ANNUAL REVIEW

Stories of Transportation Innovation from the **U.S. DOT Volpe Center**

U.S. Department of Transportation
Volpe Center

2026

Contents

U.S. DOT Volpe Center staff gathers in Kendall Square, Cambridge, MA in October 2025. The Volpe Center marked its 55th year in service to U.S. DOT and the nation on July 1.

Letter from the Director

Dear Colleagues,

Happy New Year!

Each year, the U.S. Department of Transportation's Volpe National Transportation Systems Center draws upon its multimodal, multidisciplinary expert workforce to carry out more than 350 projects in support of the Office of the U.S. Secretary of Transportation, every U.S. DOT operating administration, the Department of War, Interior, Agriculture, NASA, other federal, state, regional, and local agencies, non-profit organizations, the private sector, and others.

The Volpe Center's Annual Review 2026 illustrates some of our top work of the past year, while also documenting some of the significant headway the Department is making to advance its critical mission and strategic priorities. Each story underscores an unwavering commitment to advancing U.S. DOT's strategic goals: safety, infrastructure investment, innovation, and efficiency.

It's always exciting to shares stories of innovation that highlight impactful projects and best practices—all accomplished in collaboration with our partners at U.S. DOT and across the transportation enterprise.

I am so incredibly proud of the Volpe workforce. The Volpe staff has been running on all cylinders to support the transportation priorities of the new administration including: safety across all modes; the modernization of the air traffic management system; economic, benefit-cost, and industry analysis for informed decision-making; maritime dominance; strengthening national resilience through responsible use of positioning, navigation, and timing technologies; advancing automated vehicles, supersonic flight, advanced air mobility, and counter UAS; advancing the efficient movement of freight; helping to solidify the nation's leadership in artificial intelligence; and supporting NEPA reform to expedite federal environmental review and permitting processes to deliver transportation infrastructure projects more efficiently.

I look forward to the year ahead and collaborating with the Volpe team, our dedicated sponsors, and all of you to further advance the nation's transportation system for the public good.

Best wishes!

Gregg G. Fleming

Director
U.S. DOT Volpe Center
January 2026

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Safety

The U.S. DOT Volpe Center works across all modes to support the Department's number one priority: transportation safety. Our multimodal safety expertise and extensive partnerships enable us to leverage proven practices from one mode to improve safety in others.

ADOBE STOCK/APchanel

AVIATION

Accelerating Modernization: Fast-Track Merger of Critical FAA Safety Systems

The Federal Aviation Administration (FAA) Safety Assurance System (SAS) is a mission-critical application used by more than 5,000 Aviation Safety Inspectors (ASIs) and approximately 2,000 industry partners to perform certification and safety oversight functions. ASIs help maintain safe skies by overseeing the operations of major airlines, air ambulance operators, repair stations, pilot schools, and many other types of aviation businesses. FAA inspectors use SAS to certify new businesses that provide services to the public and to manage safety risks associated with those operations. The U.S. DOT Volpe Center provides aviation safety expertise to this project and has supported SAS-related work for FAA for many years.

In July 2025, at the request of FAA, and on an extremely accelerated timeline, two standalone FAA systems, the Operations Approval Portal System (OAPS) and the Web-based Operations Safety System (WebOPSS) were subsumed into SAS by the U.S. DOT Volpe team. OAPS allowed certificate holders, operators, and applicants to submit operations approvals to FAA as well as track those submissions in real-time. Users could also edit, review, and approve previously submitted applications. WebOPSS provided users with tools to create and manage operator-specific authorizing documents, and the system assisted in collecting non-regulatory, operator-specific data. Through WebOPSS, users could also access a robust data reporting capability. Authorizing documents created in WebOPSS included management specifications, training specifications, letters of authorization, and waivers. An important component of WebOPSS was the creation of a company's operating specifications (OpSpecs), which gives certificate holders, including major airlines, the authority to operate.

In less than three weeks, three months ahead of schedule and in response to FAA's request to fast-track the work, the U.S. DOT Volpe Center team, with support and coordination provided by FAA, successfully incorporated the capabilities of both OAPS and WebOPSS into SAS, and they deployed SAS Phase 4 OAPS/OPSS functionality to all 168 FAA offices. This significant shift required rapid adaptation from the U.S. DOT Volpe Center team who demonstrated remarkable agility and creativity to meet a seemingly impossible deadline. The team effectively absorbed this accelerated timeline by strategically migrating data and optimizing document preload, while ensuring data integrity, utilizing proactive error management, and direct user support in deploying the functionality throughout FAA. ASIs received one of the most significant benefits of the change to this expedited implementation: in the past, ASIs were required to enter duplicate data into both SAS and WebOPSS as part of their oversight responsibilities. Data capture is now far more efficient, with ASIs entering information solely in SAS.

Sponsor: FAA

An ASI inspects an aircraft inside of an airport hangar prior to flight operations. *Source: Adobe Stock/Andrey Popov*

Transforming Aviation Safety Staffing through Data-driven Forecasting

In a dynamic environment marked by rapid technological change, ensuring FAA's workforce meets current and future demands is essential. Safety in the National Airspace System (NAS) hinges on FAA's ASIs who inspect and oversee critical functions. The Aviation Safety Staffing Tool and Reporting System (ASTARS), developed and maintained by the U.S. DOT Volpe Center, enables FAA to reliably forecast ASI staffing needs for the next 10 years, supporting effective workforce planning, risk management, and regulatory compliance.

Congress mandates that FAA complete an accurate 10-year forecast of ASI staffing requirements to maintain safe operations across the NAS. This process ensures FAA can allocate resources effectively to uphold the nation's renowned aviation safety record. Failure to meet the statutory forecast deadline carries significant penalties of $100,000 per day.

ASTARS is a modern, data-driven platform that enables precise and risk-informed projection of ASI needs. ASTARS integrates complex workload data, industry forecasts, and regulatory changes across aviation domains to produce staffing forecasts that meet statutory deadlines and support proactive safety management.

ASTARS employs a hybrid approach, combining process-based and statistical modeling to analyze inspection workload and risk factors. This methodology empowers FAA leadership with insights into the interplay of operational demands, technology evolution, and workforce dynamics.

The U.S. DOT Volpe Center's team collaborates closely with FAA organizations including Flight Standards, Aircraft Certification, and Advanced Air Mobility, ensuring ASTARS reflects organizational shifts and technological trends. ASTARS directly bolsters FAA's capacity to:

- Accurately forecast ASI staffing to sustain safe NAS operations
- Analyze consequences of staffing decisions
- Adapt to regulatory and operational changes enhancing aviation safety oversight
- Ensure compliance with Congressional reporting requirements, avoiding costly penalties

Recently, the U.S. DOT Volpe Center team delivered biannual staffing forecasts and analyses for FAA leaders, supported change management activities including training and communications, and maintained secure, compliant software environments essential for statutory reporting.

The ASTARS platform serves national needs, guiding resource allocation decisions across all FAA regions, thereby supporting safe air travel for millions of passengers and the broader aerospace industry.

With ASTARS, FAA benefits from a forward-looking, evidence-based staffing solution that enhances workforce readiness and bolsters safety outcomes in a rapidly evolving aviation environment.

Sponsor: FAA

Enhancing Aviation Data Sharing

Air travel relies on fast, reliable data. With roughly 16 million flights each year and thousands of aircraft in the air at once, standardized data sharing across FAA's NAS is essential for safety, efficiency, and informed decision-making.[1]

FAA is modernizing two key systems for data sharing with support from the U.S. DOT Volpe Center:

- System Wide Information Management (SWIM) Terminal Data Distribution System (STDDS) publishes terminal NAS data such as surface operations, Terminal Radar Approach Control (TRACON) activity, departures, and weather to FAA systems and external users through standard interfaces.
- Store-and-Forward Appliance (SAFA) buffers data, retrieves it when needed, and manages security certificates so aviation systems can access recent historical data securely.

FAA is replacing legacy Time Division Multiplexing (TDM) links with modern Internet Protocol (IP) communications, supporting FAA's priorities of infrastructure modernization, cybersecurity, and innovation across the NAS. The latest releases modernize how terminal data travels through the NAS by moving from TDM to IP and improving how messages and certificates are stored and shared. This increases data availability, resilience, and security, enabling safer and more efficient air operations.

The U.S. DOT Volpe Center is the prime system developer for STDDS and provides key support for SAFA. Recent upgrades include moving Runway Visual Range components from TDM technology to modern IP, which aligns with broader FAA efforts to enhance data sharing and strengthen the system. Through its SAFA-related work, the U.S. DOT Volpe Center facilitates the seamless publication, storage, and retrieval of vital air traffic data through Application Interface Gateway routers and the Network-Enabled Message Service.

[1] FAA, Air Traffic for the Numbers, July 2025; https://www.faa.gov/air_traffic/by_the_numbers#:~:text=Every%20day%2C%20FAA%20's%20Air,).*%20based%20on%20FY24%20figures.

Some key outcomes from the Volpe Center team's work include:

- **Better Incident Recovery and Analysis:** SAFA now supports up to 15 days of terminal automation data for authorized users.
- **Stronger Cybersecurity:** IP-based distribution aligns with current security practices.
- **Improved Decision-making:** Standardized interfaces across FAA systems and external data partners.
- **Nationwide Distribution:** As of July 2025, STDDS is live at 37 of the 38 TRACON sites. SAFA appliances are installed at 129 of 141 Standard Terminal Automation Replacement System (STARS) site, nearing 100 percent completion as planned. STARS is a single-state-of-the-art platform installed at TRACONS and their associated air traffic control stations.

The U.S. DOT Volpe Center team is currently focused on completing site deployments for STDDS and SAFA, finishing integration testing, operational handover and user training, and monitoring performance while enhancing security and data distribution as NAS needs evolve.

FAA is establishing a modern, resilient data backbone for the NAS. With the U.S. DOT Volpe Center's support, FAA is moving terminal data from legacy TDM networks to IP communications, strengthening data-driven operations, cybersecurity, and overall efficiency in the U.S. airspace.

Sponsor: FAA

Elevating Air Traffic Safety and Efficiency during Departure with Flight Deck Insights

FAA partnered with the U.S. DOT Volpe Center's team of technical experts to study Multiple Air Route Separation (MARS)—an innovative air traffic concept expanding the use of Performance-Based Navigation (PBN) in the terminal area to boost traffic flow around congested airports. MARS has the potential to bring aircraft closer together in busy terminal airspace, demanding precise

adherence to flight paths to maintain safety under reduced separation. The U.S. DOT Volpe Center's earlier work identified factors that can impact the flight crew's ability to stay on the desired flight path. Understanding how pilots experience and manage these tighter conditions is vital to shaping FAA guidance and ensuring efficient air traffic flow.

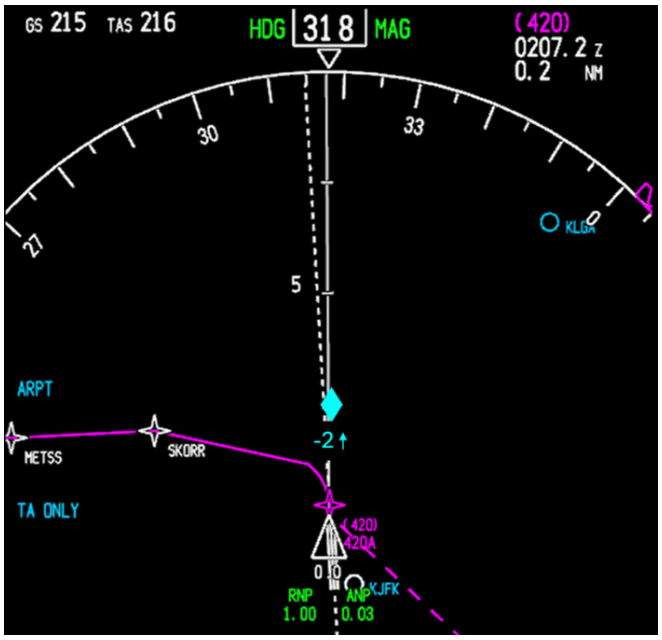
The U.S. DOT Volpe Center team's research included the following components.

- **Technical Expertise:** Engaged technical pilots to pinpoint potential flight deck issues that might arise in a MARS departure operation.
- **Real-world Analysis:** Reviewed a curated set of 20 NASA Aviation Safety Reporting System reports detailing flight path deviations during PBN departures.
- **Pilot Perceptions:** Interviewed pilots and presented periodic snapshots of MARS departure scenarios on a simulated flight deck display to gauge traffic threat awareness and response strategies.

The U.S. DOT Volpe Center's research informs FAA decision-making for regulations and guidance on PBN departures and supports safety risk management for future MARS phases. Some initial findings include:

- **Typical Flight Path Deviations Arise Intentionally and Unintentionally:** Intentional deviations respond to external factors like weather or equipment problems. Unintentional deviations more often stem from task overload or air traffic control (ATC) clearance changes.
- **Traffic Proximity Intensified Pilot Vigilance:** During simulated MARS departures, pilots paid more attention to traffic as it got closer, prompting them to consider early maneuvers or ATC communication to guarantee safety.
- **Rising Procedural Complexity:** PBN departures now include more precise altitude constraints—waypoints with altitude requirements rose from 17 percent in 2015 to 22 percent in 2023. Managing multiple constraints can increase pilot workload during critical phases.

Building on the U.S. DOT Volpe Center's earlier research, FAA's phased rollout of MARS can now rely on these critical flight deck insights to balance efficiency gains with safety assurance—ultimately enabling smoother, safer airspace operations across the nation. The full research findings can be accessed here: Flight Deck Perspectives on Performance-Based Navigation (PBN) Departure Procedures. The U.S. DOT Volpe Center team also summarized highlights from its research here: Flight Deck Perspectives on Departure Procedures for Multiple Airport Route Separation.



A simulated Boeing 737 flight deck navigation display depicting an aircraft (unfilled white triangle) on a published instrument departure procedure (magenta line) with a traffic aircraft overlay from the Traffic Alert and Collision Avoidance System (filled cyan diamond). The display indicates that the traffic aircraft is just 200 feet below the aircraft and climbing. *Source: U.S. DOT Volpe Center.*

Sponsor: FAA Human Factors Division

HIGHWAY

Ensuring Breathalyzers Are Accurate and Able to Withstand Legal Scrutiny

Every day in the United States, about 34 people die in drunk-driving crashes—one life lost every 42 minutes. In 2023 alone, 12,429 people died in alcohol-impaired driving traffic accidents. These tragedies are preventable, and a cornerstone of prevention lies in ensuring

that alcohol test devices used by law enforcement and transportation agencies are reliable, precise, and legally defensible. The U.S. DOT Volpe Center's Alcohol Countermeasures Laboratory serves this critical safety mission for the National Highway Traffic Safety Administration's (NHTSA) Impaired Driving Division.

Supporting NHTSA's Mission

The Alcohol Countermeasures Laboratory evaluates evidential breath testing devices, alcohol screening devices, and calibration units used across police, aviation, rail, marine, and other transportation modes. Under NHTSA Model Specifications (Federal Register 58 48705-48710), devices must meet stringent precision and accuracy requirements before appearing on NHTSA's Conforming Products Lists (CPLs). The Volpe Center is the sole laboratory designated to conduct all required testing, and its work directly supports NHTSA's goal of reducing drunk-driving fatalities.

The Volpe Center's mission begins by subjecting submitted instruments to rigorous evaluation. Ninety to ninety-five percent of devices initially fail to conform, prompting close collaboration with manufacturers on hardware or software improvements. Only after repeated testing confirms compliance are devices approved. This process protects end users—police officers, airline pilots, train engineers, and commercial drivers—and ensures that readings reflect true breath-alcohol concentrations.

A defining capability of Volpe's Alcohol Countermeasures Laboratory is its unique Breath Alcohol Sample Simulator (BASS). These Volpe-designed and built robots are the only wet-bath "drinking" robots in the world, faithfully reproducing the water vapor, temperature, and breath profiles of human breath. Most other laboratories rely on compressed gas simulators that cannot replicate human physiology. BASS units are used for critical breath-sampling tests and help validate that instruments perform accurately under realistic conditions.

The Crucial Role of Scientific Integrity

The Volpe team also provides expert testimony in federal and state courts, defending the scientific integrity of breath testing devices and maintaining public confidence in the criminal justice process. In challenges regarding software or procedural updates, Volpe scientists demonstrate that modifications have no adverse impact on precision or accuracy. The laboratory has not lost a case in its history, and judges rely on Volpe's independent findings when weighing expert evidence.

Recent milestones include special testing of the Dräger Alcotest 9510 for New Jersey and the CMI Intoxilyzer 9000 for Florida. In both cases, defendants argued that user-software updates disqualified the devices from NHTSA's CPLs. Volpe's exhaustive evaluations—performed under state-specific protocols—confirmed that neither software nor procedural changes affected the instruments' performance. Volpe staff have provided testimony in New Jersey's Supreme Court and Florida trial courts and stand ready to do so again.

Beyond device evaluation and litigation support, the Alcohol Countermeasures Laboratory advises NHTSA on model specification updates and participates in the International Organization of Legal Metrology working group to develop global recommendations for evidential breath testers. The laboratory continuously monitors conforming devices, retesting them after any modification to ensure ongoing compliance.

The U.S. DOT Volpe Center's BASS Drinking Driver Robot, which is used to simulate breath samples from impaired drivers. *Source: U.S. DOT Volpe Center.*

U.S. DOT Volpe Center Alcohol Countermeasures Lab

Since 1970, the U.S. DOT Volpe Center's **Alcohol Countermeasures Laboratory** has been the primary **NHTSA**-recognized national laboratory with the authority to **test and approve alcohol-detection devices** that are used by law enforcement and the transportation industry.

30% of all traffic fatalities in the U.S. involve an alcohol-impaired-driver—a 7.6% decrease from 2022 to 2023.

12,429
LIVES LOST IN ALCOHOL IMPAIRED DRIVING TRAFFIC CRASHES (2023)

34
PEOPLE DIE IN DRUNK DRIVING CRASHES EVERY DAY

$58B
ESTIMATED ECONOMIC COST OF ALCOHOL IMPAIRED DRIVING CRASHES* (2019)

A fatal traffic crash involving a driver with a BAC of .08 g/dL or higher is an alcohol-impaired driving crash.

*Costs include lost productivity, medical costs, congestion impacts, and property damage.

THE ALCOHOL COUNTERMEASURES LAB IN ACTION

Reduces the rate of intoxicated driving by developing and evaluating measurement techniques for alcohol on the breath testing.

Tests all Evidential Breath Testing devices, Alcohol Screening Devices, and Calibrating Units used by police and across modes including aviation, rail, transit, marine, and pipelines.

Develops NHTSA's model specifications for evaluation of submitted police and workplace alcohol testing devices performance guidelines for breath measurement devices.

Designs and builds robots to simulate impaired drivers during instrument evaluations.

Monitors changes to all conforming alcohol test devices and retests to confirm continued conformance.

Supports development of international recommendations for Alcohol Breath Testing, and participates in the International Organization of Legal Metrology.

The U.S. DOT Volpe Center's Alcohol Countermeasures Laboratory supports NHTSA by combining advanced engineering, data analysis, and innovative approaches to safeguard the accuracy and reliability of breath-alcohol testing devices.

The U.S. DOT Volpe Center is respected for its independence and integrity. Volpe Center experts are the only ones able to testify in federal and state courts about the precision and accuracy of these instruments.

U.S. Department of Transportation Volpe Center

01/2026

By combining advanced engineering, data analysis, legal expertise, and innovative robotics, the Volpe Center's Alcohol Countermeasures Laboratory safeguards the accuracy and reliability of breath-alcohol testing devices. Its work plays a vital role in deterring impaired driving and upholding the rule of law—ultimately saving lives and reinforcing public trust in transportation safety.

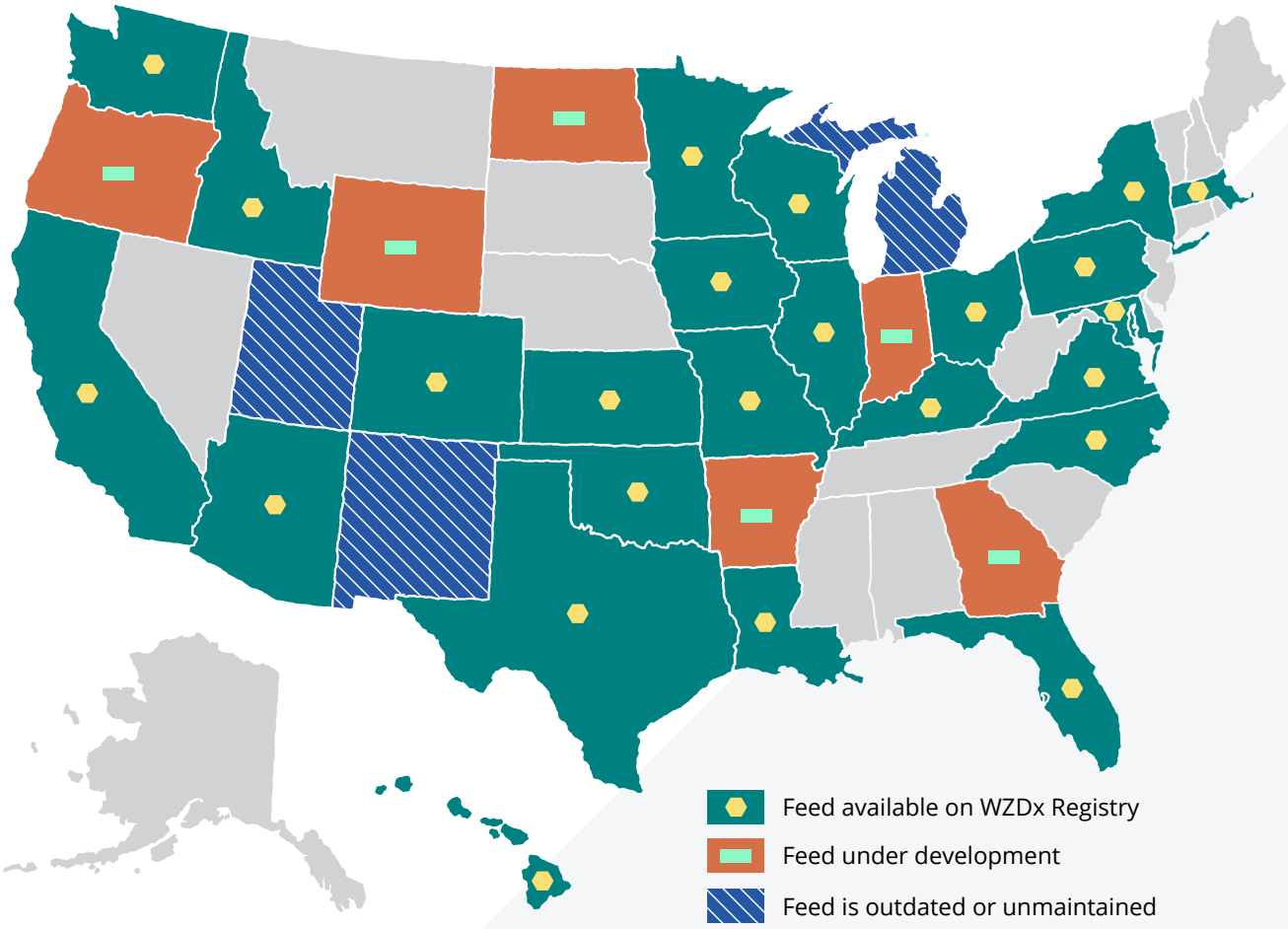
Sponsor: NHTSA

Enhanced Work Zone Data Exchange Program Improves Roadway Safety

Vehicle crashes often occur in highway work zones, leading to injuries, fatalities, congestion, and inefficient roadway management. In the U.S., one work zone fatality occurs for every 4 billion vehicle-miles of travel, and for every $112 million worth of roadway construction.[2] In 2022, there were 891 work zone traffic fatalities recorded in the U.S. In the year that followed, 101,000 work zone crashes caused 39,000 injuries and 899 deaths, including 176 construction workers.[3]

By working with data producers and consumers, the U.S. DOT Volpe Center's Work Zone Data Exchange (WZDx) team has standardized the way work zone information is shared with third-party mapping and navigation providers, allowing information to reach drivers and inform their decisions about how to safely navigate active construction zones. Work zone data feeds are listed on the WZDx Feed Registry, a clearinghouse overseen by the Volpe Center team. To date, the WZDx Feed Registry has been downloaded 183,000 times.

[2] FHWA Work Zone Facts and Statistics; https://ops.fhwa.dot.gov/wz/resources/facts-stats.htm.
[3] National Work Zone Safety, At a Glance; https://workzonesafety.org/work-zone-data/.



Map of WZDX Deployment by State. *Source: U.S. DOT Volpe Center.*

In 2025, a Volpe Center team of planners, engineers, and analysts onboarded six new data feeds to the WZDx Feed Registry including Louisiana Department of Transportation & Development, Illinois Tollway, Ohio Department of Transportation, Idaho Transportation Department, Delaware Department of Transportation, and Quebec City. As of September 2025, there are currently 35 data feeds in the WZDx Feed Registry with new feeds being developed with Arkansas and Indiana Departments of Transportation (DOTs). The WZDx team coordinates with infrastructure owners and operators, typically state DOTs, to perform feed validation and address any technical questions.

The WZDx team also developed and refined a data feed monitoring dashboard, which is used internally to check feeds for non-compliance or other errors. It engaged the I-80 Corridor Coalition and the Eastern Transportation Coalition to better understand barriers to adoption of WZDx and state DOT requirements related to capturing, managing, and sharing work zone information.

Formalizing the WZDx specification using a systems-engineering process led by the Institute for Transportation Engineers, the official Connected Work Zones (CWZ) standard was released in early 2025. The CWZ standard built upon the WZDx model's success and serves as a jumping-off point for the development of data specifications to communicate information about incidents and weather-related roadway impacts. In 2025, Colorado DOT became the first organization to update its feed from WZDx to the new CWZ standard.

The U.S. DOT Volpe Center team presented its research findings at the August 2025 ITS World Congress and the April 2025 New Jersey Work Zone Safety Conference on the future of work zone data, including U.S. DOT's efforts to improve data quality and expand usage of the CWZ standard. The team worked closely with the National Park Service to maintain its WZDx feed of road closures on public lands and expanded their first Road Restriction feed at Great Smoky Mountains National Park, during Hurricane Helene recovery efforts in September 2024.

The U.S. DOT Volpe Center applied its data standardization and data visualization expertise to the CWZ standard development process, feed validation role, and development of a dashboard tool. The U.S. DOT Volpe Center's institutional knowledge of WZDx has proven extremely beneficial as the feed expands to include incidents and weather, as well as work to improve the coverage and quality of existing data feeds. The new incident data specification and weather event data specification is anticipated to be published in winter 2025, following an intensive series of stakeholder meetings held throughout the summer.

Sponsors: FHWA, Intelligent Transportation Systems Joint Program Office, National Park Service Washington Support Office

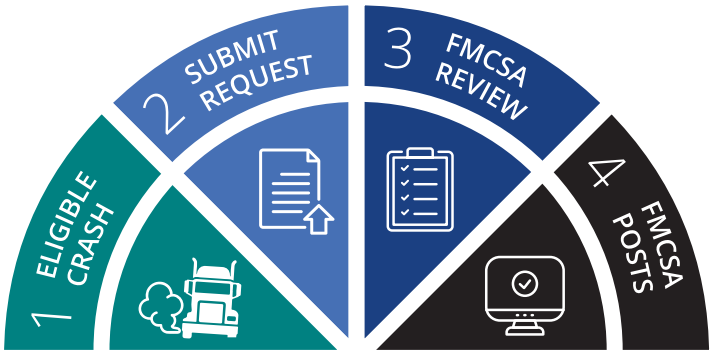
MOTOR CARRIERS

Expanding FMCSA's Crash Preventability Determination Program to Target Highest-risk Carriers

The Federal Motor Carrier Safety Administration's (FMCSA) Crash Preventability Determination Program (CPDP) supports the agency's mission to reduce crashes, injuries, and fatalities involving large trucks and buses. Part of FMCSA's strategy to carry out its safety mandate is to harness safety data stored in federal information systems to focus enforcement efforts on carriers that pose the greatest risk to safety.

According to FMCSA's Motor Carrier Safety Management Information System, large trucks and buses in the United States were involved in 183,466 crashes in 2024 that resulted in 4,871 fatalities. Of those large trucks and buses involved in crashes, FMCSA and state partners conducted 12,291 motor carrier safety investigations, underscoring the importance of identifying highest-risk carriers.

FMCSA's CPDP allows motor carriers to request a review of crash records they believe were not preventable by the truck or bus driver. If FMCSA determines a crash was not preventable, the crash remains on record but is excluded from the algorithm that FMCSA uses to prioritize carriers for intervention. The crash also appears on the driver's Pre-Employment Screening Program records with a "Not Preventable" determination.



Step-by-Step of the Crash Preventability Determination Program Review Process. *Source: FMCSA.*

STEP 1 Eligible crash occurs

STEP 2 The motor carrier or driver submits a Request for Data Review (RDR) in FMCSA's DataQs system

STEP 3 FMCSA reviews requests and determines if crashes are:

- Not Preventable
- Preventable
- Undecided

STEP 4 FMCSA posts final determinations to the Safety Measurement System (SMS)

The U.S. DOT Volpe Center helps FMCSA review crash reports and related carrier, driver, and vehicle data to recommend whether a crash was not preventable. Since CPDP began in 2020, more than 80,000 crash review requests have been submitted. Of the 60,000 eligible requests, more than 90 percent have been found not preventable.

Expanded Eligibility

Based on industry feedback and Federal Register comments, FMCSA expanded eligibility from 16 crash types to 21 in December 2024. The U.S. DOT Volpe Center contributed to the development of the expansion criteria by using experience gained through years of crash analysis and analyzing Federal Register notice comments to inform the final program changes.

New reviewable crash scenarios include:

- Commercial motor vehicle (CMV) struck on the side by a vehicle traveling in the same direction;
- CMV struck by a vehicle entering from a private driveway or parking lot;
- CMV struck by a motorist who lost control of their vehicle; and
- Any CMV crash captured on video that clearly shows the event sequence.

The addition of eligible crash types, including those captured on video, helps modernize the crash review process, giving FMCSA and CMV carriers the opportunity to leverage newer technology such as dashcams to inform crash analysis and justify preventable or not preventable determinations.

The recent CPDP expansion was welcomed by industry. The Owner-Operator Independent Drivers Association supports the changes. Industry leader J.B. Hunt says the CPDP allows FMCSA to prioritize motor carriers experiencing a disproportionate number of preventable crashes for safety interventions. J.B. Hunt also believes the changes will benefit drivers by including more notations of not preventable determinations in their pre-employment screenings.[4]

In addition to supporting the expansion of eligible crash types, the U.S. DOT Volpe Center designed and delivered communication materials including fact sheets, job aids, and briefing decks to increase stakeholder awareness of the changes.

The U.S. DOT Volpe Center continues to provide support for FMCSA's CPDP by analyzing crashes, and developing reports and dashboards to help visualize key safety data used to prioritize safety enforcement activities.

Sponsor: FMCSA Office of Enforcement and Compliance.

[4] FMCSA Announces Changes to Crash Preventability Determination Program, Landline. Media, December 3, 2024, Mark Schremmer.

Enhancing Motor Carrier Safety with Process Improvements for the Data Analysis and Reports Team

FMCSA's Analysis Division provides the transportation industry and the public with analytical reports related to large truck and bus crashes and monitors data quality to guide the development of effective safety countermeasures.

The Data Analysis and Reports Team (DART) is one resource FMCSA uses to share critical safety data with stakeholders. Through the DART Data Requests online tool, FMCSA manages and responds to data requests from FMCSA Division Offices and other state partners to support the informed development of annual safety plans and other enforcement activities.

Authorized users, such as FMCSA personnel and state partners, can use the DART Data Requests online tool, housed within FMCSA's Analysis and Information platform, to view, manage, and respond to data requests. According to FMCSA, in fiscal year 2024, the DART program, consisting of three analysts, responded to 1,971 data requests, producing 1,661 reports for FMCSA users and state partners.

The U.S. DOT Volpe Center supports DART by assisting with data requests and offering usability suggestions, making the process of requesting custom reports and safety data easier for agency stakeholders.

Analysts and developers from the U.S. DOT Volpe Center implement changes to the DART Data Requests online tool and coordinate with FMCSA's Information Technology team to publish the changes. These modifications prioritize user experience, as well as enhance FMCSA's ability to respond to the large volume of requests.

Recent updates to the tool include a personalized user dashboard view that allows users to easily see previously submitted requests, and monitor their status, as well as search other user requests. The DART team also made improvements to the submission form, allowing users to fill out request information, make note of any deadlines, and include any other relevant details.

The U.S. DOT Volpe Center team also provides the requested data extracts and performs additional data analysis upon request. If there are questions about the

I-40 near Asheville, North Carolina. *Source: Adobe Stock*

requested safety information, U.S. DOT Volpe Center analysts arrange meetings with the requestor to discuss the purpose of the request.

Through DART program support, the U.S. DOT Volpe Center enhances FMCSA's ability to review and respond to requests for tailored data reports and analyses that are used to help FMCSA leaders and program managers focus enforcement efforts where they are needed most—targeting companies and drivers that pose the greatest risks to public safety.

Sponsor: FMCSA

PUBLIC TRANSPORTATION

Improving Rail Transit Safety with Risk-based Inspections

To improve safety, the Infrastructure Investment and Jobs Act (Public Law 117-58) required every State Safety Oversight Agency (SSOA) to develop and implement a risk based inspection (RBI) program for the rail transit agencies they oversee. SSOAs are responsible for ensuring rail transit systems comply with federal requirements and operate safely within their state.

RBI programs enable SSOAs to make objective, data-driven decisions about how best to allocate and prioritize their inspection resources, so they can focus on the highest risk safety issues before hazards cause serious damage, injuries, or accidents.

To implement RBI, the Federal Transit Administration (FTA) turned to the cross functional experts at the U.S. DOT Volpe Center to help build the program from the ground up and deliver the tools, training, and hands-on support needed.

The U.S. DOT Volpe Center team took a systems approach to supporting FTA's RBI program, which included the following elements.

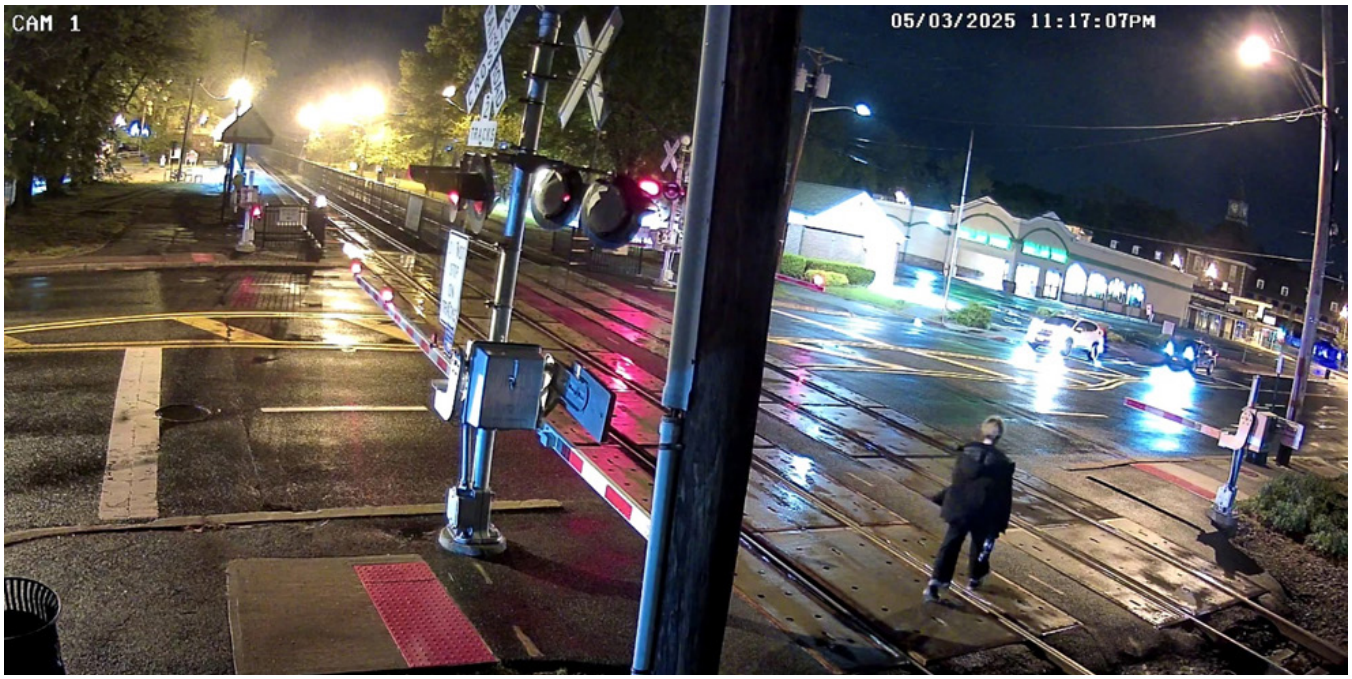
- **Standardized Reviews:** created uniform evaluation criteria and trained reviewers to ensure fair, consistent assessments of RBI programs across widely varying transit systems.
- **Scaled Quickly:** monitored submission timelines, anticipated a surge, and recruited/trained additional reviewers to ensure timely and high-quality evaluations.
- **Supported SSOAs Directly:** hosted webinars, organized 380+ one-on-one meetings, provided premeeting written feedback, and delivered regular status communications.
- **Built the Program Infrastructure:** produced procedures, IT systems, web pages, and user toolkits and checklists.

The Volpe Center team's strategic deployment of innovations was critical to the success of the RBI program. The team built interactive dashboards to give FTA leadership real-time visibility into where each SSOA was in the course of developing and deploying its RBI program plan, as well as progress on key project milestones. Facilitating structured and effective debriefs enables RBI program evaluators to shorten review cycles and harmonize feedback.

The multidisciplinary technical team included program and data analysts, communications strategists, instructional designers, developers, and user interface/user experience (UI/UX) designers. The RBI approach included proactive engagement and outreach strategies that kept stakeholders informed, aligned, and ultimately accelerated RBI adoption. As a result, all 31 SSOAs, which oversee the safety of about 60 rail transit agencies across 30 states and Puerto Rico, submitted RBI program development plans by October 2024.

Throughout 2026, FTA will continue to monitor and evaluate how SSOAs are implementing their RBI programs with a focus on continuous improvement. The U.S. DOT Volpe Center team will continue its support for this effort by reviewing SSOAs' RBI documentation, improving dashboards, and meeting one-on-one with the SSOAs to help advance their programs. The team will also continue promoting peer-to-peer sharing of lessons learned among SSOAs and rail transit agencies to drive adoption of the most effective data analysis techniques in risk-based decision-making—all resulting in improved transit safety nationwide.

Sponsor: FTA



Video cameras capture pedestrian violation at the testing location in Fair Lawn, New Jersey. *Source: U.S. DOT Volpe Center.*

RAIL

Using Innovative Warning Systems to Prevent Pedestrian Fatalities at Highway-rail Grade Crossings

Risky pedestrian behavior at actively protected highway-rail grade crossings in the U.S. is a significant safety problem. Pedestrian grade crossing incidents have steadily increased in proportion to overall grade crossing incidents over the past two decades.

Between 2015 and 2024, pedestrian fatalities at crossings increased by almost 75 percent over the most recent 10-year period, registering 66 fatalities in 2015 compared to 115 fatalities in 2024. Additionally, pedestrian-involved incidents at crossings tend to have a higher fatality rate than vehicle-involved incidents. In 2024, about 45 percent of fatalities at highway-rail grade crossings involved pedestrians—compared to around 28 percent in 2015.

The Federal Railroad Administration's (FRA) Office of Research, Development, and Technology Controls and Communication Research Division tasked the U.S. DOT Volpe Center with using its experience in safety-focused research on pedestrian and cyclist safety at highway-rail grade crossings to research pedestrian grade crossing warning systems to mitigate potential trespassing incidents.

Researchers at the U.S. DOT Volpe Center selected and analyzed pedestrian detection technologies and applications and used their research to develop an innovative prototype system that detects pedestrians traversing grade crossings after the gates have descended and provides a verbal warning over a loudspeaker.

Once the prototype was developed, U.S. DOT Volpe Center engineers worked with New Jersey DOT and New Jersey's rail system (New Jersey Transit) to identify a location for testing. Together, they selected a grade crossing location in Fair Lawn, New Jersey, where multiple pedestrian fatalities have occurred.

From December 2024 to May 2025, the research team collected field-testing data and is now conducting data analysis to ensure prototype technology is feasible. Preliminary results indicate the system components functioned as intended. The technology determined when the gate crossing was activated, detected trespassing pedestrians, and provided an automated verbal warning.

Once the final analysis is complete, FRA hopes to publicize the results for industry awareness. If the

prototype system works as intended, it can become a new tool for municipalities and train operators to use at high-risk grade crossings to improve safety and mitigate trespassing incidents.

Sponsor: FRA Office of Research, Development, and Technology

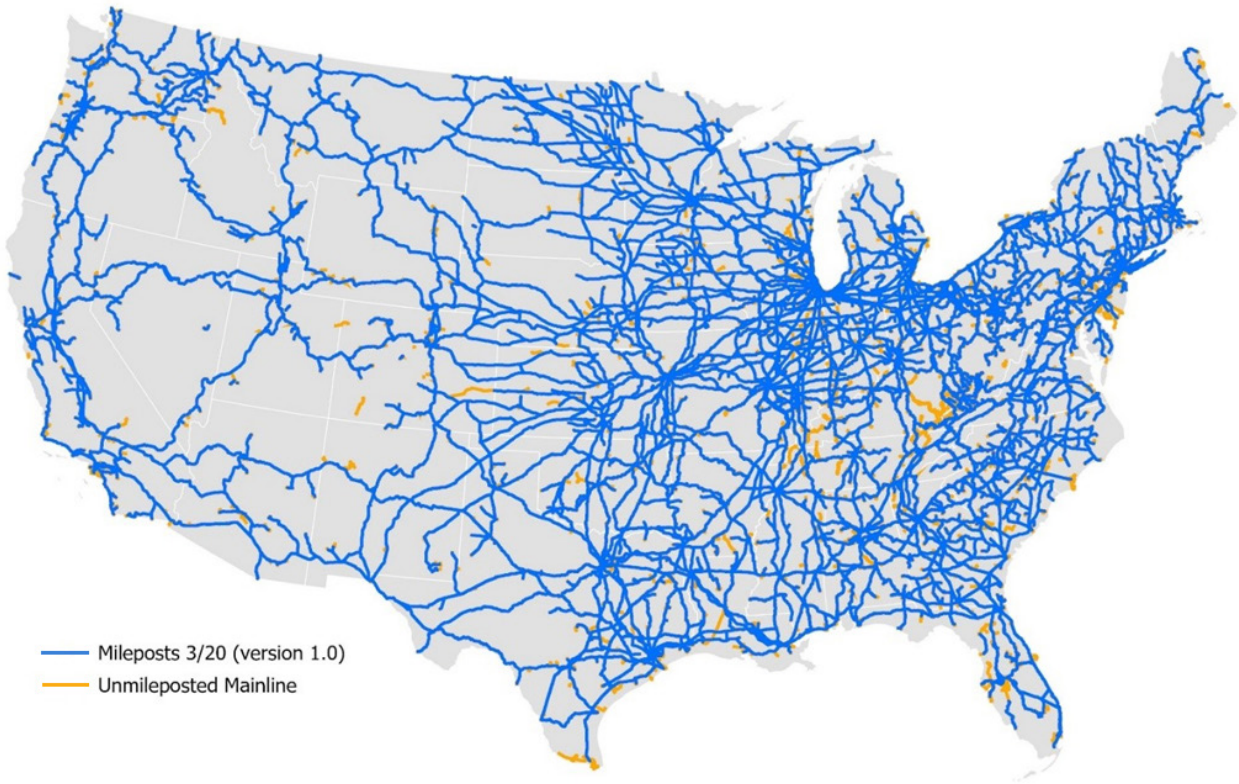
Development of a National Geographic Information System Rail Milepost Layer

Rail mileposts are important locational references that railroads have established along the rail. Railroads, FRA inspectors, and others reference precise milepost locations (e.g., 25.3) and ranges (e.g., from 32.4 to 43.1) for operations, assets management, inspections, reporting, and more.

While FRA maintains many datasets that reference railroad mileposts, including the Rail Equipment Accident/Incident Data and the Highway Rail Crossing Inventory, the agency needed an accurate and reliable database of all mileposts in the national railway network. FRA's Office of Research, Data, and Innovation asked the U.S. DOT Volpe Center to develop a comprehensive geographic information system (GIS) milepost data layer that pulls together information from various data sources to improve accuracy and situational awareness of milepost information for railroads nationwide.

U.S. DOT Volpe Center GIS experts worked with FRA to combine more than 10 years of Automated Track Inspection Program data and inspector feedback, creating a national, GIS milepost layer that ties into the FRA's North American Rail Network (NARN). The U.S. DOT Volpe Center team delivered the milepost layer to FRA in March 2025, and it is already being used by the Data Analysis and GIS Division to support analysis and inspection work conducted by the Office of Railroad Safety. The layer is also now publicly available as part of the National Transportation Atlas Database from the Bureau of Transportation Statistics.

The national milepost layer includes approximately 130,000 mileposts and currently covers more than 90 percent of the rail network in the United States. This



Resulting GIS-ready Rail Milepost Layer Developed by the U.S. DOT Volpe Center. *Source: U.S. DOT Volpe Center.*

new layer will be used to locate, visualize, and analyze rail-related data more efficiently and reliably. It is also being used to find and correct issues in the Highway Rail Crossing Inventory.

The layer will also provide the groundwork for a full Linear Referencing System within the NARN to further advance GIS-driven safety and analysis. A robust Linear Referencing System uses main rail lines, which are measured and treated as routes of linear features along the rail network. This is similar to a statewide highway milepost data layer which represents milepost locations on numbered routes throughout a state. Instead of using latitude and longitude coordinates, a Linear Referencing System locates features relative to a measured line, making it a natural way to manage, visualize, and analyze many sources of railroad information, including events and assets such as railroad crossings, bridges, signs, and signals.

Sponsor: FRA

MARITIME

Chasing 100: A Shared Maritime Domain Awareness Mission Leads to Global Partnerships

How the Volpe Center's maritime domain awareness team changed the world in collaboration with the U.S. Navy, NATO, and more than 100 nations.

The Early Days

In summer 2005, U.S. DOT Volpe Center engineers Dave Phinney and Henry Wychorski were working on projects for the U.S. Navy in Rota, Spain and Souda Bay, Greece. They were introduced to four-star Admiral Harry Ulrich, then-Commander of Naval Forces in Europe and Africa and Commander of the North Atlantic Treaty Organization (NATO) Forces by John Mittelman, PhD, former science advisor for the U.S. Navy's 6th Fleet. The Volpe Center team demonstrated a vessel-tracking tool they had been developing, and Admiral Ulrich immediately recognized the potential for broader implementation. At the time, there was very little information available for tracking and securing U.S. maritime vessel operations and that concerned the Admiral, particularly in a post-9-/11 security posture. The Volpe Center's concept of real-time visibility of vessels traversing the Mediterranean Sea was clearly a game-changer.

By integrating Automatic Identification System signals with coastal receivers, the Volpe Center could feed real-time vessel data into Transview 32, Volpe Center-developed software, which aggregates the shared data into a single common operating picture.

At the time, a solution like this was the first of its kind—cost-effective, easy to implement, and capable of facilitating international cooperation through government-to-government sharing with lower barriers to entry.

Rapid Expansion

From its modest beginning in 2005, Volpe's Maritime Safety and Security Information System (MSSIS) quickly grew. With Admiral Ulrich's support, the network expanded into Sub-Saharan Africa, the Indo-Pacific region, and Northern Europe.

By 2008, the Volpe-developed MSSIS had established itself as a collaborative platform that safeguards global shipping routes for over 50 nation states from 5 continents. The U.S. DOT Volpe Center team was nationally recognized with an Innovations in American Government Award from Harvard's Kennedy School of Government for advancing safety and stability on the world's seas.

The Development of SeaVision

As participation in MSSIS increased, and users could get a picture of traversing maritime vessels for the first time, new challenges arose. Many nations lacked the hardware and infrastructure needed to connect to the real-time tracking network and remain connected. This hindered expansion of the global data-sharing network.

The need for a more reliable way for MSSIS partners to connect and remain connected emerged. This inspired the Volpe Center team to develop SeaVision, the web-based version of MSSIS.

SeaVision incorporated data from MSSIS and other shared information sources and introduced new innovations such as history trails that display where ships have traveled in recent months, and a method to discover if a ship may be spoofing its position to conceal illicit activities such as drug smuggling.

The Volpe Center's innovations opened the door to conducting diverse analyses of maritime operations and unlocked an enhanced capability that provided unprecedented transparency to vessels traveling the global seas.

Partnerships and a Broader Impact

In 2025, MSSIS welcomed its 100th international partner, a major milestone. Today, SeaVision has 4,600+ active users, of which approximately 3,100 are U.S. government users. U.S. users come from 26 major organizations, including Departments of Transportation, Homeland Security, War, Energy, State, Justice, and Commerce, as well as organizations such as the Library of Congress, National Transportation Safety Board, and NASA. Users also come from the intelligence community, university researchers, and agencies from 17 different state governments. As a result, maritime operations worldwide are safer, more secure, and smarter.

The sustained growth of MSSIS and SeaVision is a testament to their value and impact both here and abroad. These innovative systems help participating nations combat illegal fishing, piracy, drug trafficking, human trafficking, and smuggling operations. MSSIS and SeaVision have also been vital for natural disaster response efforts, analyses of the fuel economy of ships to promote supply chain resilience, and natural resource protection such as tracking the migration of endangered species.

As MSSIS sails into its third decade, the U.S. DOT Volpe Center remains dedicated to expanding partnerships and enhancing the system's capabilities. The Volpe Center's Situational Awareness and Logistics Division continues to innovate, ensuring that maritime security evolves with emerging and future technologies. The Volpe Center's global maritime domain awareness work exemplifies the power of international collaboration, technological innovation, and the relentless pursuit of maritime safety and security. What began as a local initiative quickly transformed into a globally respected maritime domain awareness network underscoring the ocean's crucial role as a bridge—not a barrier—between nations.

Looking Ahead

The U.S. DOT Volpe Center remains dedicated to expanding partnerships and enhancing MSSIS capabilities.

What This Means for Volpe and Beyond

- **Enhanced Data Sharing:** More partners means a richer, more comprehensive network of maritime data.
- **Improved Safety and Security:** Increased coverage enhances early warning capabilities and emergency response.
- **Innovation Opportunities:** Collaboration drives ongoing technological advances and solutions.
- **Enhanced Arctic Presence:** As the U.S. seeks to increase its maritime presence in the Arctic region, improved domain awareness will be essential. MSSIS is a prime tool that can be used to help strengthen information sharing and could be expanded to provide increased coverage in the region.

Sponsor: U.S. Navy

2 Transformation

The U.S. DOT Volpe Center collaborates with its partners, including the Office of the Secretary of Transportation, U.S. DOT operating administrations and offices, other federal agencies, and the broader transportation community, to help transform our transportation system into a safe, efficient, and world-class system. This is achieved by developing fresh approaches and new solutions to emerging and future transportation issues.

ADOBE STOCK

ARTIFICIAL INTELLIGENCE

Accelerating the U.S. DOT Volpe Center's AI Capability

The U.S. DOT Volpe Center is leading U.S. DOT's efforts to harness artificial intelligence (AI) to solve complex transportation challenges. The Volpe Center provides secure infrastructure and workforce expertise needed to drive safe, scalable, and cost-effective AI solutions across the Department.

Leveraging the Advanced Research and Testing Network for Scalable AI Solutions

The Advanced Research and Testing (ART) Network is a secure, cloud-based IT environment managed by the Office of the Assistant Secretary for Research and Technology (OST-R) to support rapid AI research, development, testing, and deployment within the U.S. DOT. The Volpe Center coordinates with OST-R, the Office of the Chief Digital Information Office (OCDIO), and the Chief Artificial Intelligence Officer to leverage the ART Network and help accelerate AI innovation while maintaining rigorous oversight.

Within the ART Network, the Volpe Center has built the technology infrastructure to run AI systems using cloud technologies. This AI-enabled infrastructure is designed to scale depending on the size and complexity of the challenge. Whether small data sets or massive volumes of data, the team has positioned the Volpe Center to scale AI capabilities to improve efficiency and streamline decision-making across the U.S. DOT. The Volpe Center's multidisciplinary team designs and maintains the AI infrastructure, develops and implements AI use cases, manages AI project administration, and ensures risk compliance.

Through the ART Network, the Volpe Center is accelerating secure adoption of AI across transportation sectors. This capability directly supports the Department's innovation strategic goal of accelerating AI adoption in government. It provides AI developers with timely and secure access to cutting-edge AI tools, scalable cloud infrastructure, and collaborative environments while ensuring compliance with federal cybersecurity, privacy, and risk mitigation standards.

Providing a Robust AI Training Foundation

As AI continues to evolve, a robust training foundation will be critical to ensure the workforce can scale AI-enabled services across all modes of transportation. The Volpe Center's AI training is a comprehensive, multi-track curriculum designed to equip Volpe staff at every level with the knowledge and skills to responsibly leverage AI in their work. The curriculum has included three distinct learning tracks to ensure relevance and depth: a session for project managers and division chiefs on identifying use cases and overseeing AI projects; a hands-on course for technicians and practitioners to develop, test, and deploy AI solutions; and a

foundational session for everyday users aiming to boost confidence in integrating AI tools into routine workflows. Participants not only gain practical experience with AI tools and cloud-based development environments but also learn best practices in model evaluation, prompt engineering, and responsible use of AI.

Since its launch in June 2025, more than 300 Volpe staff have participated in the training series and are able to apply lessons learned directly to real-world transportation challenges.

By fostering a workforce that understands both the promise and the pitfalls of AI, the Volpe Center's training initiative directly supports the Department's innovation goals. The training strengthens internal expertise, accelerates AI adoption, and ensures alignment with departmental standards for privacy, security, and ethical use. Participants are better positioned to collaborate on interdisciplinary teams, propose high-impact AI use cases, and manage projects that deliver smarter, safer, and more efficient transportation solutions.

Sponsor: U.S. DOT Volpe Center

U.S. DOT Volpe Center staff participate in the inaugural AI training that took place in June 2025, positioning Volpe to be on the leading edge within the Department with a workforce that is fully skilled and versed in AI. *Source: U.S. DOT Volpe Center.*

Harnessing Artificial Intelligence at the U.S. Department of Transportation

Through the Artificial Intelligence Chatbot Assistant for Transportation (AI-CHAT) initiative, sponsored by the Office of the Assistant Secretary for Research and Technology's Highly Automated Systems Safety Center of Excellence (HASS COE), the U.S. DOT Volpe Center developed chat.dot.gov, a web-based chatbot for U.S. DOT employees. The AI-CHAT initiative and the accompanying chat.dot.gov platform exemplify the collaborative effort between the U.S. DOT Volpe Center and HASS COE. The U.S. DOT Volpe Center assumed primary responsibility for the technical development, including design, integration, and deployment of a secure, cloud-hosted, web-based chatbot that enables U.S. DOT staff to leverage large language models for mission-critical tasks.

HASS COE contributed essential programmatic leadership, sponsorship, and operational partnership, extending the initial scope through expansion of the beta to all operating administrations, securing Authority to Operate approvals to facilitate additional funding, and sustaining comprehensive user support activities. Partnering the Volpe Center's technical leadership with HASS's programmatic oversight and support proved central to the tool's successful development and broader adoption within the Department.

The chat.dot.gov platform is currently in beta testing with more than 3,300 registered users as of fall 2025. The Volpe Center continues to work on the platform to improve its performance and scalability for larger numbers of users. In addition, the Volpe Center and HASS COE are actively collaborating on a second chatbot, ask.dot.gov, aimed at providing more targeted assistance for transportation research and management-related tasks.

By putting AI tools directly into the hands of U.S. DOT's federal staff, the U.S. DOT Volpe Center and HASS COE are not only boosting productivity but also fostering a culture of innovation across the Department. As these tools mature, U.S. DOT will be better equipped to harness cutting-edge technology, accelerate decision-making, and ultimately deliver safer, more efficient transportation for the American public.

Sponsor: U.S. DOT Office of the Assistant Secretary for Research and Technology Highly Automated Systems Safety Center of Excellence (HASS COE)

Executing Rapid Phase of the U.S. DOT Complementary Positioning, Navigation, and Timing Action Plan: One Step Closer to User Adoption

The Global Positioning System (GPS) is the most widely adopted source of positioning, navigation, and timing (PNT) services essential to critical infrastructure, supporting all modes of transportation including aviation, maritime, rail, and road. Beyond transportation, GPS serves as a foundational technology across many economic sectors, including land surveying, finance, machine control, precision agriculture, seismic monitoring, scientific research, and space operations.

By enabling accurate route planning, real-time tracking, and synchronized operations, GPS enhances safety, reduces delays, reduces fuel costs, improves effective time productivity, and enables more resilient logistics networks. Its widespread availability streamlines emergency response, supports collision-avoidance capabilities, and lays the groundwork for safe emerging automated and connected vehicle technologies. Because GPS user equipment relies on low-power signals from Medium Earth Orbit, it is inherently vulnerable to intentional and unintentional signal disruptions, highlighting the need for complementary PNT (CPNT) systems to bolster resilience.

To address this vulnerability, the U.S. DOT Volpe Center, on behalf of the U.S. DOT's Office of the Assistant Secretary for Research and Technology (OST-R) Office of PNT and Spectrum Management, developed a CPNT Action Plan designed to accelerate the adoption of CPNT solutions throughout the nation's transportation system and other critical infrastructure sectors.

The U.S. DOT Volpe Center has extensive knowledge and expertise within the PNT resilience landscape and is working closely with OST-R's Office of PNT and Spectrum Management. Together, they are executing the CPNT Action Plan including field testing of mature and commercially available technologies that could offer complementary service in the event of GPS services disruptions.

The U.S. DOT Volpe Center's continued support includes an acquisition strategy to fast-track CPNT technology testing and adoption. This strategy led to the release of a Request for Information and a subsequent Combined Synopsis Solicitation or Request for Quotation. In June 2024, more than $7 million was awarded to nine CPNT technology vendors for Rapid Phase testing at federal, critical infrastructure, and vendor field test ranges. The U.S. DOT Volpe Center coordinated vendor site visits and technology deployments, developed test plans and documented the range of PNT services for future inclusion in the federal PNT Services Clearinghouse.

Successful testing of vendor technologies was completed in June 2025. Test data collection and analysis was performed, and initial test results were presented during the third U.S. DOT Interagency Complementary PNT Workshop in Washington, D.C., held in August 2025. The report on Rapid Phase Award I testing supporting the Instrument Field Test Ranges objective of the CPNT Test Plan is expected to be delivered to DOT OST-R leadership in late fall 2025.

By encouraging adoption of CPNT solutions throughout the nation's transportation system and stakeholders, this work aligns with Executive Order 13905, *Strengthening National Resilience through Responsible Use of Positioning, Navigation, and Timing Services*, which seeks to ensure the disruption or manipulation of PNT services does not undermine the safety, reliability, or efficiency of critical infrastructure services.

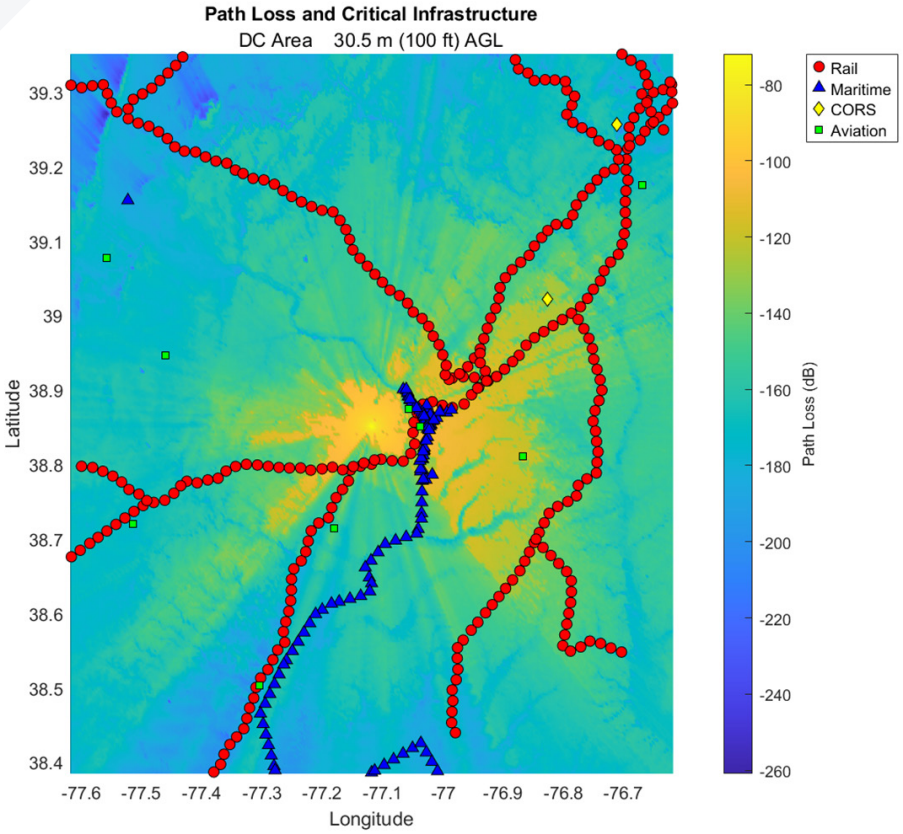
Sponsor: U.S. DOT Office of the Assistant Secretary for Research (OST-R) and Technology Office of PNT and Spectrum Management

Developing Counter Unmanned Aircraft Systems Collateral Radio Frequency Impact Analysis Tool for Critical Infrastructure

The threat posed by intentional or unintentional unauthorized use of unmanned aircraft systems (UAS), commonly known as drones, against domestic assets, critical infrastructure, and public safety has risen in the past two years. Multiple publicly reported UAS incidents impacting multimodal transportation operations at airports around the world have now been disclosed in public media outlets. Moreover, the advancement and ubiquity of UAS technology and services will likely increase the frequency of such events, necessitating greater development and deployment of risk mitigation countermeasures. One commonly used countermeasure is Counter-UAS (CUAS) technology that uses radio frequency (RF) signal emissions for the purpose of jamming or intercepting control command signals from GPS satellites. While these RF systems are effective against unauthorized UAS in sensitive or restricted areas, it can also disrupt Positioning, Navigation, and Timing (PNT) systems of critical infrastructure in the area of operations.

Critical transportation infrastructure systems span sectors such as freight, surface surveillance, aviation, rail, maritime, and pipelines. If a CUAS jams (denies) or spoofs (deceives) the Global Navigation Satellite System (GNSS) receiver of a UAS, the emitted signals can inadvertently affect multimodal passenger navigation and timing systems, used for radar and other surveillance infrastructure. In the aviation sector, this could inadvertently increase the workload for pilots and controllers and potentially increase safety risks for passengers within the NAS. One approach to limiting these potential collateral impacts is to identify—or predict—the multimodal systems that will be potentially affected in the CUAS deployment operating region and notify multimodal transportation operators to preemptively prepare.

Under the direction of the Office of the Assistant Secretary for Research and Technology, RF and PNT



This example of the developed tool shows the location of known critical infrastructure receivers in the Washington D.C. area overlayed on the predicted propagation path loss (color bar from yellow to blue) at a height of 100 ft above ground level (AGL) for a CUAS located at DCA at 15 ft AGL. Note that the propagation modeling tool relies on the area's terrain to predict the radio signal emission coverage. The bright yellow areas experience less propagation path loss and therefore receivers in these bright yellow areas will experience higher impact from CUAS operations. *Source: U.S. DOT Volpe Center.*

modeling research experts at the U.S. DOT Volpe Center developed and implemented an RF emissions impact-analysis tool that U.S. DOT personnel can use to effectively predict and assess the level of collateral harmful interference to receivers from a particular CUAS deployment in an area of known operations. The tool can also help identify infrastructure owners/operators that may experience disruption during a planned or simulated CUAS jamming event in their area of operations. In addition, the tool will aid in coordination with CUAS operating authorities on assessing potential impacts from CUAS operations. This effort directly supports a recent Presidential Executive Order, Restoring American Airspace Sovereignty, which directs building CUAS capacity in the homeland.

The Volpe Center research team investigated radio propagation models, performed sensitive analyses for a variety of terrains and urbanization levels, and tuned the model parameters to be conservative. Multiple field tests were conducted for empirical validation of the tool and to determine the power impact thresholds for some key infrastructure receivers. While the current development is focused on impacts of GPS and GNSS disruption to multimodal transportation assets, future versions may incorporate all RF impacts.

The Volpe Center team also developed an input database that is key to the tool's function comprising: (1) an up-to-date list of CUASs with key specifications such as transmit power levels, operational frequencies, and waveform structure, and (2) a list of infrastructure receivers and their associated antenna locations, impact power level thresholds, and geographic locations. In building this database, the Volpe Center team researched online and publicly available facility information and conducted outreach to multiple government agencies and critical infrastructure operators.

The tool's output includes textual data as well as color-coded contours of signal effects visual representations of collateral receiver assessment locations overlaid on top of the geographic estimated impact region. Armed with this capability, U.S. DOT personnel will be able to quickly determine potential impacted locations for a wider range of CUAS operations scenarios and reach out to receiver owners/operators allowing them to preemptively mitigate the potential impact from an anticipated CUAS deployment.

Sponsor: U.S. DOT Office of the Assistant Secretary for Research and Technology Office of PNT and Spectrum Management

U.S. DOT Volpe Center Liaisons Bridge the Gap between Civil and Military Global Positioning System

U.S. DOT Volpe Center analysts play a pivotal role as liaisons to the U.S. Space Force (USSF) and provide expertise to strengthen federal efforts to protect the integrity of the GPS during critical modernization efforts. This work ensures civil infrastructure and economic systems receive accurate, uninterrupted GPS data while supporting USSF-led upgrades through the new Next Generation Operational Control System (OCX). The OCX will command all modernized and legacy GPS satellites, manage all civil and military navigation signals, and provide improved cybersecurity and resilience for the next generation of GPS operations.

To help align civil GPS priorities with the U.S. military's evolving space operations, U.S. DOT Volpe Center liaisons work collaboratively with USSF personnel and FAA leadership to resolve GPS signal transition risks, support civil monitoring capability, and communicate potential disruptions. The Volpe Center coordinated U.S. DOT, FAA, and USSF efforts to mitigate potential civil signal impacts from OCX testing activities, including response efforts during a signal testing event that exposed vulnerabilities in select GPS receiver behavior. Working closely with FAA, the 2nd Navigation Warfighter Squadron (2 NWS), and USSF stakeholders, the U.S. DOT Volpe Center isolated the issue and informed mitigation strategies that preserved critical operations for civil aviation and infrastructure systems.

The U.S. DOT Volpe Center's coordination and rapid mitigation efforts safeguarded civil signals during OCX transition testing for over 330 million civilian GPS users; ensured uninterrupted service for GPS-based aviation systems supporting more than 900 million annual passengers and enabled continuity for $1.4 trillion in U.S. economic activity that is reliant on GPS. The Volpe Center team also resolved technical and policy coordination issues at national-level GPS forums and summits and collaborated with the OCX Operational Acceptance Working Group and provided guidance to OCX Public Affairs. Ongoing project activities focus on the OCX transition, PNT modernization, and civil-military signal monitoring collaboration across federal agencies.

This vital work aligns with White House priorities to strengthen national resilience through the responsible use of PNT services and Space Policy Directive-7, which establishes implementation actions and guidance for U.S. space-based PNT programs. This effort is helping to maintain U.S. global leadership in PNT technologies, fostering interagency cooperation, and directly protecting the transportation systems that drive economic strength and national security.

Sponsors: U.S. Space Force, U.S. DOT Office of the Assistant Secretary for Research and Technology Office of PNT and Spectrum Management, 2nd Navigation Warfighter Squadron Schriever Space Force Base, FAA

The Freight and Fuel Transportation Optimization Tool Supports Supply Chain Flow and Resilience Analyses

Freight and fuel supply chains provide the nation with access to essential goods and services. The U.S. DOT Volpe Center led a transformative effort to develop and extend the Freight and Fuel Transportation Optimization Tool (FTOT), delivering a flexible, open-source framework that enhances supply chain analysis for energy and freight scenarios. The Volpe Center partnered with FAA, Department of Energy, the Pipeline and Hazardous Materials Safety Administration (PHMSA), and other key contributors to build FTOT from inception into a commodity and supply chain decision support tool that optimizes transportation routing, analyzes disruption risks, and enables resilience testing for critical freight activities.

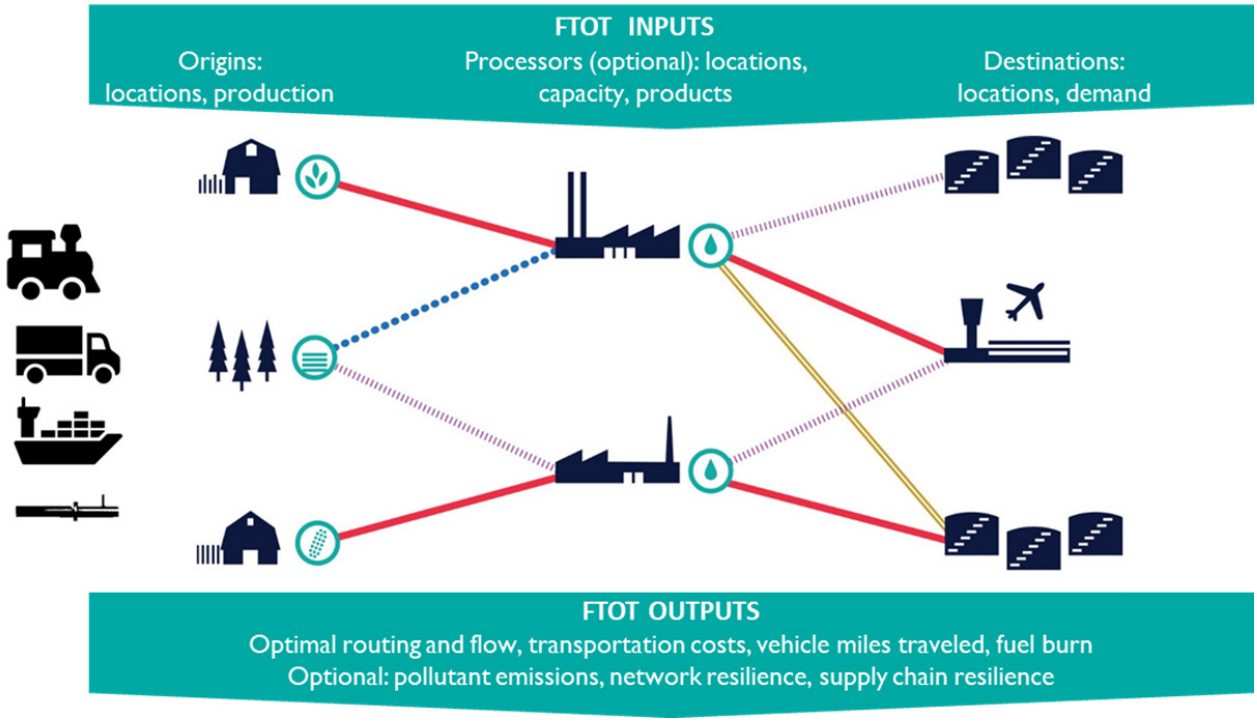
FTOT began with early scenario analyses for aviation fuel supply chains and defense fuel delivery and evolved into a robust platform suitable for a wide range of sectors and datasets. Under continuous FAA support, FTOT now supports scenario exploration that captures variations in supply and demand, assesses facility siting options, and evaluates the impacts of transportation infrastructure changes. FTOT has matured into an open-source resource used by government agencies, academia, and private sector partners, with quarterly releases that expand functionality and precision. U.S. DOT Volpe Center oversight and a dedicated user-group ensure rapid feedback from the user base and ongoing alignment with real-world needs.

Since fall 2019, the U.S. DOT Volpe Center team has delivered 32 releases of FTOT. The public version of FTOT is released quarterly, with the most recent release occurring in September 2025. The public FTOT release fosters transparency and broad adoption, while internal risk-based versions extend capabilities for hazardous materials with the goal of enhancing safety across critical supply chains. FTOT's architecture supports geospatial inputs, optimization routines, and multiple objective perspectives, empowering sponsors to compare alternative strategies, quantify trade-offs, and plan for disruptions.

The interdisciplinary Volpe Center FTOT team—drawing on GIS, data science, operations research, computer science, and resilience expertise—continues to refine models, expand data integrations, and tailor analyses to sponsor priorities. Through FTOT, the U.S. DOT Volpe Center demonstrates its capacity to translate sophisticated analytics into practical, implementable guidance that strengthens national freight security, efficiency, and resilience.

In addition, the need for cost-effective, resilient, domestic energy, mineral, and freight supply chains is highlighted in recent Presidential Executive Orders such as Unleashing American Energy, Immediate Measures to Increase American Mineral Production, and Achieving Efficiency Through State and Local Preparedness.

Sponsors: Development of public version of FTOT and scenario analyses – FAA (current), DOE Office of Policy (former), Development of risk-based optimization version of FTOT for reducing hazardous material transportation risks (not public) – PHMSA (former), Scenario analyses and exploratory use cases – DOE Bioenergy Technologies Office, USDA (former), Oregon State University, FHWA (former)



Overview of the FTOT inputs, functions, and outputs. *Source: U.S. DOT Volpe Center.*

AUTOMATED VEHICLES

Managing Cybersecurity for Automated Vehicles—and Risks for Commercial Motor Vehicle Teleoperation

As more automated vehicles (AVs) come to market in the U.S., teleoperation, which may include features such as remote driving and/or remote assistance, can aid AVs with navigating scenarios that are beyond their current capabilities. Teleoperation systems can become increasingly more useful as AVs accrue more miles driven. This is evident through business initiatives, such as driverless robotaxis deployed in urban areas, and with autonomous commercial motor vehicles (CMVs) used to transport cargo on highways. The longer AVs are on the road, the potential for them to encounter complex and obscure driving scenarios increases. If an AV encounters one of these scenarios and is unable to safely and properly navigate a situation, a remote human driver can intervene and assist the AV.

Although AVs are learning and evolving rapidly, they cannot yet manage every scenario they may encounter on the roadway such as complex construction zones, obscure roadway and traffic conditions, intricate shipping yards or warehouses, and other potential hazards or events that require safety critical decision-making, planning, and maneuvering. Depending on the type of teleoperation system used, a human operator may be able to provide remote driving or assistance under certain scenarios. In remote driving, the remote human operator is responsible for the dynamic driving task. Remote assistance differs because the automated driving system (ADS) maintains control of the vehicle and is responsible for object and event detection and response (OEDR) while a remote human operator provides decision making and/or path planning to assist the ADS.

The U.S. DOT Volpe Center, in partnership with the Intelligent Transportation Systems Joint Programs Office (ITS JPO), and technical support from FMCSA, performed a cybersecurity analysis of a notional teleoperation system. The notional teleoperation system was developed through research and discussions be-

tween government subject matter experts and industry developers within the cybersecurity and automative field. The collaborative effort involved applying the industry standard ISO/SAE 21434:2021–Road Vehicles–Cybersecurity Engineering on a CMV waypoint guidance teleoperation system to produce an assessment comprised of a system definition, threat analysis and risk assessment, and a cybersecurity concept. A waypoint guidance teleoperation system lets the ADS-equipped CMV control the vehicle and is responsible for OEDR while a remote human operator provides waypoints to the ADS-equipped CMV to follow when it encounters a scenario it cannot navigate on its own.

The Volpe Center team applied cybersecurity expertise, knowledge in advanced vehicle systems, and advanced understanding of both automated driving systems and CMVs to identify potential cybersecurity considerations for teleoperation systems. The team defined the teleoperation system's functions, preliminary architecture, and boundaries, then analyzed potential realistic attack scenarios to identify potential vulnerabilities that could harm roadway users. The Volpe Center team also identified principal attack paths spanning physical and remote access vectors to both the teleoperation control center and autonomous CMVs.

The analysis revealed at least six different types of teleoperation control types, variations on control type, driving mode (drive or assist), and potential use cases. Within the notional waypoint guidance teleoperation system, the Volpe team identified over 90 different scenarios that pose a cybersecurity threat. Drawing from these results, the Volpe Center team developed a cybersecurity concept that describes high-level mitigations, yielding 24 potential mitigation measures focused on secure communications, authenticated access controls, hardening of remote-operator workstations, and resilience strategies for command-and-control channels. Through more collaboration between government experts and industry developers, these 24 potential mitigation measures could be refined and implemented to help safeguard a teleoperation system from cyber threats and maintain vehicle and road user safety. Volpe provided recommendations to ITS JPO that prioritized mitigations aimed at reducing potential attacks and impacts that aligned with operational constraints for commercial trucking.

A final draft report was delivered to ITS JPO in January 2025 that documents the system architecture, threat analysis, risk profiles, and recommended cybersecurity strategies. The report informs potential users of teleoperation systems in CMVs by providing actionable guidance for designing, evaluating, and operating teleoperation systems more securely.

Teleoperations can play a critical role in advancing automated CMV operations, but they introduce unique cybersecurity challenges across control centers, communications networks, and vehicle endpoints. By applying vehicle-industry standards and leveraging expertise in advanced vehicle systems and communications, the U.S. DOT Volpe Center helps stakeholders anticipate attack vectors, prioritize risk reduction, and integrate cyber-resilient practices into teleoperation design and deployment—supporting safer, more secure adoption of emerging technologies.

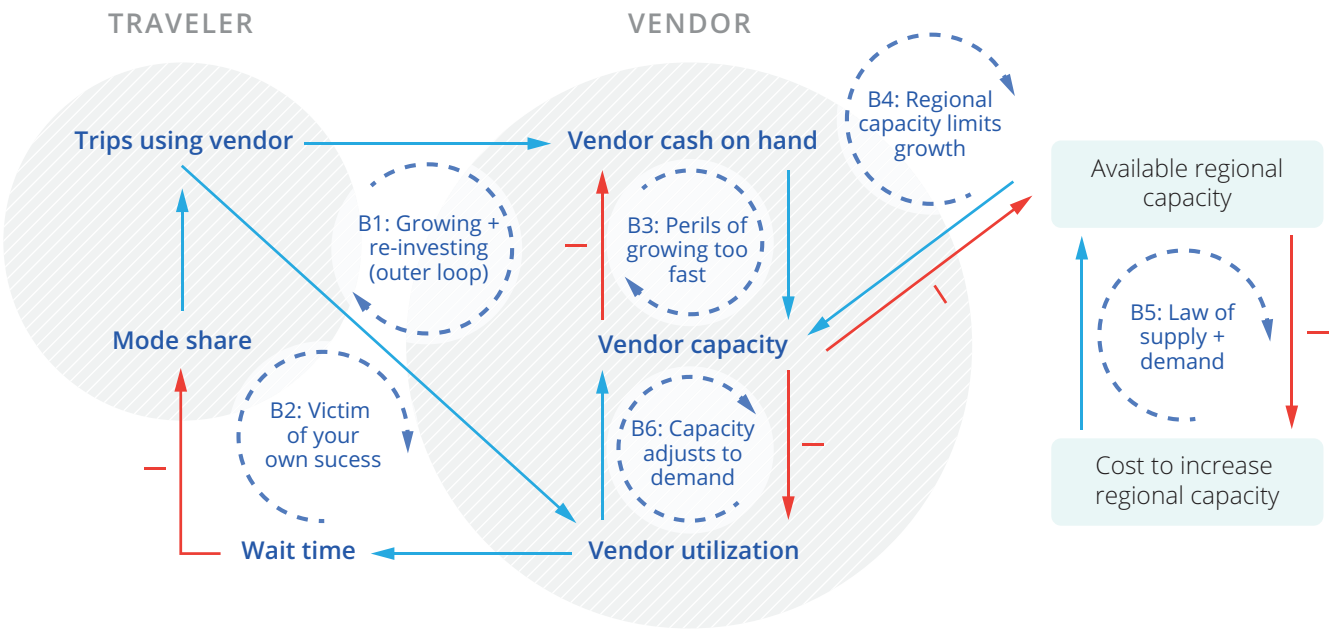
Sponsor: ITS JPO, FMCSA

Dynamics of Supply and Demand for Competing Shared Mobility Services

U.S. DOT's new Automated Vehicle Framework seeks to expand innovation and promote the deployment of automated driving, with the goal of improving safety and mobility for all. As automated driving grows within ridesharing, it will be increasingly important to simulate travel modes, like transportation network companies (TNCs), where supply adjusts to demand in near-real time. Today, many travel demand models treat TNC supply as exogenous.

To assist U.S. DOT, the Volpe Center developed and extended system dynamics models to simulate how shared mobility services, including those using ADS, evolve when multiple providers compete for a limited pool of resources. Working with Argonne National Laboratory and building on earlier U.S. DOT ITS JPO work, a Volpe Center team updated a model they previously developed, to incorporate service-provider responses, traveler behavior, and near-real-time supply adjustments that many traditional travel-demand models do not capture. The updated model addresses this gap by allowing the supply of transportation services to respond quickly to market cues.

The Volpe Center team collaborated with Argonne to integrate U.S. DOT's model with Argonne's large-scale agent-based travel model, POLARIS. The collabora-



High-level simplified schematic of system dynamics model. *Source: U.S. DOT Volpe Center.*

tion shaped model structure and data exchanges and guided extensions that allow several service providers to draw from a shared resource base while reacting to market cues. To calibrate and validate behavioral relationships, Volpe Center analysts examined publicly available TNC operations data from New York City, refining parameters that govern fleet deployment, pricing response, and demand dynamics.

Phase 1 of the project delivered an updated multi-provider system dynamics model in April 2025 and demonstrated practical interoperability with POLARIS, following earlier integration efforts by the University of Texas–Austin on a previous version. Results and methods were presented to peers at the International System Dynamics Society Conference and the Modeling Mobility Conference in 2025, generating feedback that will inform next-stage refinements. Depending on funding availability, Phase 2 could expand scenario sets, incorporate automated driving rollout pathways, and deepen calibration with additional metropolitan datasets.

U.S. DOT Volpe Center's modeling fills an important planning gap: conventional travel-demand tools typically treat supply as static or slow-moving, while supply in shared mobility modes can shift rapidly in response to demand. By representing feedback between provider and traveler reactions over time, U.S. DOT Volpe Center's system dynamics approach reveals how market structures, pricing strategies, and resource constraints interact to influence congestion, service availability, and effects on different user groups. With connections to advanced travel demand models like POLARIS, the model enables planners and policymakers to test strategies and explore policy levers that encourage the efficient deployment of shared and automated mobility.

Through rigorous model-building, empirical calibration, and partnership-driven integration, U.S. DOT Volpe Center equips stakeholders with a dynamic toolset to anticipate and manage the complex trajectories of shared mobility markets.

Sponsor: U.S. Department of Energy Argonne National Laboratory

Advancing Electrified Flight Research for Subsonic Air Travel

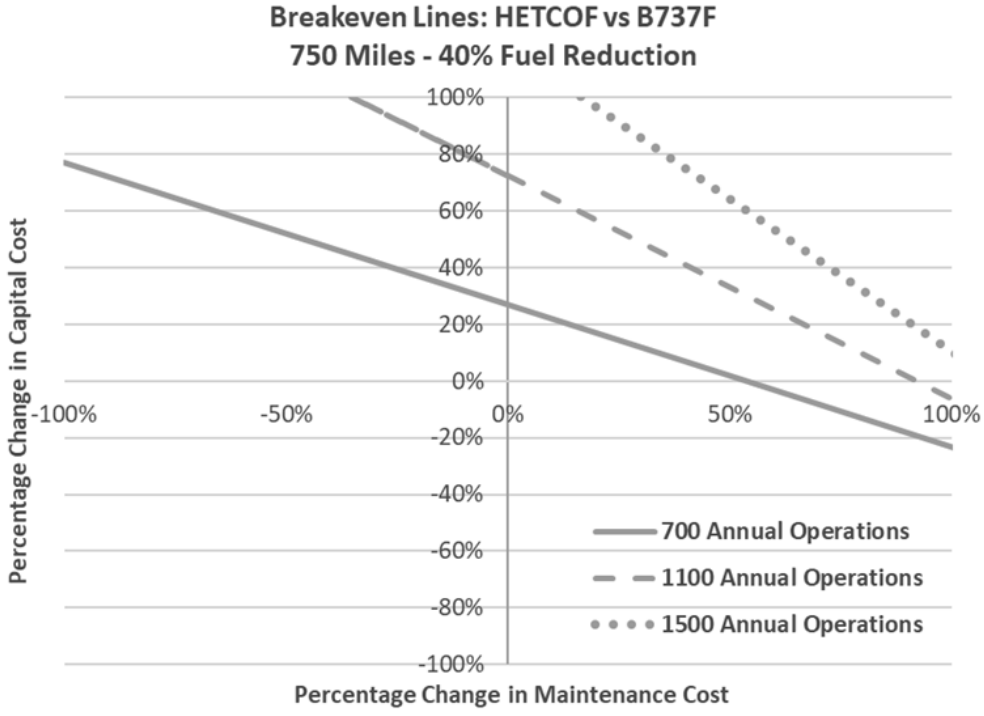
Lower operating costs, more efficient fuel burn, and quieter communities coupled with improvements in technology are driving NASA's vision for electrified propulsion that will power subsonic commercial aircraft. Integrated electrified aircraft propulsion (EAP) concepts have seen rapid advancements in propulsion systems and battery technology in recent years. NASA's Aeronautics Research Mission Directorate (ARMD) and NASA's Glenn Research Center support analyses of technologies that have the potential to enhance the fuel efficiency and economic performance of subsonic transport with opportunities to transition to alternative propulsion and energy.

To help evaluate the cost-effectiveness of the potential transition, NASA asked U.S. DOT Volpe Center economists to measure and quantify the potential market and competitiveness of the Hybrid Electric Turboprop Commercial Freighter (HETCOF) concept.

The U.S. DOT Volpe Center conducted detailed research using publicly available data from the Bureau of Transportation Statistics to determine the potential market size for the concept aircraft and develop an in-house lifecycle cost model for freighter aircraft. The analyses incorporated core operational and ownership cost components as a function of aircraft age and various utilization rates. The lifecycle cost model allowed the team to determine how improvements could balance out potential increases in either capital or maintenance costs relative to conventional aircraft.

The team found the concept aircraft could have broad market coverage, accounting for up to 73 percent of the existing mid-sized air cargo market with full electric operations up to 750 miles. The cost-effectiveness analysis of operating and capital costs showed potential for market competitiveness but required additional energy and acquisition cost savings from the concept aircraft.

Additional findings from the U.S. DOT Volpe Center team's analysis demonstrated that higher rates of aircraft utilization were key to lowering overall costs and increasing competitiveness. Specifically, raising



This graph details the potential range of cost changes for the HETCOF concept to be cost effective, assuming a 40 percent fuel reduction and an operational range of 750 miles, while maintaining 700 operations per year. The HETCOF concept could increase capital costs by 25 percent or maintenance costs by 53 percent, and still breakeven in terms of total operating costs.

Breakeven rates by alternative annual operations levels. *Source: U.S. DOT Volpe Center (AIAA published results).*

Illustrations of the HETCOF aircraft during takeoff and taxing. *Source: NASA Glenn.*

the annual operations of the concept aircraft from 700 to 1,100 improved the overall benefit from lower fuel burn rates, allowing for the potential capital cost of the aircraft to increase from roughly 25 percent to 75 percent and still breakeven.

The completed market study was presented in two separate papers at the annual American Institute of Aeronautics and Astronautics SciTech Forum in 2025 and continues to evolve with additional research for NASA, including a recent paper at the Electric Aircraft Technologies Symposium in 2025.

Sponsor: NASA Aeronautics Research Mission Directorate and NASA Glenn Research Center

COMMERCIAL SPACE

Measuring and Modeling Commercial Space Transportation Noise

As the tempo of commercial space vehicle launches and reentries continues its sharp rise, it is important that noise impacts are well understood and up to date to enable safe and efficient growth of the commercial space transportation industry. The Department of the Air Force (DAF) Air Force Civil Engineer Center's Comprehensive Planning Division (AFCEC/CIP) is the tactical center of excellence in regard to operational noise modeling for the U.S. Air Force, and has agreements with the U.S. DOT Volpe Center to support their needs for improved modeling of rocket noise and first-in-class access to noise and software development experts.

The U.S. DOT Volpe Center's multidisciplinary team provides noise measurement and modeling expertise to ensure that products are effective and legally defensible through integrated measurement and modeling activities. In cooperation with AFCEC, the U.S. Air Force Research Lab, and U.S. Space Force, Volpe Center subject matter experts in aerospace noise measurements support measurements of rocket noise. The U.S. DOT

Outdoor test of Launch Acoustics Recording Systems on the terrace of the U.S. DOT Volpe Center's Kendall Square building. *Source: U.S. DOT Volpe Center.*

A SpaceX Falcon Heavy rocket carrying the National Oceanic and Atmospheric Administration (NOAA) GOES-U (Geostationary Operational Environmental Satellite U) mission lifts off from Launch Complex 39A at NASA's Kennedy Space Center in Florida. *Source: NASA/Cory Huston.*

Volpe Center recently developed and deployed multiple Launch Acoustic Recording Systems (LARS) to measure noise from a range of vehicles launching from Cape Canaveral Space Force Station, Kennedy Space Center, and SpaceX Starbase. These data contribute to a growing database of rocket noise measurement data used to evaluate and improve rocket noise models. The Volpe Center rocket noise team applies noise modeling expertise to independently evaluate noise studies conducted by launch operators and delivered to the Department of War.

Sponsor: Department of the Air Force (DAF) Air Force Civil Engineer Center Comprehensive Planning Division.

ADVANCED AIR MOBILITY

Advancing Noise Certification for a Competitive Advanced Air Mobility Future

As the U.S. races to safely and efficiently deploy advanced air mobility (AAM) nationwide, the need for technically feasible, economically viable, and environmentally beneficial noise standards is essential. In September 2025, Transportation Secretary Sean Duffy announced a new pilot program that will accelerate AAM vehicle deployment aimed at connecting rural American communities, reducing road congestion, and enhancing medical services and transport. The pilot program seeks to form public-private partnerships with state and local government agencies and private

sector companies to develop new frameworks and regulations that will enable safe AAM operations.[5]

Existing aircraft noise rules have evolved around conventional aircraft and are not easily adaptable to the distinctive noise profiles generated by distributed electric propulsion and other technologies that define AAM today. Communities under congested flight paths continue to express resistance to expanding aerial operations without assurances of low noise levels and noise monitoring regulations. By streamlining noise certification, U.S. DOT can enable a faster, safer rollout of AAM operations for new entrants such as drones and electric vertical takeoff and landing (eVTOL) aircraft and accelerate a safer, quieter, and more efficient airspace.

FAA's Office of Environment and Energy is leading efforts to modernize and harmonize noise certification, in alignment with White House goals and U.S. DOT priorities to accelerate infrastructure delivery, enable public-private collaboration, and ensure rapid yet responsible adoption of transformative aviation technologies.

The U.S. DOT Volpe Center's multidisciplinary team worked with FAA and other stakeholders to develop a practical, globally harmonized noise-certification framework. The team combined policy analysis, engineering insight, data-driven research, and international certification standards procedures to help develop a pathway FAA can implement across a broad range of AAM platforms. To date, key activities have included drafting Rules of Particular Applicability (RPA) tailored to commercial drones and eVTOLs, developing noise measurement methodologies, and conducting targeted acoustic measurement campaigns to develop and validate both models and metrics.

By anchoring the methodology in empirical noise data, the U.S. DOT Volpe Center team is enabling the development of a technically robust, scalable, and globally uniform noise certification procedures. The work was accomplished through three integrated activities:

1) The FAA-U.S. DOT Volpe Center team crafted RPAs as interim noise standards for noise certification that reflects the unique noise characteristics of small, electric-powered aircraft, moving beyond one-size-fits-all rules.
2) The team modified existing noise measurement standards to accommodate modern propulsion technologies and the evolving AAM landscape, providing manufacturers seeking type certification with clear, repeatable tests and providing regulators with standardized and meaningful datasets.
3) Dedicated acoustic measurement campaigns on multiple eVTOL prototypes generated high-quality data to validate models and refine noise certification metrics.

Together, these steps created a streamlined, scalable pathway for certifying noise that supports rapid innovation while safeguarding public health and the environment.

The initiative has already moved policy forward, with seven manufacturer-specific RPAs published in the Federal Register to date. The U.S. DOT Volpe Center team delivered draft guidance for AAM and commercial drones, and measurement campaigns continue to inform ongoing refinements to FAA noise standards.

Looking ahead, the team will refine RPA guidance and measurement methods, broaden testing to cover more aircraft configurations, and continue aligning U.S. standards with the International Civil Aviation Organization and other international frameworks. The final goal will be a finalized, scalable noise-certification standard that minimizes regulatory burden, incentivizes innovation, and sustains a robust U.S. AAM ecosystem. The U.S. DOT Volpe Center team stands ready to continue to support implementation, harmonization, and ongoing performance assessment as the AAM landscape expands.

This work demonstrates how rigorous technical analysis, collaboration, and forward-looking policy design can unlock transformative aviation innovations to propel a new era in mobility.

Sponsor: FAA Office of Environment and Energy

[5] FAA (September 2025). Trump's Transportation Secretary Sean P. Duffy Unveils New Plan to Fast-Track Advanced Air Mobility Vehicles. https://www.faa.gov/newsroom/trumps-transportation-secretary-sean-p-duffy-unveils-new-plan-fast-track-advanced-air.

Taking Urban Air Mobility Noise Modeling and Analysis to New Heights

A NASA study estimates that by 2030, a significant number of new air vehicles will be operating to support Urban Air Mobility (UAM). UAM vehicles will vary in size, speed, and configuration depending on their purpose and may be used for public transportation, cargo delivery, air taxi services, and more.

Many of these new air vehicles are designed to be quieter than traditional aircraft and helicopters and should be modeled as their own unique form of air transportation with UAM-specific data. FAA requires the use of the Aviation Environmental Design Tool (AEDT) for all noise, fuel burn, and emissions modeling for FAA actions under the National Environmental Policy Act (NEPA), as well as for other FAA-approved studies, such as those under 14 CFR Part 150 and Part 161.

In June 2025, President Trump issued Executive Order 14307, Unleashing American Drone Dominance, which aims to accelerate the commercialization of unmanned aircraft systems in the NAS.

Before these new air traffic vehicles can be deployed, however, accurate tools and metrics are needed to assess community noise impacts and avoid complaints that could limit the growth of UAM operations.

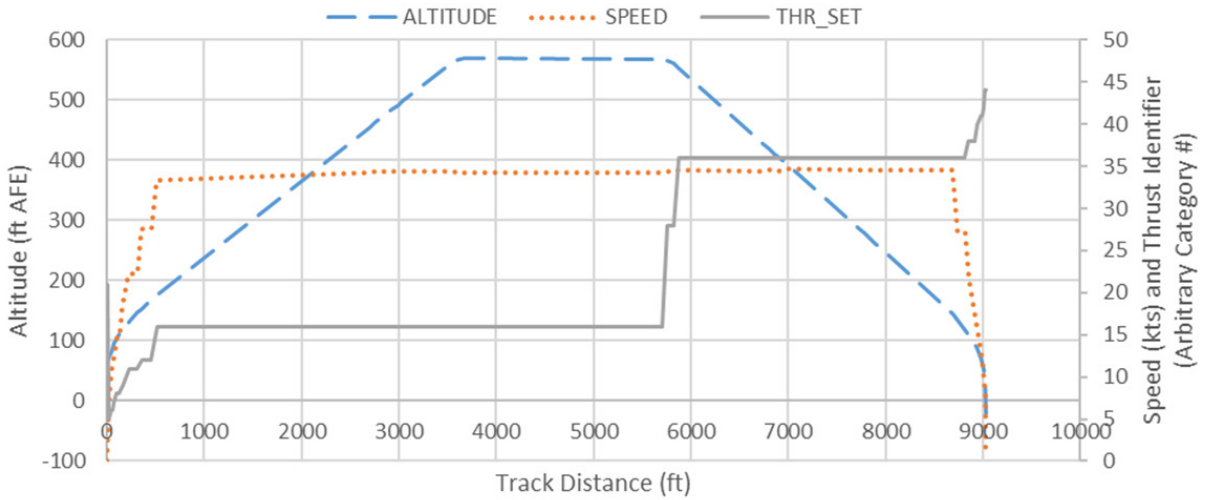
The U.S. DOT Volpe Center possesses extensive expertise in aircraft noise modeling, performance modeling, data and software development, and in the overall use of FAA's AEDT aircraft modeling system.

Recently, NASA's Langley Research Center developed noise source data and flight profiles for multiple UAM vehicles and has modeled noise exposure in their own models for various scenarios. NASA and the U.S. DOT Volpe Center evaluated AEDT's ability to model noise from UAM operations, identified potential shortcomings, and made recommendations to improve near-term UAM modeling.

U.S. DOT Volpe Center experts developed custom queries to import modeling data, helped troubleshoot technical issues, and analyzed unexpected modeling results. The team also provided feedback on NASA presentations and documents comparing alternative methods for modeling UAM in AEDT, including airplane, helicopter, and hybrid options.

Ultimately, the results of NASA's and the U.S. DOT Volpe Center's analyses informed feature improvements that are slated to be included in the next release of FAA's AEDT. These updates bolster U.S. DOT's mission to support the efficient and safe introduction of new air technologies into the NAS. The Volpe Center team was recognized for their noise and aircraft performance modeling contributions as members of a team receiving a NASA Group Achievement Award for UAM operational fleet noise assessment. The prestigious NASA Group Achievement Award recognizes an outstanding group accomplishment that has contributed substantially to NASA's mission.

Sponsor: NASA Langley Research Center



Example NASA UAM Flight Profile Showing Altitude, Speed, and Thrust as a Function of Track Distance. *Source: U.S. DOT Volpe Center report* DOT-VNTSC-NASA-22-02.

Innovative Motive Power and Rolling Stock Solutions to Improve National Security, Safety, and Efficiency

The U.S. Department of War (DoW) and U.S. DOT Volpe Center are long-standing partners on a major overall railroad modernization effort for DoW locomotives and railcars. Central to the effort is the replacement of aging locomotives and railcars with modern, right-sized equipment that works across diverse installations and constrained layouts where available space presents challenges. Together, the federal agencies deliver innovative motive power and rolling stock solutions designed to boost national security, improve infrastructure, and streamline safety and efficiency.

Key military partners guiding this work include the U.S. Army Tank-automotive and Armaments Command; the U.S. Navy Facilities Engineering and Expeditionary Warfare Center; and the U.S. Air Force Life Cycle Management Center, Support Equipment and Vehicles. These agencies, in collaboration with the U.S. DOT Volpe Center, shape a comprehensive modernization program that leverages the War Department's requirements with U.S. DOT safety standards and industry best practices.

New locomotive delivered to a DoW installation. *Source: U.S. Army.*

A recent U.S. Air Force locomotive fully assembled and moved to the tracks for testing. After successful testing by the vendor in Minnesota, the locomotive was delivered to USAF Joint Base Charleston. *Source: U.S. Air Force.*

The U.S. DOT Volpe Center has supported DoW's high-priority rail modernization efforts for more than 30 years. A U.S. DOT Volpe Center team provides expertise in planning, engineering, policy analysis, and data-driven decision support. The team's capabilities include alternatives analysis, industry standards research, regulatory application, and the generation of preliminary technical guidance and cost estimates. By translating requirements into feasible designs, the U.S. DOT Volpe Center supports market research, independent cost estimates, and program decision-making, ensuring modernization efforts remain technically sound and economically viable.

Recent significant milestones include a new modern design of four domestically-manufactured road-switcher locomotives and the fielding and commissioning of three of these locomotives to date. One model was delivered to the Navy in April 2025; two models were delivered to the Army in November 2025; and the Air Force locomotive is scheduled for delivery in January 2026. As of this writing, the U.S. DOT Volpe Center has replaced 35 outdated locomotives and is working with DoW to assess the condition of the remaining locomotive fleet to determine the best approach for continuing the modernization effort. The U.S. DOT Volpe Center continues to provide technical support to the U.S. Army for procuring more than 500 heavy-duty flatcars utilizing a new design, which will go into production and replace the current fleet that is reaching end-of-life.

The Department of War's fleet reduction and modernization effort has substantially lowered maintenance costs while improving operator safety and reliability. The U.S. DOT Volpe Center has successfully replaced more than one-third of the fleet with locomotive of higher efficiency, greater reliability, and improved safety. The U.S. DOT Volpe Center will continue to drive innovation, sustainment, and strategic planning across DoW's rail network, a critical component of national security.

Sponsors: U.S. Army Tank-automotive and Armaments Command; U.S. Navy Facilities Engineering and Expeditionary Warfare Center; U.S. Air Force Life Cycle Management Center, Support Equipment and Vehicles

ACCELERATING ORGANIZATIONAL INNOVATION

Innovation Initiative Reaps Government Efficiencies

The U.S. DOT Volpe Center's *Everyday Innovation Initiative* empowers staff across our technical centers to experiment with small, practical changes that make daily work more efficient and effective. This year, the initiative involved 11 divisions working on 19 projects, each aimed at streamlining workflows, improving collaboration, and enhancing the quality of deliverables.

From refining analytical tools to rethinking project management practices, these ideas build on past internal improvement efforts and are designed to scale, ensuring the benefits extend across the organization. Everyday Innovation projects help Volpe deliver timely, high-quality solutions to our sponsors while making the most of our technical expertise and resources.

Many of this year's projects focused on enhancing the way Volpe harnesses data, technology, and expertise to serve our sponsors. Efforts to establish clear guidelines for responsible AI use, coupled with targeted coaching for staff, are enabling teams to integrate emerging tools into project workflows with confidence, accelerating analysis while maintaining the accuracy and quality expected in sponsor deliverables. Complementary work to centralize templates and design standards for data visualization is improving the consistency of dashboards and visual products, reducing development time and improving overall project delivery to our sponsors.

With an emphasis on efficiency and collaboration, new AI-powered search capabilities are making it easier to assemble high-performing teams with the optimal blend of expertise and skills to address sponsor priorities. Together, these innovations demonstrate how small, targeted improvements can have a compounding effect on project quality, timeliness, and responsiveness.

By embedding continual improvement into our daily work, Volpe's Everyday Innovation Initiative strengthens the foundation on which large, complex projects are built. Sponsors benefit from sharper tools, streamlined processes, and teams equipped to adapt quickly to changing needs. This helps ensure the solutions Volpe delivers are not only technically excellent but also produced with the efficiency and agility that today's transportation challenges demand.

Sponsor: U.S. DOT Volpe Center

3

Infrastructure

The U.S. DOT Volpe Center collaborates with federal agencies to support civilian and defense infrastructure modernization, maintenance, and resiliency efforts that further U.S. economic growth and enable more efficient movement of people and goods.

ADOBE STOCK/Ondra Vacek

AVIATION MODERNIZATION

Steering toward Safer, More Efficient Air Traffic Control Facilities

Upgrading the nation's terminal facilities not only improves airspace reliability, safety, and efficiency, it also supports travel, business, and global competitiveness.

The FAA Terminal Facilities Program Office is responsible for synchronizing investment decisions across more than 300 staffed U.S. air traffic control (ATC) facilities spanning the continental U.S. as well as Hawaii, Alaska, Puerto Rico, and the U.S. Virgin Islands. Many ATC facilities are more than 50 years old, and FAA faces decisions about when to modernize, realign, or replace them as part of its management of the broader NAS infrastructure.

Long-range capital decisions in the NAS require clear lifecycle cost estimates and transparent funding plans. This is part of a broader federal push to reform ATC infrastructure and modernize critical transportation assets.

The FAA Terminal Facilities Program Office's long-standing partnership with the U.S. DOT Volpe Center helps frame FAA's investment decisions and improves acquisition management processes. The Volpe Center team builds and maintains 40-year lifecycle cost models, including operations, personnel, utilities, and maintenance. This work includes planning and portfolio management support, integrating plans with FAA organizational strategies, providing critical systems engineering, and creating governance and decision-support documents to ensure terminal facility platforms are technically sound, well-integrated with ongoing execution efforts—and importantly, improving investment choices and funding alignment.

The work is shaping a more transparent approach to facility investments, with a focus on identifying best practices and strengthening business-case development for terminal upgrade. FAA's goals is to develop clearer spending plans and investments that align with funding timelines.

By combining cost analysis with strategic planning and systems engineering, this program seeks to deliver better, more timely upgrades to critical aviation infrastructure for travelers today and tomorrow.

Sponsor: FAA Terminal Facilities Execution

Accelerating Adoption of Modern Aviation Telecommunications Capabilities

FAA faces rapid growth and new demands across the aviation sector with air travel increasing and new entrants to the NAS including drones, AAM, and commercial space operations. To maintain efficient and reliable communications, FAA is investing in modern, high-speed Internet Protocol (IP) based networks with diverse paths including Long-Term Evolution (high-speed wireless) and Low Earth Orbit satellite communications. These networks will enable transition to Voice over Internet Protocol (VoIP) and other modern protocols for faster data transfer and supportable infrastructure. These innovations directly align with U.S. DOT's Brand New Air Traffic Control System initiative.

The U.S. DOT Volpe Center is a key contributor in the cybersecurity effort to support FAA's Brand New Air Traffic Control System (BNATCS) program. BNATCS is a strategic investment initiative to modernize the NAS by replacing aging telecommunications and infrastructure with modern IP-based systems. Volpe Center

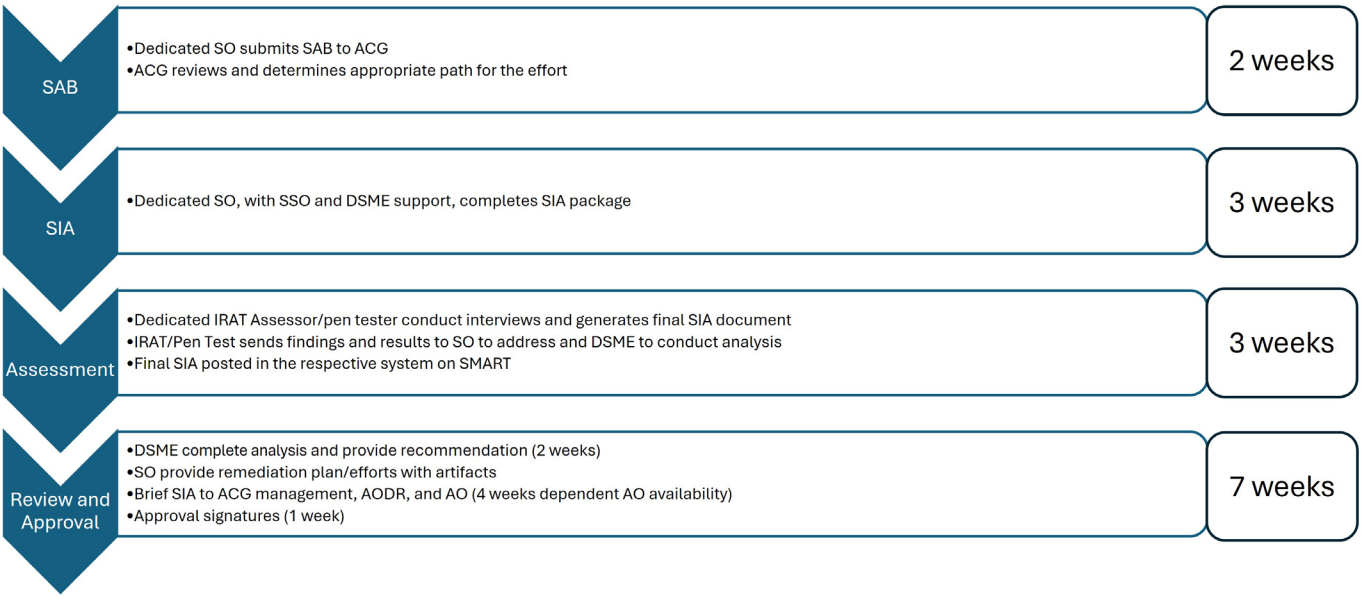
cybersecurity experts delivered a structured, end-to-end assessment of the evolving NAS environment. The team focused on safeguarding new capabilities while enabling a timely, safe transition to IP-based networks, with an understanding that some systems will provide interim time division multiplexing (TDM) services until full migration is completed.

Volpe's cybersecurity team created a three-phase BNATCS Security Impact Analysis (SIA) to speed up the usual 12-month Authority to Operate (ATO) process. BNATCS SIA shortens the cycle to about 15 weeks and includes a documentation phase, an assessment phase, and a review/approval phase. During this process, the team worked closely with the system owners to complete the SIA package. The team held weekly status meetings to track progress, celebrate wins, tackle challenges, and plan the next steps, keeping the work aligned with FAA's needs.

BNATCS ensures responsible, auditable deployment of communication systems across the Continental United States, Alaska, Hawaii, and Guam. To date, the Volpe Center has delivered a complete set of BNATCS systems including IP radio upgrades, an air-to-ground protocol converter, voice switch upgrades, and Surveillance and Broadcast Services System TDM–IP circuit upgrades—having achieved ATO approval. FAA identified roughly 80 additional systems requiring BNATCS SIA processing, with resource planning underway to advance this work. The program's impact is already showing promise with faster deployment of secure, modernized communications pathways across the NAS while maintaining strict safety and resilience standards.

The U.S. DOT Volpe Center's role spans planning, policy implementation, cybersecurity engineering, and program management. The team integrates cross agency perspectives, crafts streamlined procedures and delivers concrete risk mitigations that align with FAA's needs. As the NAS migrates to robust, IP-based networks, U.S. DOT Volpe Center staff continue to enable safer, more reliable air traffic operations, delivering both security and efficiency for the nation's critical aviation infrastructure.

Sponsors: Air Traffic Organization Cybersecurity Group (ACG) and ACG Cybersecurity Engineering



Brand New Air Traffic Control System (BNATCS) Security Impact Analysis process

The key phases of the BNATCS Security Impact Analysis process. *Source: U.S. DOT Volpe Center.*

Highlighting the Economic Contributions of America's Inland Waterway System

American farmers compete in a fast-moving, price-sensitive global marketplace, and the nation's inland waterways—rivers, canals, locks, and related infrastructure—are a strategic asset that helps keep U.S. agricultural exports competitive. In support of U.S. Department of Agriculture (USDA), the U.S. DOT Volpe Center led a study in partnership with the U.S. Army Corps of Engineers, to quantify how the inland waterway network supports jobs, incomes, and gross domestic product (GDP) and evaluates the economic case for targeted lock and capacity investments in line with DOT Order 2100.7.

The U.S. DOT Volpe Center updated a 2019 analysis to include more states, commodities, and waterways. The team led strategic stakeholder outreach to understand how shippers, operators, and communities use and depend on the inland network. The team applied planning and economic analysis, freight modeling, and data-driven tools—including economic impact software and the Volpe Center's own Freight Transportation Optimization Tool (FTOT)—to estimate baseline contributions and to model scenarios such as lock expansions and disruptions to capacity.

The team found that exports moved via inland waterways of five major agricultural commodities support an estimated 123,185 jobs, $8.27 billion in labor income, and $17.62 billion in GDP annually. These estimates are broken out by soybean, corn, wheat, rice, and sorghum grain exports in the main report.

Expanding lock capacity as referenced in the U.S. Army Corps' Capital Investment Strategy could create roughly 8,199 additional jobs and generate more than $1.0 billion in GDP each year. The analysis also highlighted transportation cost advantages: moving a typical shipment from Scott County, IA, to New Orleans, LA by rail would cost about $60,000 more than using inland waterways; a comparable route from Whitman County, WA, to Portland, OR would cost about $20,000 more by rail.

The updated report is pending final USDA review and clearance and is expected to be released in January. The U.S. DOT Volpe Center team's results offer actionable evidence for policymakers weighing cost-effective infrastructure investments that sustain U.S. agricultural competitiveness and strengthen the nation's economic position in global markets.

Sponsor: U.S. Department of Agriculture (USDA), Agricultural Marketing Service (AMS)

Surface Transportation Infrastructure Investment Modeling

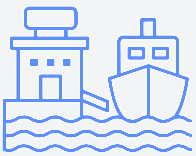
As U.S. DOT and its state partners continue to make significant investments in transportation infrastructure, accurately assessing and forecasting the nation's transportation needs has become more critical than ever. Decision-makers face complex questions: How much funding is necessary to maintain and improve roads, bridges, and transit systems? Where should investments be prioritized to achieve the greatest economic and safety benefits? To support these vital questions, U.S. DOT continues to develop and refine advanced modeling tools that estimate the infrastructure requirements of the future. The U.S. DOT Volpe Center has provided data modeling expertise to the U.S. DOT for decades, and performs economic, data, and policy analyses to support this important work. These efforts are central to ensuring federal investments are effective and aligned with national priorities.

At the core of this work are two interrelated projects: the Highway Economic Requirements System (HERS) and the Transit Economic Requirements Model (TERM). These models provide detailed forecasts of transportation infrastructure needs based on a range of economic, technical, and policy considerations. Their data and insights feed into U.S. DOT's biennial Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance Report (C&P Report), a critical document that informs Congress and guides transportation policy and budgeting.

A U.S. DOT Volpe Center team applies state-of-the-art tools and methodologies to develop, maintain, and improve these models. They support data collection efforts, refine model parameters, and interpret the

Economic Contributions of America's Inland Waterway System

Farmers nationwide rely on America's inland waterways system, a network of rivers, canals, locks, and other waterways that provide the U.S. with a competitive advantage in getting products to export markets in a timely and cost-effective way.



SOYBEAN EXPORTS

56,858 JOBS AND

$11.7B

IN GDP **ANNUALLY**

CORN EXPORTS

48,101 JOBS AND

$4.3B

IN GDP **ANNUALLY**

WHEAT EXPORTS

15,876 JOBS AND

$1.4B

IN GDP **ANNUALLY**

ALL ANALYZED COMMODITIES

123,185 JOBS AND

$17.6B

IN GDP **ANNUALLY**

A U.S. DOT Volpe Center economic analysis team, in support of the USDA's Agricultural Marketing Service and in partnership with the U.S. Army Corps of Engineers, quantified how the inland waterway network supports jobs, incomes, the nation's GDP, and evaluated the economic case for targeted lock and capacity investments.

THE TEAM'S RESEARCH ON INFRASTRUCTURE IMPROVEMENTS AND CAPACITY INVESTMENTS CONCLUDED THAT:

- **Expanding the capacity of locks and dams** along the waterway would create 8,199 additional jobs and generate more than $1.0 billion in GDP annually.
- **Transporting a shipment of goods** over a typical route from Scott County, IA, to New Orleans, LA would cost about $60,000 more if moved by rail rather than inland waterways.
- **Transporting a shipment of goods** from Whitman County, WA, to Portland, OR would cost about $20,000 more if moved by rail rather than inland waterways.

The U.S. DOT Volpe Center team's detailed research and analysis updates a 2019 report on the economic impacts of the inland waterways system, expanding the number of states, agricultural commodities, and waterways analyzed.

U.S. Department of Transportation
Volpe Center

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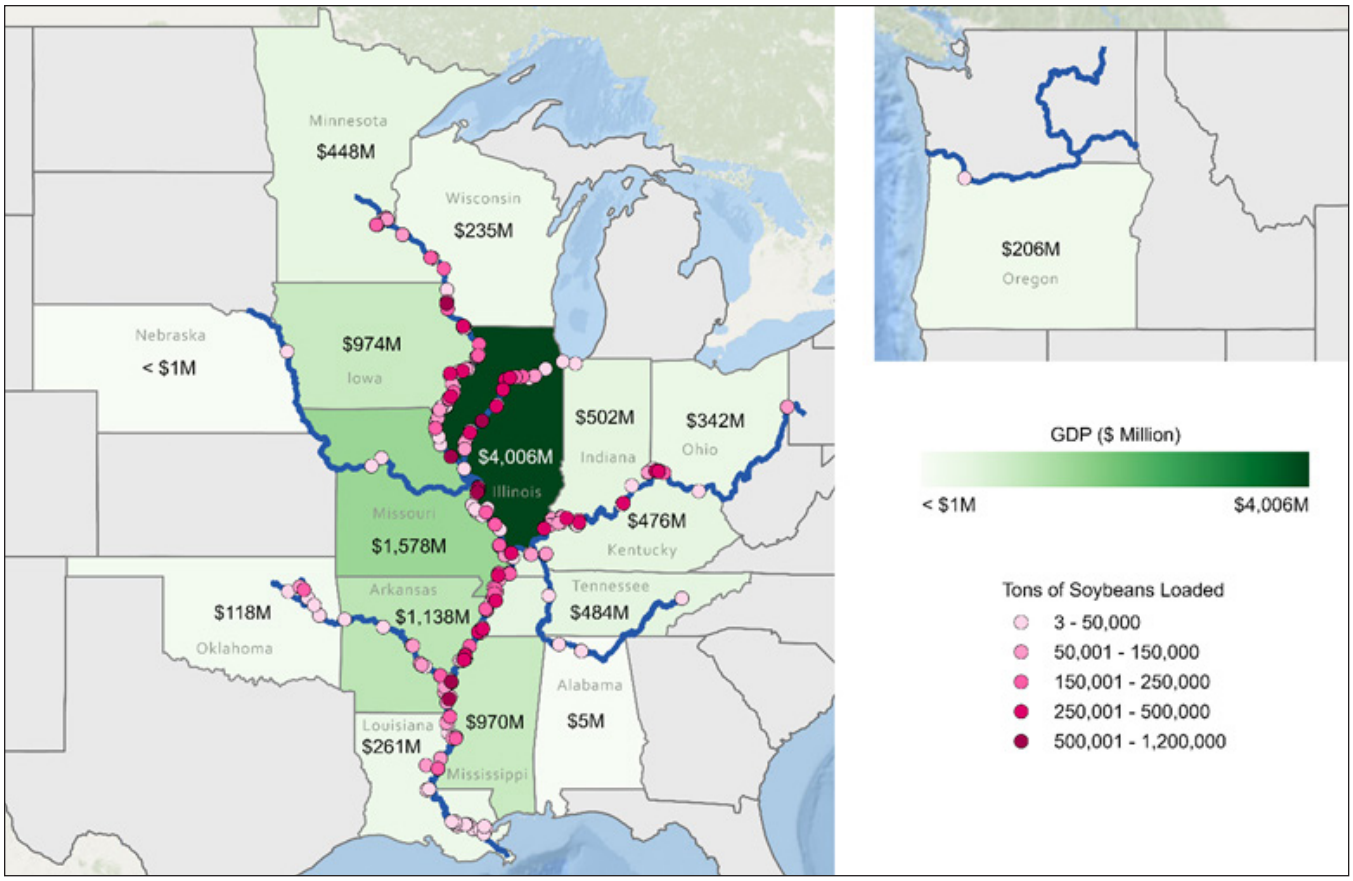


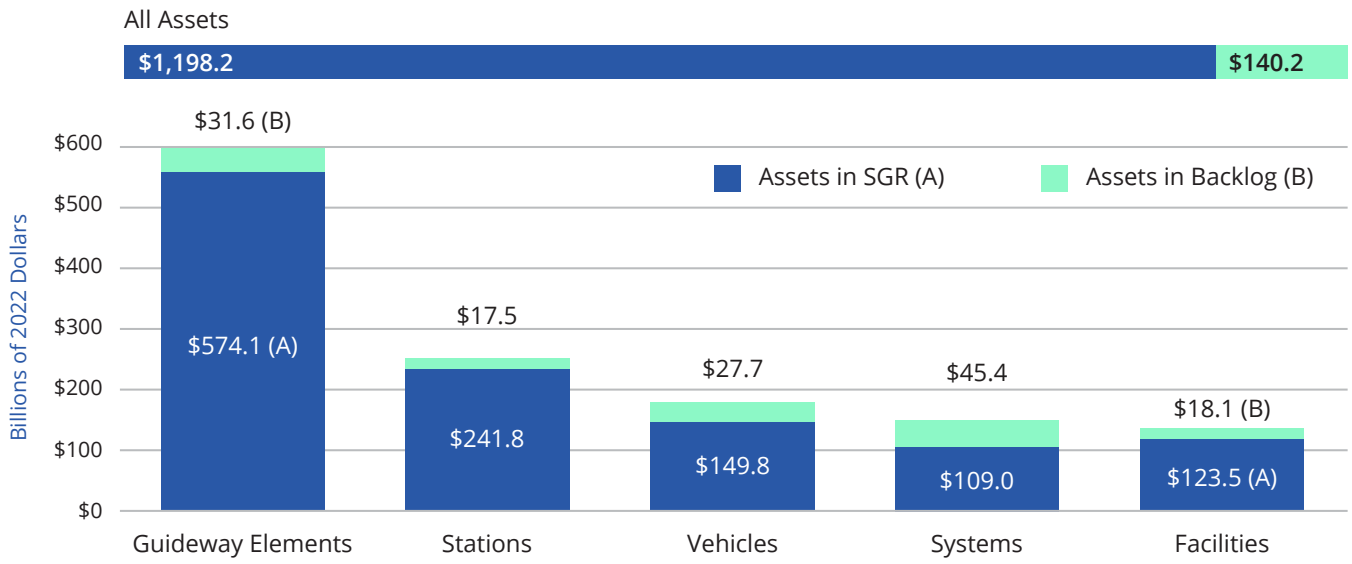
Outgoing soybean shipment volumes by location and GDP contributions from soybean exports for selected states.
Source: U.S. DOT Volpe Center, USACE WCSC, IMPLAN.

results within the context of federal funding statutes and future policy discussions. The Volpe Center team's work ensures the models remain robust, accurate, and relevant to current infrastructure challenges.

HERS, which has been in use since 1992, forecasts highway investment needs by combining detailed data on roadway segments with empirically validated engineering relationships and cost estimates. The model examines how different levels of investment influence outcomes such as congestion, pavement conditions, and roadway user costs. Most recently, Volpe experts supported the 26th edition of the C&P Report. The report, currently under review by U.S. DOT leadership before submission to Congress, demonstrates how targeted investment can improve road conditions and reduce congestion nationwide.

Similarly, TERM models transit asset conditions by assigning and forecasting condition ratings on a scale from 1 to 5—where assets above 2.5 are considered in good repair. It captures aging, usage patterns, weather impacts, and maintenance practices to predict future deterioration and identify optimal timing for replacements or upgrades. Recently, the Volpe Center team supported the migration of TERM from an MS Access platform into an SQL/Python environment to enhance its flexibility and scalability. The model's results contributed to the draft 26th edition of the C&P Report, with plans to use the model for future editions and more frequent reports of investment needs.

These modeling projects support U.S. DOT's primary goal of strengthening infrastructure to enhance safety, efficiency, and economic growth. They align with the Secretary's emphasis on applying economic principles to investment decision-making, ensuring federal funds are allocated in a cost-effective manner. The models help quantify infrastructure needs, prioritize investments, and evaluate the potential impacts of different funding scenarios—ultimately guiding policy decisions



Value of U.S. transit assets in an SGR vs. backlog by asset type, 2022. *Source: U.S. DOT Volpe Center.*

that sustain and advance America's transportation network.

One significant finding from recent analyses highlights a $140.2 billion backlog in transit asset rehabilitation needs as of 2022—about 10 percent of transit assets by value—underscoring the scale of investment required to maintain system safety and reliability. For highways, increased spending levels correlate with improvements in pavement quality and reductions in congestion, demonstrating the tangible benefits of strategic investment.

Through complex economic, data-driven modeling, U.S. DOT is better equipped than ever to plan for future infrastructure needs. Supported by the U.S. DOT Volpe Center's multidisciplinary expertise, these tools provide essential insights for policymakers striving to build a safer, more efficient, and resilient transportation system that meets the demands of a growing nation. This commitment to rigorous planning and analysis underscores the Department's dedication to investing wisely in America's transportation future.

Sponsors: FHWA, FTA

Partnering with ARPA-I to Accelerate Transformative Technologies

America needs transportation technologies that decrease the long-term costs of transportation infrastructure, increase system safety, enhance infrastructure resilience, and make America more globally competitive. Adapting the successful innovation model pioneered by DARPA and ARPA-E, in 2023 U.S. DOT launched the Advanced Research Projects Agency - Infrastructure (ARPA-I) to fund the development of high-risk, high-reward, next-generation transportation technologies that will maintain America's position as a global leader in the sector.

ARPA-I's partnership with the U.S. DOT Volpe Center has helped the agency gain early traction in its fast-paced mission. The U.S. DOT Volpe Center's federal status, innovative culture, multidisciplinary expertise, and established partnerships across U.S. DOT and the broader transportation enterprise compliment the ARPA-I model. Over the course of the past year, a U.S. DOT Volpe Center team has provided critical support, and operational planning, while assisting in various aspects of ARPA-I's project and program development.

As an integral part of the team, the U.S. DOT Volpe

Center has supported ARPA-I's preliminary strategic thrusts.

Open and Exploratory

In August 2025, ARPA-I launched a new Ideas Challenge, the agency's open call to American innovators across the public and private sectors to help transform the future of transportation. The Challenge provided an opportunity for individuals and entities to submit breakthrough ideas and innovative concepts that will improve safety, lower costs, and enhance America's infrastructure. Winning teams are eligible for cash prizes awarded at a maximum of $1 million. The ARPA-I Ideas Challenge Stage 2 is planned for 2026. The U.S. DOT Volpe Center team continues to provide substantial support to the Ideas Challenge.

The U.S. DOT Volpe Center dedicated substantial resources to help develop and implement Stage 1 of the Ideas Challenge in the span of two months from start to finish. This includes support to develop the Ideas Challenge solicitation, conduct a webinar, coordinate the Challenge website and online resources, develop and guide the review process, and plan the awards event. The review process involved reviewing nearly 450 submissions from across all transportation modes and with technologies as varied as AI, AAM, robotics, quantum computing, and more. The review process involved staff from all Operating Administrations and resulted in a final list of 15 prize winners being invited to an in-person event with the Secretary of Transportation at U.S. DOT Headquarters. The Volpe Center team was deeply involved in all aspects of the Ideas Challenge. The Ideas Challenge provides ARPA-I and the Department with a concrete vision of what innovation in transportation can look like, and the Volpe Center team was instrumental in making it happen.

Knowledge

In a first of its kind partnership with Massachusetts Institute of Technology Lincoln Laboratory, Utah Department of Transportation, Colorado Department of Transportation, the Denver Regional Council of Governments, and U.S. DOT's Volpe Center, ARPA-I's Infrastructure Systems Insights through Geospatial-sensing for Holistic Transportation Solutions (INSIGHTS) project is exploring the use of advanced aerial LiDAR (light detection and ranging) to build digital models ("digital twins") of transportation infrastructure, and create new tools to both better understand asset conditions and address challenges like the potential for rockslides and wildfires. The Volpe Center team facilitates the work with MIT Lincoln Laboratory, evaluates the data products, and maximizes utility of the INSIGHTS data for public agencies.

> *"From the Wright Brothers to the Apollo missions, America invented transportation innovation…Our new Ideas Challenge will continue that proud tradition and support the development of new 21st century technologies to launch us forward. Start your innovation engines!"*
>
> ***Sean P. Duffy***
> ***U.S. Transportation Secretary***

Construction

The ARPA-I eXceptional Bridges through Innovative Design and Groundbreaking Engineering (X-BRIDGE) program is focused on creating transformative materials, designs, and construction techniques that can deliver bridges at half the cost, in half the time, and with twice the lifespan. Through a cooperative agreement between ARPA-I and the University of Maine, this first project under the X-BRIDGE program will develop and integrate new advanced composite materials into bridge construction and accelerate bridge design and optimization through AI-assisted system engineering tools. The Volpe Center team supports X-BRIDGE by providing subject matter expertise and overall programmatic support.

Optimization

By applying optimization techniques to high-definition mapping for both passenger and freight transportation, ARPA-I is working to advance the safe, efficient integration of autonomous driving systems across modes. The Volpe Center team provides subject matter expertise and novel program area concepts in this developing area for ARPA-I.

The U.S. DOT Volpe Center will continue to partner with ARPA-I to accelerate the U.S. DOT's mission in bringing radical transformation to our transportation infrastructure and ensuring the safety, efficiency, and resilience of our transportation systems.

Sponsor: ARPA-I

Advancing Maritime Readiness and Energy Independence through Facility Modernization at the U.S. Merchant Marine Academy

The U.S. Merchant Marine Academy (USMMA) is a federal service academy operated by U.S. DOT's Maritime Administration (MARAD) and is located in Kings Point, NY. USMMA educates leaders who are committed to serving the national security, marine transportation, and economic needs of the United States as licensed Merchant Marine Officers and commissioned officers in the U.S. Armed Forces.

With 95 percent of the world's products transported over water, USMMA graduates are vital to the effective operation of the nation's merchant fleet for both commercial and military transport during peace and war. The U.S. imports approximately 85 percent of some 77 strategic commodities critical to America's industry and defense. Although the U.S. accounts for only six percent of the global population, the nation purchases nearly a third of the world's raw materials. Ninety-nine percent of these materials are transported by merchant vessels.

In April 2025, President Trump signed Executive Order 14269 on Restoring America's Maritime Dominance, which orders the rebuilding of domestic maritime industries and workforce to promote national security and economic prosperity. This includes modernizing and revitalizing the USMMA campus and buildings. Transportation Secretary Sean Duffy has pledged to find the resources that will modernize USMMA's infrastructure that is so vital for educating the next generation of mariners.[6]

[6] U.S. Transportation Secretary Sean P. Duffy Visits the United States Merchant Marine Academy | U.S. Merchant Marine Academy. https://www.usmma.edu/about/communications/us-transportation-secretary-sean-p-duffy-visits-united-states-merchant-marine

USMMA midshipmen gather for a 9/11 memorial ceremony at the Kings Point, NY campus. *Source: USMMA.*

The U.S. DOT Volpe Center is supporting MARAD to modernize critical facilities at USMMA that will improve energy resilience, reduce operating costs, and address long-standing deferred maintenance issues. The U.S. DOT Volpe Center provides specialized expertise related to facility performance management and analysis to maximize efficiency and cost-effectiveness. MARAD enlisted the U.S. DOT Volpe Center's expertise to develop strategies, create conceptual engineering designs, deliver government cost estimates, and assist with project implementation.

A Volpe Center team helped scope and secure funding for the installation of energy conservation measures at USMMA, including rooftop and carport photovoltaic systems, two battery energy storage systems, and an air-source heat pump. With these upgrades, USMMA is targeting improved energy and cost efficiency for selected buildings without requiring major renovations, creating a scalable model for future improvements.

Additionally, the U.S. DOT Volpe Center supports MARAD's renovation of the Poland Avenue Warehouse and the Ready Reserve Fleet layberth, both located in New Orleans, LA. The Volpe team will help install a 100-kilowatt solar photovoltaic system and a battery energy storage system at the Poland Avenue Warehouse and prepared facility master planning documents to prioritize capital needs that support the National Maritime Ready Reserve Fleet. The Poland Avenue project will result in an estimated cost savings of $32,900 per year and will save an estimated 247,500 kilowatt-hours of electricity per year.

The U.S. DOT Volpe Center's coordination with MARAD and the Department of Energy (DOE) helped secure a $3.58 million award through DOE's Assisting Federal Facilities with Energy Conservation Technologies program for projects at USMMA and the Poland Avenue site. These efforts will reduce utility costs by about $307,950 per year.

The U.S. DOT Volpe Center continues to provide technical analysis and planning support to help MARAD modernize federal maritime facilities, enhance energy resiliency, address deferred maintenance, and reduce utility costs while strengthening the nation's maritime dominance.

Sponsor: MARAD

4 Efficiency

The U.S. DOT Volpe Center provides expertise across modes to streamline processes and promote greater efficiencies to ensure a safe, efficient, accessible, and convenient transportation system for all Americans.

ADOBE STOCK/Sherman Cahal

ACCELERATING INFRASTRUCTURE

Streamlining Environmental Permitting across U.S. DOT Modes

Efficient and effective environmental review and permitting is crucial to the safe expansion and modernization of the nation's transportation network and energy distribution infrastructure. Reducing administrative delays for transportation projects allows for projects to be delivered more quickly and directly supports U.S. DOT goals of infrastructure modernization, innovation, and safety.

The U.S. DOT Volpe Center provides environmental review and permitting expertise, which aligns with recent Presidential Executive Orders to expedite the development of critical transportation and energy infrastructure while complying with statutory and regulatory requirements. The U.S. DOT Volpe Center provides support to standardize and accelerate environmental review and permitting processes across its work with agencies across U.S. DOT, including the Federal Highway Administration (FHWA), FRA, NHTSA, and PHMSA.

Categorical Exclusions

Building on decades of policy and practice, the U.S. DOT Volpe Center partners with federal agencies to analyze existing permitting workflows, identify bottlenecks, and develop procedures that align NEPA requirements with agency priorities. For example, the Volpe Center has helped identify ways to streamline environmental review processes including the use of categorical exclusions (CEs) to comply with NEPA requirements. CEs are categories of actions that an agency has determined normally do not significantly affect the quality of the human environment.

The Volpe team substantiated and established CEs for NHTSA and PHMSA to streamline their environmental review process. This effort included consulting with U.S. DOT's Office of the Secretary and the Council on Environmental Quality and preparing Federal Register materials to formalize CE establishment and adoptive actions. The Volpe Center is continuing to work with U.S. DOT Operating Administrations to establish, adopt, and utilize more CEs by following the requirements outlined in NEPA and the agency's NEPA implementing procedures.

NEPA Assignment

In addition to establishing CEs, the Volpe Center helps FHWA and FRA manage their NEPA Assignment programs. NEPA Assignment, which was established by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, allows the Secretary of Transportation to assign, and the state to assume, the Secretary's responsibilities under NEPA

for one or more highway projects, as well as one or more railroad, public transportation, and/or multimodal projects. NEPA Assignment has helped states streamline their environmental review processes and accelerate project delivery by giving states the ability to control their own project schedules and minimize the need for timely federal review processes.

There are currently nine states that have either FHWA CE Assignment, FHWA Program Assignment, or both, and several more states have recently expressed interest in taking on NEPA Assignment. As the program expands, the U.S. DOT Volpe Center is supporting both FHWA and FRA in assisting states to receive and maintain NEPA Assignment responsibilities. This has included creating procedural documentation, developing templates and checklists, and assisting with state monitoring and audit efforts.

Accelerating Project Delivery

The U.S. DOT Volpe Center further creates guidance and templates to help agencies prepare streamlined NEPA documentation across diverse projects, from pipeline and rail projects to regulatory actions. By standardizing processes and improving interagency coordination, the U.S. DOT Volpe Center helps reduce duplicative processes and ensures the environmental review process is incorporated into transportation infrastructure decisions. The Volpe team's efforts have contributed to measurable gains in accelerating project delivery to support the Administration's priorities and strengthen the nation's transportation system.

Sponsors: FRA, NHTSA, PHMSA, FHWA

FREIGHT

Driving Efficiency in Annual National Highway Freight Network Corridor Designation

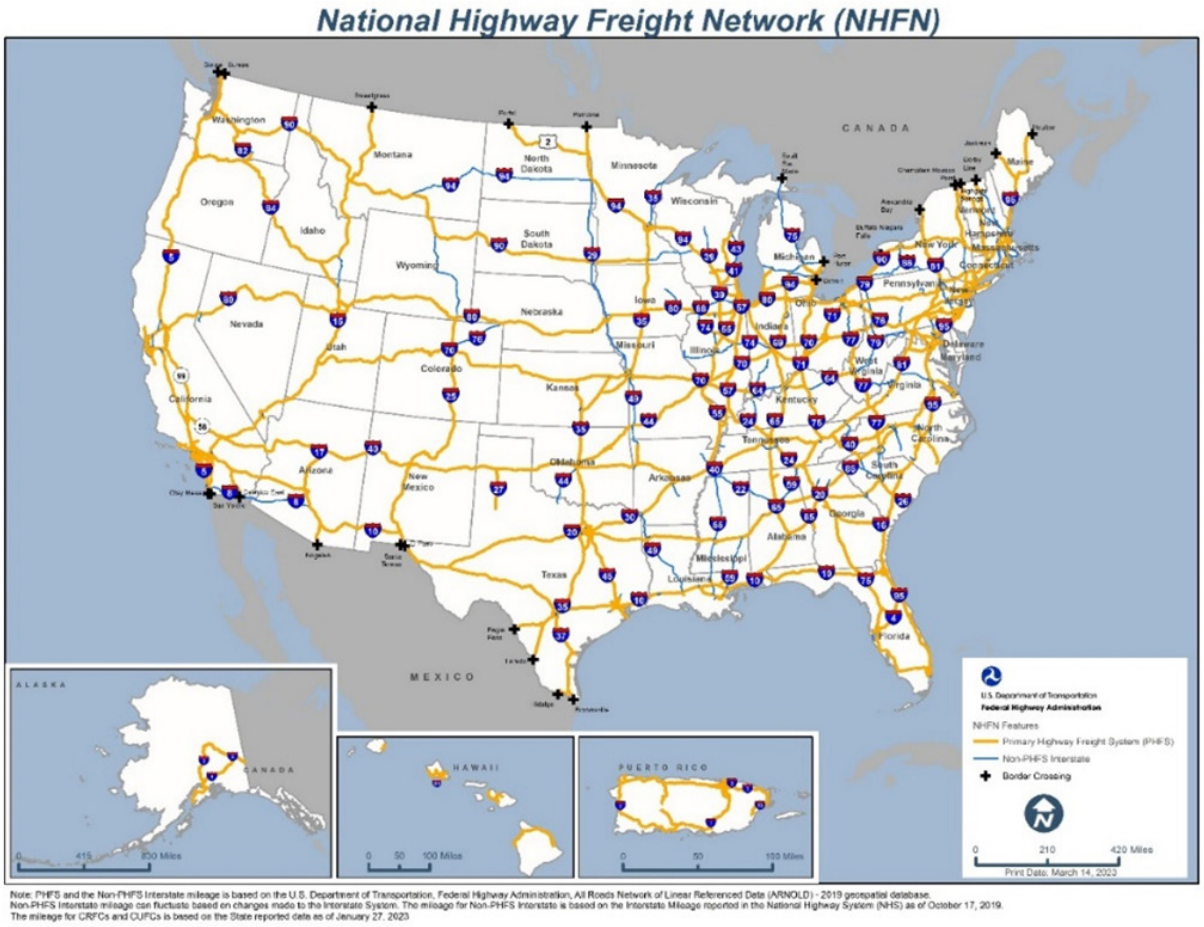
The efficient movement of goods is vital to the nation's economy, and the National Highway Freight Network (NHFN) plays a central role as the designated framework for supporting freight planning and investment. Congress established the NHFN under 23 U.S.C. 167 in the Fixing America's Surface Transportation (FAST) Act, empowering states and regions to prioritize critical highway freight infrastructure. To help achieve this goal, the U.S. DOT Volpe Center partnered with FHWA's Office of Freight Management, introducing innovative tools and processes that streamline corridor designations and improve planning accuracy.

The U.S. DOT Volpe Center applied a combination of geospatial data analysis, business process modeling, and system integration capabilities to modernize the way metropolitan planning organizations (MPOs), states, and FHWA collaborate to re-designate and validate NHFN freight corridors. Over the past year, the U.S. DOT Volpe Center developed process flows to guide multiple stakeholders to ensure smooth integration into the Highway Performance Monitoring System (HPMS) and improve overall system reliability. The team used geospatial analysis to quickly validate NHFN corridor submissions, reducing FHWA labor costs, and ensuring data accuracy. The Volpe Center team worked closely with FHWA to facilitate technical support for states and MPOs, helping stakeholders address discrepancies and clarify submission standards for future cycles.

In addition, the U.S. DOT Volpe Center developed the NHFN submission process, which transitioned states from sending manual PDF maps and tables to using geo-referenced corridor data uploaded through HPMS. This transformation, first piloted in 2024, marked a major milestone, providing a more reliable and efficient pipeline for reviewing submissions. Following lessons learned during the first pilot, the U.S. DOT Volpe Center updated technical guidance documents in 2025 to reduce common data errors and assist states with submission quality.

The U.S. DOT Volpe Center also delivered a public-facing NHFN visualization tool, informed by feedback from state DOTs, MPOs, and academia. The tool allows users to view designated highway segments, toggle important freight-related layers, and conduct quick spatial analyses by uploading custom datasets. Beta testing in 2024 identified specific improvements, like adding layers of MPO boundaries, to ensure the tool's functionalities better align with stakeholder needs. Both the updated submission pipeline and the mapping application were major milestones in process modernization.

The public-facing NHFN web mapping application has made it easier for state DOTs and MPOs to an-



The Primary Highway Freight System (PHFS) is made up of more than 9,000 miles of urban and rural freight corridors.
Source: National Highway Freight Network Map, 2022 - FHWA Freight Management and Operations.

alyze corridor designations alongside other critical freight networks, including Strategic Highway Network military routes and National Network oversized/overweight routes.

The complexity of freight corridor designation underscores the importance of the U.S. DOT Volpe Center's work. Annually, more than 9,000 miles of NHFN critical urban and rural freight corridors are available for re-designation. By enabling geo-referenced submissions and empowering stakeholders with better tools, the U.S. DOT Volpe Center has streamlined this complex, multi-party process—from intake validation to certification. These innovations help FHWA ensure corridor designations meet statutory requirements while enabling stakeholders to translate corridor data into actionable freight planning priorities.

Two years into the updated NHFN submission process, the benefits are becoming increasingly evident. The new workflows have significantly reduced FHWA's review effort, allowing faster certifications and better resource allocation. The NHFN web mapping application empowers state DOTs and MPOs with easy-to-use visualization capabilities, setting the stage for smarter freight strategies and investments.

The updated NHFN Visualization Tool was published in September 2025 and is available for public use. This publication is a major milestone as it will ensure continued access to this valuable resource with improved functionality and sustained support. The new tool retains the familiar look and feel of the original for a seamless transition for users, while leveraging more current technology that supports long-term maintenance and enhancement options. These improvements enable more comprehensive analysis and informed decision-making.

Sponsor: FHWA, Office of Freight Management

Breaking Down Barriers in Flight Data Exchange

Flight management systems around the world often produce data in custom formats tailored to system-specific needs. This variability makes it difficult to exchange flight information with external systems; the resulting "language barrier" reduces the efficiency of data exchange and slows innovation.

To overcome this barrier, the Flight Information Exchange Model (FIXM) was developed jointly by FAA and EUROCONTROL. FIXM provides a common flight language by using a standardized format for flight data exchange and is part of FAA's broader Flight and Flow Information for a Collaborative Environment (FF-ICE) initiative. FIXM also directly supports the work of the International Civil Aviation Organization (ICAO) Air Traffic Management Requirements and Performance Panel. For more than a decade, the U.S. DOT Volpe Center has been a leader in supporting FAA's efforts to develop, maintain, and promote FIXM.

FIXM's Components

FIXM is organized into three components: Core, Applications, and Extensions. The Core component defines globally harmonized flight data structures, Applications support message standardization, and Extensions allow communities to define additional data required locally.

Beyond developing the data model, the U.S. DOT Volpe Center team provides subject matter expertise, program management, and community engagement. The U.S. DOT Volpe Center team released FIXM Core v4.3.0 and updated the Basic Message and FF-ICE Message applications. A modernized FIXM web site was launched to improve usability and support mobile devices. The team also continued to coordinate the international community of FIXM users by facilitating change requests through the FIXM Change Control Board (CCB), organizing technical interchange meetings and maintaining the online FIXM work area. Since its inception, adoption of FIXM has expanded: multiple FAA programs and international partners, including EUROCONTROL, have adopted FIXM, and the benefits include improved access to data, reduced redundancy, lower cost, and more time to innovate.

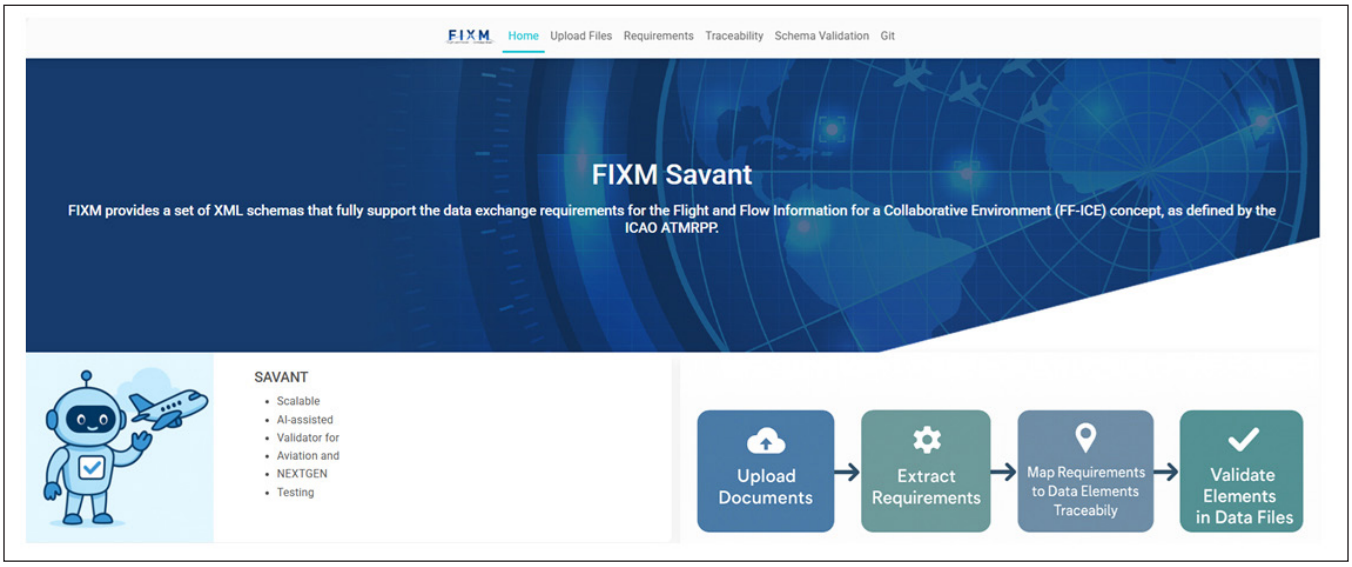
FIXM 4.3.0 overview with Applications, Core, and Extensions. *Source: www.fixm.aero.*

In 2025, the U.S. DOT Volpe Center team released FIXM US Extension v4.4 for FAA/US FIXM users. The extension provides additional data elements to support numerous systems exchanging flight information within the NAS.

Artificial Intelligence Prototype

During the past year, the U.S. DOT Volpe Center FIXM team initiated an AI prototype called Scalable AI-assisted Validator for Aviation & NextGEN Testing

Participating organizations in the FIXM community. *Source: Slide from 2025 FIXM TIM meeting.*



Screenshot showing the SAVANT AI prototype web interface which allows users to upload documents, extract requirements, perform traceability mapping, and validate steps using AI. *Source: FIXM SAVANT.*

or SAVANT. SAVANT aims to reduce the manual effort required to verify that FIXM schemas satisfy ICAO requirements. Currently, the FIXM team manually reviews requirements documents, builds traceability mappings, and validates schemas using spreadsheets. SAVANT will automate this process by using AI to parse ICAO requirements, map each requirement to specific data elements in the FIXM schemas, and perform automated validation. The desired outcome is a tool that reduces testing costs and time and increases accuracy. A prototype user interface of SAVANT has been developed and is currently being evaluated by the team.

Sponsors: FAA, NextGen Technology Development & Prototyping Division

ORGANIZATIONAL EFFICIENCY

Advancing Transportation Innovation through Distributed Testing

The U.S. DOT Volpe Center recently began development of a Distributed Testing Hub (DTH) to support a Joint Transportation Test and Evaluation Capability (JTTEC) that will enable remote testing of complex transportation systems and strategically advance U.S. DOT national transportation goals. The work was carried out in partnership with the U.S. DOT's Highly Automated Safety Systems Center of Excellence (HASS COE).

The DTH will accelerate the safe, interoperable, and efficient deployment of automated systems across air, land, sea, and space. By enabling geographically dispersed live, virtual, and constructive testing, the DTH will empower the HASS COE and other organizations to apply cutting edge tools like digital twins, artificial intelligence, and data analytics, while harmonizing cross-modal standards and strengthening federal review capacity. This initiative aligns with broader federal priorities to boost efficiency, safety, and innovation in transportation at a national and global scale.

This collaborative effort allows for a broad ecosystem of partners and users, with the goal of creating a reusable, scalable testing environment that can serve multiple agencies, departments, and stakeholders across transportation sectors. In addition to developing the testing hub, the U.S. DOT Volpe Center has worked with HASS to establish a community of action around distributed testing to share lessons learned, refine best practices, and accelerate deployment of automated and connected technologies.

The U.S. DOT Volpe Center built a secure, isolated testing setup that lets end users test multimodal use cases. A U.S. DOT Volpe Center team led the engineering of the controlled testing environment and cloud infrastructure. The team also conducted cross-industry scans of distributed testing applications to develop a decision tree to guide users on where distributed testing offers the greatest value, from environment and weather considerations to hardware availability. U.S. DOT Volpe Center human factors experts engaged in community outreach, training, and established a forum for current and prospective users to share experiences. The next phase of this work will focus on defining concrete test use cases, coordinating connections with the U.S. DOT Office of the Chief Information Officer and stakeholders, and executing and documenting tests.

While formal performance metrics are forthcoming, the DTH promises to streamline the evaluation of automated transportation technologies across transportation modes, reduce development cycles, and foster collaboration among federal agencies. By institutionalizing distributed testing, the JTTEC DTH aims to accelerate innovation while maintaining rigorous safety and reliability standards. The U.S. DOT Volpe Center's NextGen lab stands at the center of this transformation, enabling a national approach to testing that is as dynamic and interconnected as the transportation system it seeks to improve.

Sponsor: OST-R HASS COE

Resetting Light-duty Fuel Economy Standards

On December 3, 2025, President Donald Trump, U.S. Transportation Secretary Sean Duffy, Deputy Secretary of Transportation Steven Bradbury, and NHTSA Administrator Jonathan Morrison announced a proposal to reset NHTSA's Corporate Average Fuel Economy (CAFE) program. President Trump surrounded by DOT, congressional, and automobile industry leaders delivered remarks at the White House.

The proposal includes fuel economy standards that increase from newly proposed model year (MY) 2022 standards at a rate of 0.5 percent per year through MY 2026, followed by 0.25 percent per year through MY 2031, with MY 2027 stringency established as a bridge between the two sets of standards. This proposed rule fulfills NHTSA's statutory obligation to set CAFE standards at the maximum feasible level the agency determines vehicle manufacturers can achieve in each model year. This action is also consistent with Executive Orders (E.O.) 14148, "Initial Rescissions of Harmful Executive Orders and Actions," and 14154, "Unleashing American Energy," as well as the Secretarial memo titled, "Fixing the CAFE Program."

The CAFE Compliance and Effects Model is developed and maintained by the U.S. DOT Volpe Center. This analysis tool supports NHTSA's CAFE rulemaking team, allowing NHTSA staff to evaluate fuel savings, physical effects, compliance costs, and consumer and societal benefits of potential new CAFE standards. By surveying the measured fuel economy performance of gasoline- and diesel-powered passenger cars and light trucks produced for the U.S. market in MY 2022, NHTSA created a maximum feasible foundation from which to establish standards for subsequent model years and developed the aforementioned standards increases from this MY 2022 baseline.

Volpe Center analysts were responsible for updating the CAFE Model, developing inputs, and analyzing the potential regulatory alternatives at the direction of NHTSA staff. NHTSA and Volpe staff collaborated to document the analysis as part of NHTSA's rulemaking process. The Volpe Center, along with NHTSA, continues to coordinate with U.S. DOT staff to analyze the light-duty vehicle market consistent with applicable statutory factors. The team will gather and examine feedback on NHTSA's proposal from public hearings and from comments received during the public comment period. The Volpe Center will assist NHTSA in making updates to the CAFE Model and provide technical support as NHTSA finalizes its current CAFE rulemaking efforts.

"Restoring reasonable fuel economy standards will also save lives and make our roads safer," said NHTSA Administrator Morrison. "Newer cars are safer cars and by reducing vehicle prices, more American families will be able to afford newer vehicles. I'm proud of our team for the tremendous job they've done developing this proposal."

Sponsor: NHTSA

Global Environmental Trends in International Aviation to 2070

As international aviation faces mounting pressure to balance growth with environmental stewardship, the U.S. DOT Volpe Center is leading technical work that will help inform global decision making through the ICAO Committee on Aviation Environmental Protection (CAEP).

Sponsored by FAA's Office of Environment and Energy (AEE), the U.S. DOT Volpe Center's contribution to the "Environmental Trends in International Aviation to 2070" analysis informs long-range discussions that affect air navigation, aircraft manufacturing, fuels, noise, and pollutants—helping ensure U.S. interests are well represented in ICAO.

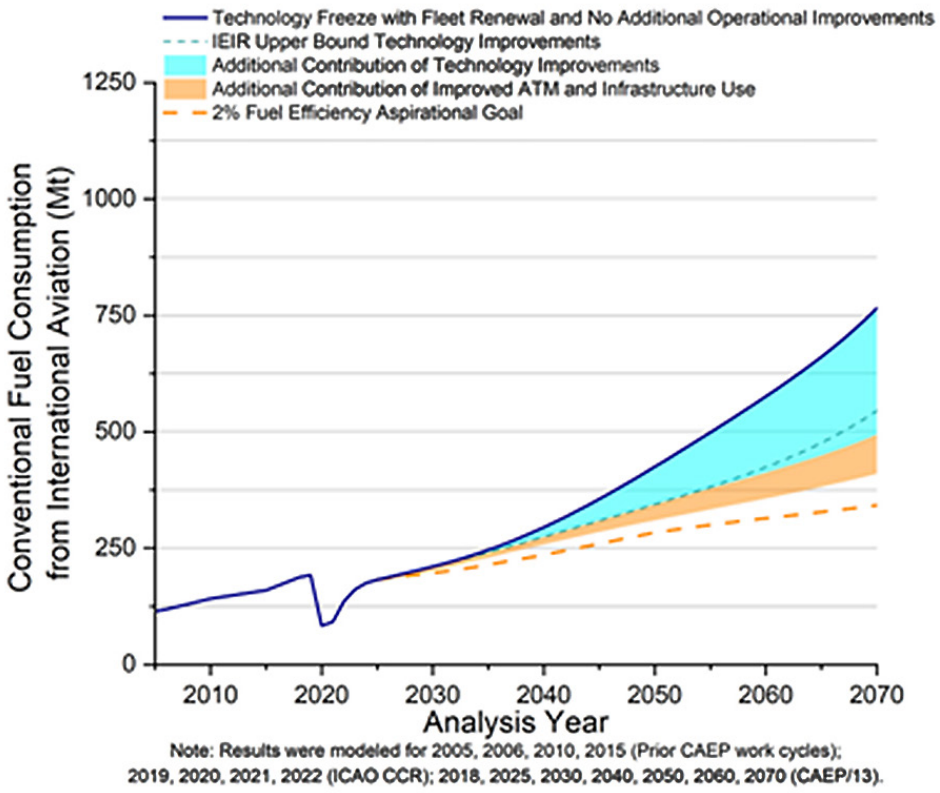
The Volpe Center team contributed leadership, technical modeling, and database development; U.S. DOT Volpe Center Director Gregg Fleming and economist David Pace, in support of FAA, co-lead ICAO CAEP's Modeling and Database and the Forecast and Economic Analysis Support groups, respectively, coordinating work programs, chairing meetings, and delivering analyses to the ICAO Assembly. The team develops and maintains the global commercial aviation flight network database, which details airport-pair operations for passenger and cargo aircraft, and business jets, and constructs the fleet inventories used in scenario modeling.

Technical capabilities applied include forecasting commercial aviation traffic demand, fleet-evolution modeling, airline operating-cost analysis, and noise and fuel-burn modeling. The U.S. DOT Volpe Center utilizes FAA's aircraft environmental and fleet evolution models such as the Aviation Environmental Design Tool and FLEET-Builder in support of CAEP analyses and contributes core databases that provide input to these models. The work combines planning, data analysis, economic modeling, and stakeholder coordination to produce robust, decision-informing results. U.S. DOT Volpe Center staff also navigate important interagency considerations, aligning technical outputs with guidance that urges continued U.S. leadership in ICAO standards-setting.

The environmental trends analysis and report were delivered for publication in spring 2025. The study provides the technical foundation for long-term scenarios—demand, noise, and fuel burn trajectories—that decision makers and international partners can use to inform mitigation measures, technology pathways, and other approaches through 2070. Visuals from the report illustrate projected demand, noise footprints, and fuel-burn trends under different fleet and technology assumptions.

With international aviation continuing to grow, U.S. DOT Volpe Center's work under FAA AEE sponsorship helps ensure environmental deliberations at ICAO are grounded in transparent, defensible technical analysis, supporting safety, innovation, efficiency, and U.S. economic competitiveness on the global stage.

Sponsor: FAA Office of Environment and Energy



Fuel Burn from International Aviation, 2005 to 2070. *Source: 2025 ICAO Environmental Report.*

5 Small Business Innovation Research

The U.S. DOT Volpe Center administers U.S. DOT's Small Business Innovation Research (SBIR) program on behalf of the Office of the Secretary of Transportation. Small businesses that participate in the Department's SBIR program have developed numerous new and innovative technologies that have benefited the Department and the public and helped small businesses grow and become successful.

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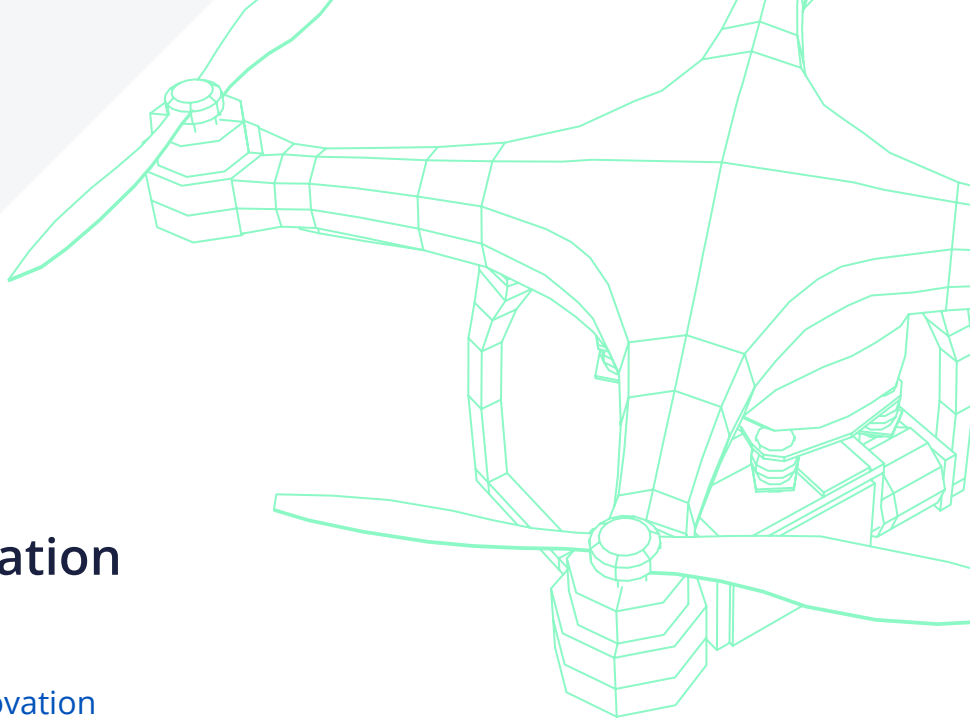


Small Business Innovation Research Program

The U.S. DOT's Small Business Innovation Research (SBIR) program awards more than $10 million annually to small businesses to enable research on and development of innovative solutions to our nation's transportation challenges. The highly competitive program encourages small businesses to explore their technological potential and provides the incentive to profit from its commercialization.

Small businesses that participate in the SBIR program have developed numerous new and innovative technologies that have benefited U.S. DOT and the public, while providing a basis for growth for small businesses. The U.S. DOT Volpe Center administers the SBIR program on behalf of the U.S. DOT and partners with funding operating administrations and small businesses alike in working toward a successful outcome that can benefit the nation's transportation system.

Using Fully Autonomous Robots to Disinfect Public Transit Assets

U.S. Transportation Secretary Sean Duffy recently identified improvements to public transportation public safety as a critical priority. There is a critical need for improved and efficient public transportation sanitation processes to maintain a high level of public safety and slow disease transmission. Funding provided by FTA through U.S. DOT's SBIR program allowed Advent Innovations to further develop its robotics technology to disinfect transit assets while also boosting its visibility in the commercial market.

The Challenge

Public transit vehicle and station sanitation are an important part of maintaining a healthy and welcoming public transportation system. While daily maintenance and cleaning of public transit vehicles is vital, it can be costly. Manual cleaning is expensive, physically demanding, and increases risk of exposure to disease and health hazards for personnel and passengers.

The Technology

Advent Innovations, a women-owned small business, developed robotic cleaning machines that reduce time, effort, and costs of traditional manual cleaning methods. Advent Innovations developed two robots, the Yogi-Bot™ and Ether-Bot™, that can disinfect transit ve-

Ether-Bot™ performs cleaning duties in a transit center. *Source: Advent Innovations.*

hicles and stations, reducing the manual labor required to maintain these facilities. Yogi-Bot™ is designed to clean the inside of transit vehicles. Ether-Bot,™ is designed to clean large areas such as transit centers. Both robots are equipped with liquid disinfectants and other cleaning methods such as UV-C lamps, allowing them to sanitize a wide variety of transit vehicles and infrastructure. According to Advent Innovations, the first end users would be transit agency janitorial staff who currently do manual sanitation in transit stations, buses, and trains. Using these robots, janitorial staff will have new tools to safely and efficiently deliver clean and safe transit systems.

SBIR's Role

Funding provided by FTA through the SBIR program helped Advent Innovations take their AI-powered robotic cleaning machines to the next level. "Our local transit agencies and the South Carolina Department of Education are interested in pilot testing the robots," said Dr. Ritubarna Banerjee, President, Advent Innovations. She noted that the SBIR award has helped make Advent Innovations more visible in the disinfection robotics market in the U.S.

Yogi-Bot™ steps onto a bus and maneuvers down the aisle. *Source: Advent Innovations.*

The Future

Advent Innovations is currently meeting with transit agencies to explore pilot testing opportunities and aims to reach commercial viability by providing innovative sanitation solutions for transit providers. After pilot testing, Advent Innovations' goal is mass production for moderate-sized transit agencies. Although the technologies are targeted toward public transit agencies, the small business envisions expanding to schools and airport facilities.

Using AI-Powered Camera Technology to Improve Grade Crossing Safety

Rail grade crossings are intersections where roadways cross railroad tracks at-grade. Trespassing along railroad rights-of-way is the leading cause of rail-related deaths in the United States each year. Wi-Tronix received funding from FRA through the SBIR program to develop AI-powered camera technology to address railroad crossing safety and improve trespass prevention.

The Challenge

In many places around the U.S., railroad tracks intersect local roads used by vehicles and pedestrians, some in densely populated communities. This can set the stage for deadly conflict with pedestrians and vehicles. Since trains are heavy, taking upwards of one mile to stop, the risk of deadly rail-related strikes is higher when people trespass onto the tracks.

With more than 200,000 grade crossings in the U.S., understanding and preventing railroad crossing incidents and trespassing events is a major safety concern for both FRA and FHWA. According to FRA, more than 500 people die every year in railroad trespassing events.[7]

The Technology

Wi-Tronix, a small business focused on real-time rail safety data and analytics, received funding from FRA through U.S. DOT's SBIR program to develop automated technology for inspecting railroad crossing infrastructure using AI technology. According to FRA data, a little more than half of public highway-rail grade crossings in the U.S. feature "active" warning devices, such as automated gates or flashing lights. These devices currently undergo manual inspections, which are labor intensive and typically happen monthly. Wi-Tronix's innovative technology performs automatic daily inspections, allowing for earlier detection of issues. Wi-Tronix leveraged front-facing cameras already installed on many locomotives to gather video data of grade crossings and uses that data to train AI models to recognize and classify whether railroad crossing features—like gates or flashers—are in working condition or have failed. The AI system alerts authorized railroad users to problems with crossing equipment that could lead to serious safety issues.

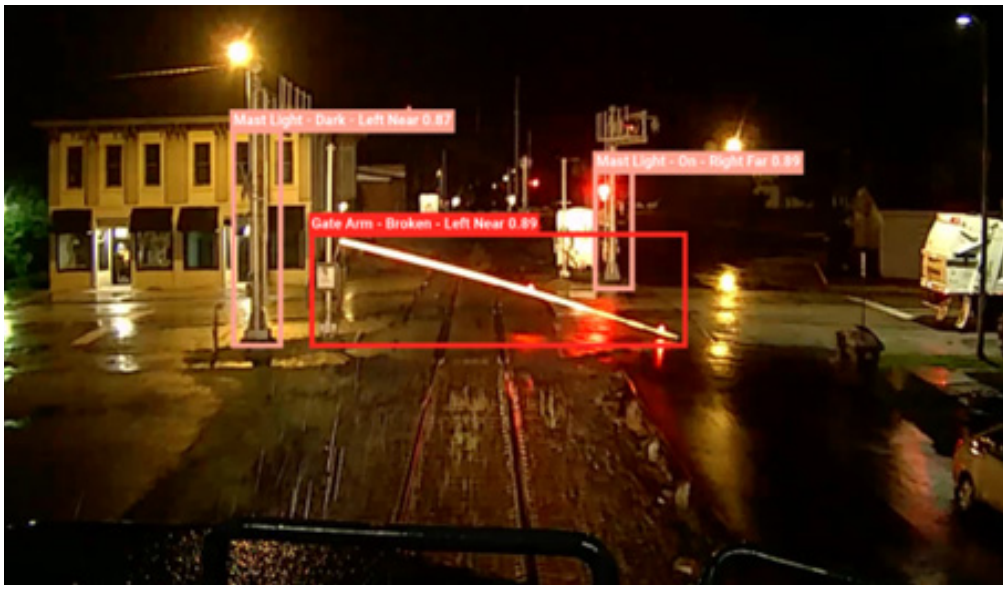
Wi-Tronix partnered with rail operator Brightline on a competitive Consolidated Rail Infrastructure and Safety Improvements (CRISI) grant from FRA to detect and analyze pedestrian trespassing events. This allows Brightline to identify which areas should be prioritized for safety improvements. Ritu Chawla, Wi-Tronix's Director of Artificial Intelligence, noted that railroads can combat trespassing by figuring out where they should apply "corrective actions" to reduce trespassing, such as providing additional education, engineering physical barriers including fencing, or applying greater enforcement.

"It's critical to develop technology that can detect near-miss events to gather broader and more accurate information about where dangerous areas are located," said Chawla. Gathering near-miss data also allows railroads to make safety interventions proactively—without having to wait for fatalities to happen first.

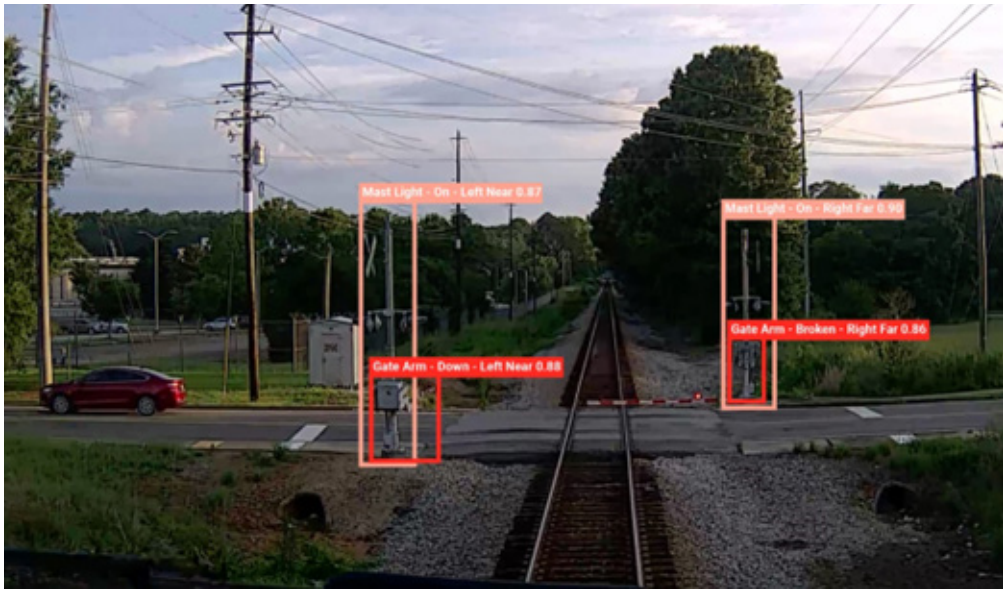
Chawla shared that the trespasser detection technology the company is developing through the CRISI grant builds off the same data-gathering technology Wi-Tronix originally developed during their SBIR award. The key to solving both the SBIR challenge of detecting failed infrastructure and the CRISI challenge of detecting trespassing events is getting enough video data to train the AI system to accurately recognize these scenarios. Gathering data is particularly challenging for rare events like pedestrians trespassing in front of trains.

To solve this data-gathering problem, Wi-Tronix's continuously improving onboard platform detects hundreds of locomotive signals in real-time, providing the ability to identify an abnormal event. By identifying these events, Wi-Tronix can standardize reporting of near-miss situations that risk not being manually reported by engineers due to stress, fatigue, or other emotional states. Once the AI system can accurately detect trespassing, Wi-Tronix customers can analyze which areas of the corridor have the most trespassing events so that they can prioritize installing fences or other interventions.

[7] FRA (September 2025). Trespass Prevention. https://railroads.dot.gov/railroad-safety/divisions/crossing-safety-and-trespass-prevention/trespass-prevention.



Broken gate arm detection utilizing AI at night. *Source: Wi-Tronix.*



Broken gate arm utilizing AI during the day. *Source: Wi-Tronix.*

SBIR's Role

With funding received from the FRA through the SBIR program, Wi-Tronix advanced its smart data collection and other AI-enabled techniques as well as camera technology to be able to see farther ahead of the train. In addition to the technological advances, Chawla says that SBIR has played an important role in helping the small business navigate the world of rail transportation operations. "There's more value than just funding. We got feedback through interactions with the experts to better understand the regulations and railroad operations," she said.

The Future

Wi-Tronix is scaling up their SBIR research on grade crossings and will soon be able to inspect gate arms at around 8,000 crossings. Since Wi-Tronix's SBIR research was piloted on 50 grade crossings, inspecting 8,000 crossings requires enhancements to enable AI predictions on a much larger data load. Wi-Tronix is also re-training AI models to recognize infrastructure elements in a wide variety of scenery and locations across the country. Wi-Tronix plans to use its active learning pipeline to maintain the model performance.

6 Volpe Conference Center

The Volpe Conference Center is a lively hub for collaboration, technical exchanges, thought leadership, knowledge-sharing, and the dissemination of best practices. Recent events include meetings, workshops, and seminars with federal partners and organizations from across the country and abroad, including U.S. DOT modal partners.

U.S. DOT VOLPE CENTER

The Volpe Conference Center: A Hub for Collaboration and Innovation

A key feature of the U.S. DOT Volpe Center's state-of-the-art building is its 17,000 square feet of flexible conference and meeting space. The Volpe Conference Center continues the U.S. DOT Volpe Center's long-standing tradition of bringing together the transportation community to address issues vital to the nation's future.

The Volpe Conference Center has welcomed over 7,200 visitors and hosted more than 170 events since opening less than two years ago

The space offers multiple options for gatherings of all sizes, including a large main conference room, smaller meeting rooms, and classroom-style training spaces, with an integrated audio-visual system compatible with multiple commercial collaboration platforms.

The Volpe Conference Center can accommodate events of up to 800 people and is available to U.S. DOT, U.S. DOT Volpe Center staff, regional DOT offices, and other government agencies.

The Volpe Conference Center is a lively hub for collaboration, technical exchanges, thought leadership, knowledge-sharing, and the dissemination of best practices. Recent events include meetings, workshops, and seminars with federal partners and organizations from across the country and abroad, including U.S. DOT modal partners.

In support of its mission to advance transportation innovation for the public good, the U.S. DOT Volpe Center continues to foster an environment where ideas flourish and partnerships grow.

U.S. DOT Volpe Center Director Gregg Fleming welcomes federal, state, non-profit and community leaders to a regionally coordinated Clean Air Northeast Partners meeting. *Source: U.S. DOT Volpe Center.*

Dab Kern, Director of Operations, Gregg Fleming, U.S. DOT Volpe Center Director, and Stephen Popkin, PhD, Director for Research and Innovative Technology during the Volpe Center's 54th Annual Awards Ceremony. *Source: U.S. DOT Volpe Center.*

An attendee visits FAA's Aviation and Space Education booth during the New England UAS and Advanced Air Mobility Summit. *Source: U.S. DOT Volpe Center*.

Stephen Popkin, PhD, Director for Research and Innovative Technology, and Jonathan Walker, PhD, Center for Communication, Navigation, Surveillance Systems, and Engineering Director, participate in a discussion during an FAA UAS meeting. *Source: U.S. DOT Volpe Center.*

Stephen Popkin, PhD, addresses U.S. DOT Volpe Center staff and attendees during the Aviation Cyber Initiative Cyber Rodeo event. *Source: U.S. DOT Volpe Center.*

Tracy Lennertz, PhD, Co-Chief of the Transportation Human Factors Division, addresses staff and attendees in the Human Factors Lab during the Aviation Cyber Initiative Cyber Rodeo event. *Source: U.S. DOT Volpe Center.*

A Japanese delegation and FAA colleagues with Director Gregg Fleming and the U.S. DOT Volpe Center team met to discuss UAS and aircraft noise measurement and modeling. *Source: U.S. DOT Volpe Center.*

Attendees of the 49th Meeting of the NATO Joint Airdrop Capability Syndicate conference pose for a photo inside the U.S. DOT Volpe Center's glass atrium. *Source: U.S. DOT Volpe Center.*

U.S. DOT Volpe Center staff participate in the 2025 Everyday Innovations kick-off event. *Source: U.S. DOT Volpe Center.*

U.S. DOT Volpe Center staff review colleagues' brainstorming ideas during the 2025 Everyday Innovations event. *Source: U.S. DOT Volpe Center.*

Gregg Fleming speaks to a group of children visiting the U.S. DOT Volpe Center during April's Take Our Children to Work Day. *Source: U.S. DOT Volpe Center.*

Mario Caputo, Jack Clark, David Phinney, Nicholas Sclafani, and Henry Wychorski met with members of NATO's Allied Maritime Command Shipping Centre to review current and plan for future NATO feeds into the Maritime Security and Safety Information System network. *Source: U.S. DOT Volpe Center.*

The U.S. DOT Volpe Center's Situational Awareness and Logistics Division team hosted members of the U.S Navy Naval Information Warfare Center-Pacific to advance priorities and increase collaboration. *Source: U.S. DOT Volpe Center.*

The CAFE Team workshop convened 20 working sessions over three days, bringing together experts in economics, engineering, environmental modeling, and policy from across NHTSA and the Volpe Center. *Source: U.S. DOT Volpe Center.*

7

Historical Timeline – Key Contributions through the Decades

Since its establishment on July 1, 1970, the U.S. DOT Volpe Center has proudly served the nation, 10 Presidents, and 19 Secretaries of Transportation.

A Tradition of Impact, Relevance, and Advancing Transportation Innovation for the Public Good

PRESENT – 1970

Presidents	**Donald J. Trump** 2025 – Present
Secretaries of Transportation	Sean Duffy

- Strengthening **transportation safety** across modes through incident investigations and inspections, evaluation of safety technologies and analysis, and implementation of safety management systems
- Advancing the **Secretary's Innovation Agenda** and supporting the **safe, efficient introduction of emerging technologies** into the transportation system, including **automated vehicles, connected vehicles, commercial space transportation, unmanned aircraft systems (UAS), counter UAS, advanced air mobility, and supersonics**
- Harnessing **artificial intelligence** (AI) to solve complex transportation challenges and provide the secure infrastructure and expertise needed to drive **safe, scalable, and cost-effective** AI solutions across U.S. DOT
- Providing subject matter expertise and leadership to the congressionally mandated **U.S. DOT's Safety Council and the FAA Task Force on Human Factors for Aviation Safety**
- Supporting FAA with the **modernization of the Nation's air traffic management system**
- Supporting U.S. DOT's role as the lead for **civil Positioning, Navigation, and Timing (PNT) requirements in the U.S.** and implementing the **Complementary PNT Action Plan** to drive adoption of PNT technologies
- Working across U.S. DOT to support **NEPA reform** to modernize and expedite federal **environmental review and permitting processes** to deliver transportation infrastructure projects more rapidly and efficiently
- Supporting implementation of the Presidential Executive Order on **Restoring Maritime Dominance** to revitalize and rebuild the U.S. domestic maritime industries and workforce and enhancing **maritime domain awareness** in waterways worldwide

- Identifying weak spots in our **supply chains** through **freight corridor analysis** to help decision makers prioritize investments
- Supporting demand forecasting and cost benefit analysis for **national/international roadway and aviation fuel efficiency standards**
- Assessing strategies supporting travelers with disabilities to ensure **safe accommodation and an accessible transportation system**
- Reducing **cyber risk** by crafting standards, tools, training, and analysis products that help builders, buyers, and operators make informed decisions

Joseph R. Biden
2021 – 2024

Pete Buttigieg

20

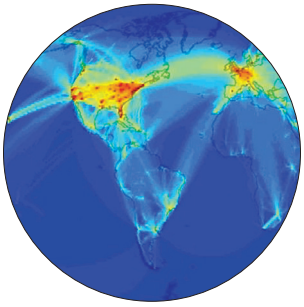
Donald J. Trump
2017 – 2021

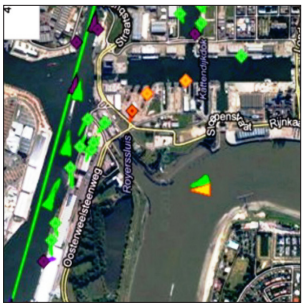
Elaine L. Chao

- Supporting implementation of the **Infrastructure Investment and Jobs Act** also known as the Bipartisan Infrastructure Law across all modes
- Performing analysis to inform the development and implementation of the **National Roadway Safety Strategy**
- Providing analytical support to FAA's **Sustainable Tower Design Initiative**, enabling the cost-efficient and rapid deployment of these towers nationwide
- Identifying transportation supply chain vulnerabilities and recommending potential policy responses to **strengthen the resilience of the freight system**
- Contributing technical expertise to the nationwide development of **electric vehicle charging corridors**
- Supporting development of a report to Congress on opportunities for **maritime highway transportation**
- Improving resilience and fostering responsible use of **Positioning, Navigation, and Timing** services
- Supporting efforts related to safety, infrastructure, security, environmental responsibility, and federal investment in **Advanced Air Mobility**

- Providing multimodal environmental and economic analysis in response to **COVID-19 pandemic recovery**
- Building **aviation safety oversight systems** to enable FAA to focus on areas of greatest potential risk
- Providing safety management and human factors expertise to the **FAA Boeing 737 MAX Technical Advisory Board**
- Engaging industry and providing engineering and data collection support to the **Freight Logistics Optimization Works (FLOW)** public-private partnership

- Advancing high-speed aviation and informing potential changes to **supersonic flight** regulation
- Providing **infrastructure** and **automated vehicle** policy support
- Enhancing the **Environmental Review and Permitting Process**
- Assisting in the design and development of the technology for transmitting **electronic logging device** motor carrier data to safety officials
- Advancing **safe integration of new entrants** into the National Airspace System
- Advancing **data sharing** across the aviation community through the System Wide Information Management system
- Conducting **Global Positioning System** adjacent band compatibility assessments
- Supporting deployment of the **Strategic Highway Research Program** and its products
- Developing a first-ever National Long Range Transportation Plan for **National Park Service**





Barack Obama
2009 – 2017

Ray H. LaHood
Anthony Foxx

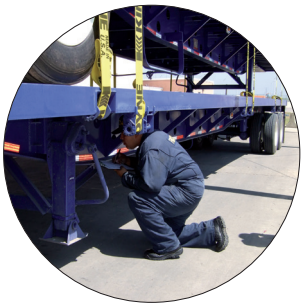
- Supporting the **Next Generation Air Transportation System** program
- Pioneering **Global Positioning System spectrum interference protection**
- Supporting **connected and automated vehicle** research, evaluation, and planning
- Assessing safety standards relevant to the safety and reliability of **automotive electronic control systems**
- Supporting **high-risk motor carrier** prioritization
- Providing analytical and engineering support related to **High-Speed Intercity Passenger Rail** service
- Bolstering development of the first-ever **aviation CO_2 emissions standard**
- Developing a national model to evaluate **freight and fuel transport options**
- Supporting **global disaster relief efforts** in Haiti and Japan in the aftermath of devastating earthquakes
- Responding to natural disasters, including **Superstorm Sandy**
- Advancing safety of **crude oil and ethanol by rail** initiatives
- Supporting development of ***Beyond Traffic 2045***

Image: Patrick Mulvihill, Hood River News

George W. Bush
2001 – 2009

Mary E. Peters
Norman Y. Mineta

- Supporting U.S. DOT's response to the **September 11 attacks**
- Performing groundbreaking research and analysis on **Global Positioning System vulnerability**
- Supporting installation of a **communications-based train control system** in Iraq
- Expanding the multinational **maritime situational awareness** network
- Designing and deploying a landmark **Automatic Identification System-based data network** on the St. Lawrence Seaway
- Strengthening analysis of **federal motor carrier safety** programs



- Synthesizing data and information related to **Electronic On-Board Recorders** for reporting hours of service
- Assessing U.S. Postal Service's Alaska **hovercraft demonstration** project
- Supporting **Intelligent Transportation Systems** programs
- Contributing to ***Transportation Vision 2030***
- Advancing **motor vehicle crash avoidance** research
- Providing safety management support to the **NASA Columbia Accident Investigation Board**

William J. Clinton
1993 – 2001

Federico F. Peña
Rodney E. Slater

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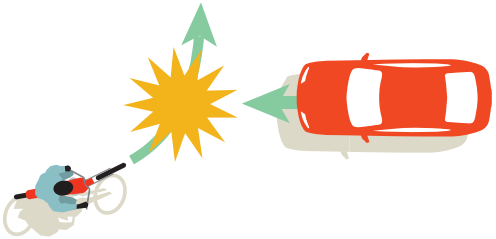
George H. W. Bush
1989 – 1993

Samuel K. Skinner
Andrew H. Card, Jr.

- Assessing the **crashworthiness of rail passenger equipment**
- Developing and installing a real-time communications and navigation system for the **Panama Canal**
- Laying the foundation for Amtrak's all-electric **Acela** high-speed service
- Testing and analyzing commercial vehicle **front and side collision warning systems** and adaptive **cruise control**
- Developing the system to calculate **aviation's contribution to global fuel burn and emissions**
- Enhancing the **integrated model for prediction and analysis** of aviation and highway traffic noise
- Implementing an **integrated security plan** for the U.S. Capitol area
- Contributing to a **surface transportation vulnerability assessment**
- Undertaking major **environmental remediation** at U.S. DOT and Superfund sites
- Playing a central role to **DOD's Cooperative Threat Reduction Program**, focused on preventing the proliferation of weapons of mass destruction
- Supporting development of U.S. DOT's **policy architecture for transportation decision-making**
- Supporting the White House **National Science and Technology Council's** transportation initiatives



- Supporting development and implementation of the **intelligent vehicle highway system** program
- Studying the effect of the **65 mph speed limit** on highway safety
- Assessing the use and design of **flight crew checklists and manuals**
- Evaluating the **ridership, cost forecasts, and performance** of federally funded transit projects
- Supporting DOD's **strategic mobility and logistics** priorities
- Conducting a **port needs study** for U.S. Coast Guard
- Contributing to ***Moving America: A Statement of National Transportation Policy***

Ronald Reagan
1981 – 1989

Drew Lewis • Elizabeth Hanford Dole
James H. Burnley IV

80

James Carter
1977 – 1981

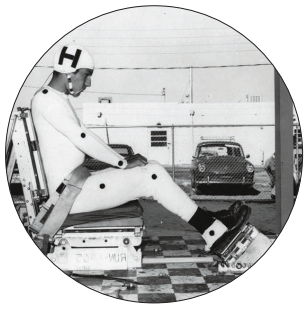
Brock Adams
Neil Goldschmidt

- Deploying groundbreaking **air traffic management** concepts, including the Enhanced Traffic Management System

- Assessing the capability of the **Global Positioning System** to meet civil navigation requirements
- Examining **transportation security** issues and countermeasures
- Creating an assessment tool to evaluate the **safety record of air carriers**—both military and commercial
- Contributing to an aviation **human factors** research plan
- Assessing prospective safety hazards associated with **commercial space launch** activities
- Studying the influence of **advanced communications** on the future of transportation
- Exploring **public-private partnerships** for urban transportation
- Studying **rail integrity** and the behavior of propagating fatigue cracks
- Examining the implications of stalling on **motor vehicle safety**
- Evaluating the effects of mandatory **seatbelt use** laws on safety

- Studying the impact of **energy trends** on the automobile industry

- Contributing to the **financial analysis of the motor vehicle industry**
- Developing the first-ever U.S. DOT–DOD **Federal Radionavigation Plan**
- Evaluating airport **ground access capacity** at commercial airports
- Assessing **fire safety** in a transportation setting
- Conducting **noise assessments** of transportation systems
- Analyzing **ridership** levels of the Morgantown Personal Rapid Transit System



Gerald R. Ford
1974 – 1977

Claude S. Brinegar
William T. Coleman, Jr.

Richard M. Nixon
1969 – 1974

John A. Volpe
Claude S. Brinegar

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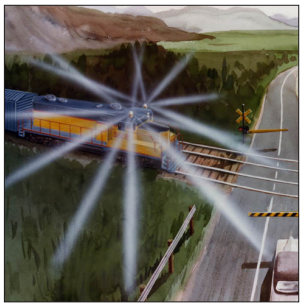
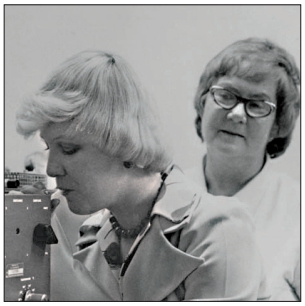
- Testing **wake vortex** sensing systems at major U.S. airports

- Conducting engineering tests and demonstrations of **rail rapid transit** vehicle technology
- Exploring the potential for flexicab services and **innovative uses of taxis** and jitneys for public transport
- Analyzing the effects of **year-round Daylight Savings Time** in reports to Congress
- Informing ***National Transportation Trends and Choices to the Year 2000***



- Simulating **national air traffic flow**
- Developing anti-hijacking **aviation security** screening systems
- Examining constraints and required characteristics for **anticipatory sensing of impending automobile crashes**
- Providing first-ever acoustic measurements of a civil **supersonic jet** (Concorde), which are informing current technical and policy advancements



- Pioneering the use of **alcohol breath analysis** for transportation safety
- Examining the control and information system and operational requirements for the **St. Lawrence Seaway**
- Supporting introduction of advanced **urban transit** technologies
- Conducting the first federal study on **automated fare collection**
- Examining highway-rail **grade crossing** protection in high-density corridors
- Informing the first **Corporate Average Fuel Economy** standards

U.S. Department of Transportation
Volpe Center

WE VALUE OUR CROSS-AGENCY, CROSS-MODAL WORK WITH COLLEAGUES IN FEDERAL AGENCIES, STATE AND LOCAL GOVERNMENTS, ACADEMIA, NON-PROFIT AND PRIVATE SECTOR ORGANIZATIONS, INTERNATIONAL GOVERNMENT AGENCIES, AND OTHERS.

8

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The U.S. DOT Volpe Center recognizes and appreciates our partners who have sponsored our work and collaborated with us to advance the national and global transportation system.

Photo: Dave Burk © SOM

U.S. DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Federal Highway Administration

Federal Motor Carrier Safety Administration

Federal Railroad Administration

Federal Transit Administration

Great Lakes St. Lawrence Seaway Development Corporation

Maritime Administration

National Highway Traffic Safety Administration

Pipeline and Hazardous Materials Safety Administration

Office of the Secretary of Transportation

- Office of the Under Secretary of Transportation for Policy
  - Office of the Assistant Secretary for Transportation Policy
  - Build America Bureau
  - Office of Multimodal Freight Infrastructure and Policy
  - Office of the Assistant Secretary for Aviation and International Affairs
  - Office of the Assistant Secretary for Research and Technology
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    - Bureau of Transportation Statistics
    - Highly Automated Systems Safety Center of Excellence
    - Intelligent Transportation Systems Joint Program Office
    - Office of Positioning, Navigation, and Timing (PNT) and Spectrum Management
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- Office of Civil Rights
- Office of Drug & Alcohol Policy & Compliance
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- Office of Intelligence, Security and Emergency Response

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Agricultural Marketing Service

U.S. Forest Service

Department of Commerce

National Oceanic and Atmospheric Administration

Department of Energy

Argonne National Laboratory

Bioenergy Technologies Office

National Energy Technology Laboratory (NETL)

Cybersecurity, Energy Security, and Emergency Response (CESER)

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Federal Emergency Management Agency

U.S. Coast Guard

Department of Housing and Urban Development

- Office of Chief Information Officer
- Office of Policy Development and Research

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- Defense Threat Reduction Agency
- Office of the Secretary of War
- U.S. Air Force
  - Air Mobility Command
  - U.S. Air Force Civil Engineer Center
  - U.S. Air Force Flight Standards Agency
  - U.S. Air Force Life Cycle Management Center
  - U.S. Air Force Materiel Command

- U.S. Army
  - U.S. Army Corps of Engineers
  - U.S. Army Tank-automotive and Armaments Command
  - Army Sustainment Command
- U.S. Navy
  - Naval Air Systems Command
  - Naval Education and Training Security Assistance Field Activity
  - Naval Facilities Engineering Systems Command Pacific
  - Naval Facilities Engineering and Expeditionary Warfare Center
  - U.S. Naval Forces Africa
  - U.S. Naval Forces Europe
- U.S. Transportation Command
  - Surface Deployment and Distribution Command (SDDC)

Environmental Protection Agency

Federal Permitting Improvement Steering Council

Joint Office of Energy and Transportation

Millennium Challenge Corporation

National Aeronautics and Space Administration

Presidio Trust

Surface Transportation Board

U.S. Access Board

STATE AND LOCAL

City of Boston, MA

City of New York, NY

City of Colorado Springs

Massachusetts Department of Transportation

Massachusetts Bay Transportation Authority

Maricopa Association of Governments (Arizona)

Summit County, CO

New Mexico Department of Transportation

Pitkin County, Colorado

Rhode Island Department of Transportation

INTERNATIONAL

Transport Canada

NONPROFIT ORGANIZATIONS, ACADEMIA, AND THE PRIVATE SECTOR

American Association of State Highway and Transportation Officials

Advanced Regenerative Manufacturing Institute

Boston Harbor Now

Casey Feldman Memorial Foundation

Columbia River Pilots

Insurance Institute for Highway Safety

Oregon State University

Santos Family Foundation

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AUTOMATED VEHICLES

SUBSONIC AIRCRAFT

COMMERCIAL SPACE

ADVANCED AIR MOBILITY

EFFICIENT RAIL MODERNIZATION

ACCELERATING ORGANIZATIONAL INNOVATION

INFRASTRUCTURE

AVIATION MODERNIZATION

ECONOMIC COMPETITIVENESS

EFFICIENCY

ACCELERATING INFRASTRUCTURE

FREIGHT

AVIATION DATA

ORGANIZATIONAL EFFICIENCY

FUEL EFFICIENCY

SMALL BUSINESS INNOVATION RESEARCH

VOLPE CONFERENCE CENTER

HISTORICAL TIMELINE – KEY CONTRIBUTIONS THROUGH THE DECADES

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REPORT DOCUMENTATION PAGE

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The U.S. DOT Volpe Center's Annual Review publication highlights our best work of the past year and illustrates the sustained impact of the U.S. DOT Volpe Center and its workforce on advancing innovation for the public good on behalf of U.S. DOT and other sponsoring agencies. This year's book features over 40 stories in support of U.S. DOT operating administrations and other sponsoring organizations including the Departments of War, Interior, and Agriculture and NASA.

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