA's SBIR program to focus on advanced technologies that are emerging disruptors and innovation accelerators. FTA anticipates the potential for research in the areas of modeling/simulation, AI, machine learning, standards-based electric charging systems, using unmanned aerial vehicles to assist with maintenance needs, and data integration tools that help FTA ensure equity/accessibility in planning and implementing public transit services.

Technology Transfer and Performance Dissemination Program

Description:

In FY 2023, the program will build from results and lessons learned from previous years. The Research to Practice and Dissemination Program will continue to empower FTA to develop a strategy to share lessons learned from FTA-funded research projects. The program will also continue to enhance the ability of transit agencies to deploy the results of research and technology investments and assess any governance barriers identified in demonstration programs. It will also identify the dissemination and outreach methods that work best for public transportation professionals and develop a plan for FTA based on those methods.

Program Objective:

- Continue the outreach to enable public transit agencies to effectively utilize promising research findings in their operations.

Anticipated Program Activity:

Outreach and Dissemination Project: Produce FTA final reports and publications and ensure they are 508 compliant and accessible to the public transportation industry and the public.