

**United States Department of Transportation
Annual Modal Research Plans FY 2026
Program Outlook FY 2027**

Federal Aviation Administration



**June 1, 2025
Revision 1 – July 18, 2025
Revision 2 – Sept 30, 2025**

Submitted by:

*Eric Neiderman, Director
William J. Hughes Technical Center for Advanced Aerospace
FAA Research Portfolio Manager*

Table of Contents

Executive Summary	v
Critical R&D Programs	vi
Collaboration Efforts	ix
Technology Transfer (T2)/Deployment Activities	ix
Anticipated Outcomes.....	x
R&D Portfolio Impacts on the Average Person.....	xi
Evaluation/Performance Measurement Efforts.....	xi
Program Changes from FY 2025 AMRP.....	xii
FY 2026 RD&T Program Funding Details.....	xiii
FY 2026 RD&T Program Budget Request by DOT Strategic Goal	xv
Chapter 1 – FY 2026 RD&T Programs	1
FAA RD&T Domains.....	2
Airport Infrastructure and Technologies.....	3
Airports Cooperative Research Program	4
Airports Technology Research Program.....	7
Aircraft Safety Assurance.....	11
Fire Research and Safety	12
Propulsion and Fuel Systems.....	15
Advanced Materials/Structural Safety	18
Continued Airworthiness	21
Digital Systems and Technologies.....	25
Digital System Safety	26
Information/Cyber Security	28
Weather and Aviation Systems.....	30
Aircraft Icing.....	31
Weather Program	33
Alternative Fuels for General Aviation.....	37
Advanced Vehicle Technologies & Operations.....	41
Aviation Systems Performance Analysis.....	43
Human and Aeromedical Factors	46
Flight Deck/Maintenance/Systems Integration Human Factors	47
Air Traffic Control/Technical Operations Human Factors	49
Aeromedical Research	52
Aviation Grant Management	55
Aerospace Performance and Planning	57
System Safety Management/Terminal Area Safety	58
Commercial Space Transportation Safety	61
Wake Turbulence.....	63

Unmanned Aircraft Systems Research	65
Advanced Technology Development & Prototyping.....	68
Separation Management Portfolio	71
Traffic Flow Management Portfolio	73
On Demand NAS Portfolio.....	76
NAS Infrastructure Portfolio	80
Laboratories and Support Portfolio.....	84
Enterprise, Concept Development, Human Factors & Demonstrations Portfolio	86
Unmanned Aircraft Systems	89
System Planning and Resource Management	92
William J. Hughes Technical Center Laboratory Facilities.....	94
William J. Hughes Technical Center Laboratory Sustainment.....	95
William J. Hughes Technical Center Infrastructure Sustainment.....	98
Chapter 2 – FY 2027 RD&T Programs	99
Airport Infrastructure and Technologies.....	100
Airports Cooperative Research Program	101
Airports Technology Research Program.....	103
Aircraft Safety Assurance.....	105
Fire Research and Safety	106
Propulsion and Fuel Systems.....	108
Advanced Materials/Structural Safety	110
Continued Airworthiness	111
Digital Systems and Technologies.....	113
Digital System Safety	114
Aircraft Cybersecurity	115
Weather and Aviation Systems.....	116
Aircraft Icing.....	117
Weather Program	118
Alternative Fuels for General Aviation.....	120
Advanced Vehicle Technologies & Operations.....	120
Aviation Systems Performance Analysis.....	122
Human and Aeromedical Factors	123
Air Traffic Control/Technical Operations Human Factors	124
Aeromedical Research	126
Aviation Grant Management	128
Aerospace Performance and Planning	129
System Safety Management/Terminal Area Safety	130
Wake Turbulence	131

Commercial Space Transportation Safety	132
Unmanned Aircraft Systems Research	133
Flight Deck/Maintenance/System Integration Human Factors	134
Advanced Technology Development & Prototyping.....	135
Separation Management Portfolio	137
Traffic Flow Management Portfolio	138
On Demand NAS Portfolio.....	140
NAS Infrastructure Portfolio	142
Laboratories and Support Portfolio.....	145
Enterprise, Concept Development, Human Factors & Demonstrations Portfolio	146
Unmanned Aircraft Systems (UAS) Portfolio	147
System Planning and Resource Management	149
William J. Hughes Technical Center for Advanced Aerospace Laboratory Facilities	150
William J. Hughes Technical Center for Advanced Aerospace Laboratory Sustainment	152
William J. Hughes Technical Center for Advanced Aerospace Infrastructure Sustainment	153

Executive Summary

The Annual Modal Research Plan (AMRP) outlines planned research for fiscal year 2026 (FY 2026) and the outlook for fiscal year 2027 (FY 2027). All U.S. Department of Transportation (DOT) operating administrations, or modes, must submit this plan annually to the Assistant Secretary of Research and Technology for review and approval, as mandated in 49 U.S.C. Chapter 65 (Research Planning) (Sec. 6501(a)(1)).

The FAA invests in research and development (R&D) to inform policymaking, regulatory efforts, certification, standards development, and modernization of the National Airspace System (NAS). The R&D Portfolio supports day-to-day NAS operations while addressing near-term, mid-term, and long-term aviation research needs to maintain the safest and most efficient aerospace system in the world. Additionally, FAA R&D cultivates the innovation needed to rapidly evolve the NAS and meet the demands of the next generation, making the aviation system more adaptable, resilient, and safer for all users.

The FAA's R&D Portfolio aligns with the DOT's goals of Safety, Infrastructure, Innovation, and Efficiency. Examples of program research supporting these goals include the Traffic Flow Management (TFM) Program, which is advancing development of a machine learning-model-based TFM capability to more efficiently manage airplane traffic and enhance future operational effectiveness; the Aircraft Icing Program, which is increasing safety and working to study the effects of icing on new more efficient aircraft designs; and the Advanced Vehicle Technologies and Operations Program, which is working with the aviation industry to develop certifiable aircraft and engine technologies that increase fuel efficiency while reducing noise and emissions. The FAA continues to ensure strategic goal alignment to support the vision of the Administration and maximize the safety, mobility, and efficiency of the U.S. transportation system.

STRATEGIC GOAL

STRATEGIC OBJECTIVE

SAFETY

Reaffirm that safety is the Department's top priority.

- 1.1 Improve aviation safety
- 1.2 Reduce surface transportation-related fatalities and serious injuries
- 1.3 Improve transportation worker safety
- 1.4 Develop improved safety management systems across transportation modes

INFRASTRUCTURE

Invest in high-quality transportation infrastructure capacity to unlock American prosperity.

- 2.1 Accelerate project delivery
- 2.2 Construct projects to expand system capacity
- 2.3 Improve system condition and reliability
- 2.4 Position the U.S. transportation sector for economic competitiveness at home and abroad

INNOVATION

Lead the world by bringing the best of American ingenuity to transportation.

- 3.1 Reduce regulatory burden
- 3.2 Enable transportation technology development and adoption
- 3.3 Invest in transformative technologies

EFFICIENCY

Improve efficiency and accountability across the Department.

- 4.1 Modernize DOT operations

Critical R&D Programs

The FAA invests in high-priority research and development activities to strengthen its position as the world's leading aerospace authority and to support the strategic goals of the current Administration. This section highlights critical research efforts within the R&D portfolio, although the examples provided represent only a sample of activities and do not reflect the full scope of the FAA's R&D activities.

Aeromedical Research

The Aeromedical Research Program focuses on safety sensitive personnel and airline passenger health safety, and performance in current and forecasted civil aerospace operations through targeted initiatives.

One of these initiatives is to develop biologically based diagnostic tools using biomarkers to objectively identify fatigue levels in individuals. Researchers will apply these tools to provide a reliable means of identifying pilot fatigue in aviation accident investigations. Accurate fatigue assessment is crucial to understanding the extent of the safety risk and creating a knowledge base to ensure that regulations appropriately address fatigue risks. Tools developed under this Program may also provide improved diagnostics to allow objective real-time measurement of operator fatigue for accident prevention and data-driven safety risk management.

The Program supports several key activities, including developing safety standards for next-generation seating and occupant protection, optimizing evacuation strategies through passenger behavior studies.

Airports Technology Research Program

The Airports Technology Research (ATR) Program supports the safe and efficient integration of new technologies into the airport environment. It evaluates new technologies and methods to support policies, standards, and regulatory guidance to increase air traffic and meet industry demands, in order to safely integrate new aircraft systems into the NAS.

ATR Program research includes Unmanned Aircraft Systems (UAS) detection technologies and application uses at airports; the development of new infrastructure design standards for Advanced Air Mobility (AAM); and advances in airport safety technologies such as new firefighting foams used in Aircraft Rescue Fire Fighting (ARFF) response.

Aviation Systems Performance Analysis

The Aviation Systems Performance Analysis (ASPA) Program supports the FAA's vision to demonstrate global leadership in safely integrating new users and technologies into the NAS. The ASPA Program supports this vision by advancing the agency's understanding of civil aviation technologies, including conventional aircraft, emerging entrants, and other novel technologies.

Some of the essential work this Program has been researching includes new entrants such as unmanned aerial systems, urban air mobility, civil supersonic aircraft, and commercial space vehicles. These novel technologies have unique noise characteristics that must be better understood before they can be certified and integrated into the NAS. The ASPA Program enables critical data collection to advance an understanding of how these new technologies operate, supporting their safe integration into the NAS. The ASPA program coordinates across partners to efficiently align Federal activities. Efforts across the ASPA Program ensure that the U.S. continues to demonstrate global leadership in this space, providing resources to facilitate key technical analyses that inform standards-setting, both domestically and internationally.

Commercial Space Transportation Safety

The FAA is licensing new commercial space launch vehicles powered by a combination of liquid oxygen and liquid methane rocket propellant. An accident involving a large launch vehicle full of fuel at or near a launch site could create a powerful explosion that could break windows a significant distance away during certain weather conditions.

The Commercial Space Transportation Safety Program will validate theory-based explosive yield models developed for liquid oxygen-liquid methane. The strength of the explosion, or explosive yield, is driven by several factors, such as total propellant mass in a given propellant combination of liquid oxygen-liquid methane. The FAA is developing relevant test data to model these explosions as the only significant test database exists for Rocket Propellant-1 (a form of kerosene) and liquid hydrogen, both of which have been used for decades. These traditional propellant combinations have significantly different properties than liquid oxygen-liquid methane.

Digital System Safety

The FAA is increasingly using Artificial Intelligence (AI) and Machine Learning (ML) in critical aviation systems while industry plans to use autonomous (non-piloted) aircraft under conditions where regulations and guidance do not exist. These technologies are not yet well understood in a safety-critical environment, and there is a risk that they could introduce new hazards. In addition, aircraft are increasingly dependent on complex digital avionics and flight control systems, which continue to evolve due to technological innovations and the aviation industry's desire to reduce costs and lessen the time it takes to get new products to the marketplace.

The Digital System Safety Program will focus on analyzing safety certification and airworthiness of highly integrated complex digital aircraft systems, including software and airborne electronic hardware, such as autopilots,

flight controls, and engine controls, as well as the integration of AI and ML in these products. The Program will address how these technological advances will impact current certification processes and guidance, while providing a better understanding of methods to safely certify these complex digital systems. Research results will be used to create policy and guidance for the certification and means of compliance for new aircraft and systems using these technologies. The FAA is committed to working with the aviation industry and other stakeholders to develop consensus recommendations to ensure the safe use of these technologies

Information/Cybersecurity Program

Air traffic control operations are managed by the FAA through a complex network of computer and information systems. A cyber-attack could have negative consequences on aviation safety and operations. The FAA's Aircraft Cybersecurity Program investigates technologies and techniques to ensure the safety of aircraft and related systems through research that addresses aircraft cybersecurity, including the protection of connected systems during operation and safeguarding against signal manipulation to and from the aircraft. Program research includes conducting analyses, demonstrations, and simulations, to evaluate methods to detect, prevent, and mitigate the effects of cyberattacks.

Collaborating with the aviation industry, the Program will explore cybersecurity data science (CSDS) concepts focusing on AI and ML. to address stakeholder cybersecurity concerns. Applying CSDS with AI and ML concepts to aviation industry challenges — through prototyping, experimentation, and demonstration — will enable greater collaboration and assist the aviation industry with CSDS implementation decisions. Program research results will include documented guidance for aviation industry stakeholders and standards-setting bodies to adopt cybersecurity-enhancing technologies. This will allow the aviation industry to use research lessons learned to strengthen its cybersecurity, making the broader aviation ecosystem safer and more resilient for the flying public.

Propulsion and Fuel Systems

The aviation industry is rapidly pursuing new propulsion concepts such as unducted (open rotor) composite fans and electric propulsion systems. As these new propulsion concepts emerge - such as open rotor and multi-rotor systems, potentially powered by alternative fuels and integrated into increasingly electrified architectures - new hazards and failure modes arise. This risk may not be fully addressed by current regulations, standards, or advisories. Identifying, prioritizing, and addressing such gaps require collaborative research where the FAA plays a key role through its unique capabilities.

In collaboration with stakeholders, the Propulsion and Fuel Systems Program researchers are developing performance-based standards and test methodologies to ensure the durability, endurance, and reliability of electric aircraft engines. Industry is pursuing electrically propelled designs in various aircraft types (including fixed-wing airplanes, large air carriers, and rotorcraft). The FAA has commenced electric engine durability, endurance, and reliability experiments because new propulsion system designs differ significantly from traditional fossil fuel-powered systems and require new certification rules. Although such guidance exists for electric cars, the standards are not directly applicable to aircraft due to the difference in system architecture, operating voltage, and environmental conditions experienced during flight.

Unmanned Aircraft Systems (UAS) Research Program

As the NAS continues to evolve, additional research, concept development, and validation are needed to reduce risk and identify technical and operational requirements that will provide improved services to increase its capacity, efficiency, system flexibility, and safety. As part of this evolution, work continues to integrate Unmanned Aircraft Systems (UAS) and Advanced Air Mobility (AAM) into the NAS, ensuring safe airport access, such as detect-and-avoid classifications that support beyond-visual-line-of-sight operations and cybersecurity and exploring the impact of lost link (when the pilot in command loses the communication link with the UAS aircraft).

The Unmanned Aircraft Systems (UAS) Research Program supports a unified FAA approach to safe, secure, and efficient integration of UAS and AAM into the NAS. Research performed within this Program informs the development of rules, policies, procedures, standards, decisions, training, and other outcomes needed to integrate safe and secure UAS and AAM operations into the NAS.

Collaboration Efforts

In pursuit of our mission, the FAA maintains partnerships with nearly 400 stakeholders representing other Federal agencies, academia, the aviation industry, international entities, and technical societies. These relationships support the DOT strategic goals promoting Safety, Infrastructure, Innovation, and Efficiency. FAA partners include the following groups, associations, and agencies.

Category	Partnership Examples
Federal / Interagency	Defense Logistics Agency, Department of Defense, NASA Ames, NASA Glenn, NASA Johnson, NASA Langley Research Center, National Oceanic and Atmospheric Administration, Naval Air Warfare Center, U.S. Air Force, U.S. Army, U.S. Coast Guard, U.S. Space Force, and Volpe National Transportation Systems Center.
Academia	Drexel University, Embry-Riddle Aeronautical University, George Mason University, George Washington University, Georgia Institute of Technology, Iowa State University, Massachusetts Institute of Technology Lincoln Laboratory, Mayo Clinic, Ohio State University, Rowan University, Seoul National University, St. Mary's University, University Corporation for Atmospheric Research, University of Central Florida, University of Iowa, University of Maryland, University of Melbourne, University of Reading, University of Texas, University of Washington, and Yonsei University.
Industry	Acellent Technologies, ACME, Aer Lingus, Aerospace Corporation, Aerospace Vehicle Systems Institute, Afton Chemical Company, Airbus, Air France, All Nippon Airways, Archer, Arconic, ARINC, ASTI, Bell Helicopters, Beta, Boeing, CAE, Campbell Scientific Incorporated, CNA Corporation, Collins Aerospace, Dallas Fort Worth Airport Fire Training and Rescue Center, Delta Airlines, Embraer, FLYHT Aerospace, Solutions, General Dynamics, Honeywell, Industry Turbulence Safety Action Team, Leonardo, Lockheed Martin Sikorsky, Metis Design, Metro Aviation, Robinson Helicopters, Supernal LLC, Southwest, Swiss Air, Teledyne, Textron Aviation, VAI, VRPilot, and Wisk.
International	International Air Transport Association, International Civil Aviation Organization, Loft Dynamics, Meteo France, National Research Council of Canada, Netherlands Aerospace Centre, Onera, Saab, Shell Global Solutions, UK Meteorological Office, Vertical Aviation Safety Team, and World Meteorological Organization.
Professional Societies and Other	Aerospace Industries Association, Aerospace Medical Association, Aerospace Physiology Society, Airframe Modeling and Simulation Ad Hoc Standards Committee, Air Traffic Control Association, American Institute of Aeronautics and Astronautics, American Society of Mechanical Engineers, American Statistical Society, ASME, ASTM International, Committee on Space Research, Common Standards Working Group, IEEE, Institute of Industrial and Systems Engineers, Institute of Noise Control Engineering, International Society of Air Safety Investigators, MITRE, RTCA, SAE International, United Nations Working Group on Lithium Batteries, and Vertical Flight Society

Technology Transfer (T2)/Deployment Activities

The FAA's Technology Transfer Program facilitates the transfer of knowledge and technology, developed with Federal research and development funds, to benefit the American public and the U.S. economy.

The Program disseminates federally funded research and innovations to private and public entities as required by the Stevenson-Wydler Technology Innovation Act of 1980. It brings the latest technology into FAA labs and advancing innovation out of the agency to the private sector. The program fulfills three primary roles:

- **Stimulating Collaboration**

The FAA's Technology Transfer program promotes synergy and growth between internal agency research and the aviation community. In coordination with the FAA's legal counsel, the agency allows the sharing of advanced expertise, facilities, and capabilities with the aviation industry, academia, and Federal partners. The Program uses the full range of available options to bring new technologies to the marketplace and promote economic development.

- **Encouraging and Protecting Innovation**

With the assistance of the FAA's legal counsel, the Technology Transfer Program office manages the agency's patent licensing program. Inventions patented by FAA employees are available for commercial licensing and can result in royalty revenue shared with the inventor and the agency. The FAA has held a small number of active income-generating license agreements.

- **Promoting Public Benefit**

A significant focus of the Technology Transfer Program is to facilitate the transfer of innovations and outcomes from FAA research to the aerospace industry, other Federal agencies, and the public.

FAA researchers contribute to technical advancement through various means, including traditional technology transfer mechanisms such as Cooperative Research and Development Agreements (CRADAs) and patent licenses.

The agency also disseminates its research through technical notes and reports, advisory circulars, regulatory guidance, technical findings, participation in technical society panels, and membership in international advisory organizations and other forums.

Anticipated Outcomes

To maintain the safest aerospace system in the world while being an innovator at the forefront of aviation, the FAA conducts multiple research programs to prepare the NAS for new types of autonomous vehicles that will soon become a common presence in our skies - all while ensuring that progress is made in a safe and efficient manner.

The FAA's Fire Research and Safety Program continues to address the threat of lithium battery fires in the aircraft cargo hold and cabin. Data suggests that lithium battery fires within the aircraft cabin are increasing— most commonly e-cigarette fires but also other devices. The Program generates valuable and impartial test data from laboratory and full-scale fire tests performed at the FAA's fire safety laboratories. Test data from aircraft cargo compartment fire tests will provide metrics for developing technical standards for new fire detection and suppression technologies and for fire resistant cargo containers, with the goal of enabling the safe shipment of lithium batteries. Data from engine and nacelle fire tests will provide a basis for the development of consensus-based fire test standards for engine components and for new, environmentally friendly fire suppression agents for engines. Subject matter experts from the FAA are working with manufacturing, air carriers, shippers, and international stakeholders to implement and enforce requirements relating to the safe air transportation of lithium batteries.

Although ensuring that conventional aircraft are safe from fire threats, the agency is exploring how new AAM vehicles may be able to help in emergency situations. The Unmanned Aircraft Systems (UAS) Research Program looks at the real-time capabilities and versatile functions of UAS and their ability to deploy rapidly, making them powerful tools during emergencies and for disaster preparedness and response. Improving our Nation's ability to use UAS by researching and developing best practices and tools to prepare for, respond to, and recover from

disasters will help State and local first responders and emergency management organizations adopt and implement drone technologies. The UAS Research Program will focus on creating procedures that help improve collaboration between local, State, and Federal government agencies to ensure proper coordination during disaster and emergency response situations.

Wake turbulence, rotating vortices that form behind an aircraft's wings as it flies through the air, can be hazardous to other nearby aircraft. The bigger the aircraft, the stronger the wake turbulence produced. Air traffic controllers must separate aircraft so the wake from one plane does not impact others behind it. By refining aircraft wake turbulence categories, the FAA via its Separation Management Portfolio research, has safely decreased the required separation between certain aircraft. Current research will focus on using wake recategorization to increase capacity when poor weather or other conditions require instrument flight rules (IFR) procedures. The FAA will use research results to develop standards, processes, and decision-support tools for air traffic controllers, allowing them to increase takeoffs and landings at crowded airports. This would result in fewer flight delays and cancellations, reduce in-flight operating costs, and ensure the safety of the aircraft, crew, passengers, and cargo.

R&D Portfolio Impacts on the Average Person

The FAA's R&D Portfolio delivers meaningful benefits and impacts on the average person by improving the safety, efficiency, and reliability of air travel. Ongoing research into emerging technologies and analytical tools helps ensure aviation remains safe while meeting growing demand for better air transport services. The R&D Portfolio targets critical areas such as engine failure prevention, aircraft icing, and digital systems safety, and streamlining the certification of new technologies. It also supports advancements in weather prediction, human factors integration, and alternative fuels to promote safer and more efficient flight operations. In addition, the FAA facilitates the safe integration of UAS, AAM, and commercial space operations into the NAS is also supported, ensuring these technologies are safely adopted. Moreover, efforts to improve and address wake turbulence further enhance flight safety and reduce delays. Overall, the FAA's R&D efforts help introduce new aerospace innovations safely and efficiently directly benefiting the average person.

Evaluation/Performance Measurement Efforts

The FAA's Research and Development Management Division collects, analyzes, tracks, and measures FAA-conducted research performance in multiple ways, using a combination of internal and external evaluations to review R&D program results and internal processes. The FAA actively tracks ongoing and completed products (technical presentations, conference papers, publications, etc.) and projects, National Aviation Research Plan (NARP) outputs, and Technology Transfer (T2) activities. These products, projects, and activities are tracked and measured through various reporting mechanisms including the NARP, Annual Review (AR), Portfolio Management Data System (PMDS), and the T2 Record of Activity (ROA).

The NARP presents a subset of critical research areas spread across more than 30 independent programs, while the Annual Review reports on the significant research accomplishments completed each fiscal year and provides status on activities previously identified in the NARP. The T2 ROA provides T2 performance metrics including the number and status of CRADAs, invention disclosures, patent submittals, license agreements, Centers of Excellence (COE) grant awards, and associated funding.

FAA internal evaluations include several performance tracking systems used by various offices and lessons learned sessions. In addition, the FAA's R&D Executive Board meets to review the lessons learned from the current year's R&D Portfolio development process. The purpose of the lessons learned session is to identify areas of success and opportunities for improvement for the next Portfolio development process. Meeting attendees are encouraged to engage in open discussion to identify issues and opportunities for improvement, which are recorded and addressed. After review and approval by the REB, changes are made in the Portfolio development process.

Program Changes from FY 2025 AMRP

Program	FY 2026-2027 Status
Environment and Energy	Closed
Environmental Research – Aircraft Technologies and Fuels	Closed
Advanced Vehicle Technologies and Operations	Initiated
Aviation Systems Performance Analysis	Initiated

FY 2026 RD&T Program Funding Details

RD&T Program Name	FY 2026 Pres. Budget (\$000)	Applied (\$000)	Technology Transfer (\$000)	Facilities (\$000)	Experimental Development (\$000)	Major Equipment, R&D Equipment (\$000)
Fire Research and Safety	6,647	6,647				
Propulsion and Fuel Systems	4,200	4,200				
Advanced Materials /Structural Safety	4,240	4,240				
Aircraft Icing	2,798	2,798				
Digital System Safety	5,375	5,375				
Continued Air Worthiness	8,198	8,198				
Flight deck/Maintenance/System Integration Human Factors	12,410	12,410				
System Safety Management/Terminal Area Safety	9,096	9,096				
Air Traffic Control/Technical Operations Human Factors	5,709	5,709				
Aeromedical Research	10,394	10,394				
Weather Program	15,436	15,436				
Unmanned Aircraft Systems Research	15,567	15,567				
Alternative Fuels for General Aviation	10,000	10,000				
Commercial Space Transportation Safety	4,200	4,200				
Wake Turbulence	4,728	4,728				
Information/Cybersecurity	4,596	4,596				
Advanced Vehicle Technologies & Operations	11,750	11,750				
Aviation Systems Performance Analysis	18,365	18,365				

RD&T Program Name	FY 2026 Pres. Budget (\$000)	Applied (\$000)	Technology Transfer (\$000)	Facilities (\$000)	Experimental Development (\$000)	Major Equipment, R&D Equipment (\$000)
System Planning and Resource Management	3,894	3,894				
Advanced Aviation Training Research	800	800				
William J. Hughes Technical Center Laboratory Facilities	6,597			6,597		
Advanced Technology Development and Prototyping	32,500				32,500	
William J. Hughes Technical Center Laboratory Sustainment	19,900			19,900		
William J. Hughes Technical Center Infrastructure Sustainment	23,000			23,000		
Separation Management Portfolio	13,800				13,800	
Traffic Flow Management Portfolio	9,000				9,000	
On Demand NAS Portfolio	10,000				10,000	
NAS Infrastructure Portfolio	17,100				17,100	
Laboratories and Support Portfolio	7,000				7,000	
Unmanned Aircraft Systems (UAS)	16,000				16,000	
Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio	10,500				10,500	
Center for Advanced Aviation System Development (CAASD)	55,000				55,000	
Airport Technology Research Program	41,827	41,827				
Airports Cooperative Research Program	15,000	15,000				
Administrative	15,358				15,358	
Total	450,985	215,230		49,497	186,258	

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

FY 2026 RD&T Program Budget Request by DOT Strategic Goal

RD&T Program Name	FY 2026 Pres. Budget (\$000)	SAFETY (\$000)	INFRASTRUCTURE (\$000)	INNOVATION (\$000)	EFFICIENCY (\$000)
Fire Research and Safety	6,647	6,647			
Propulsion and Fuel Systems	4,200	4,200			
Advanced Materials /Structural Safety	4,240	4,240			
Aircraft Icing	2,798	2,798			
Digital System Safety	5,375	5,375			
Continued Air Worthiness	8,198	8,198			
Flight deck/Maintenance/System Integration Human Factors	12,410	12,410			
System Safety Management/Terminal Area Safety	9,096	9,096			
Air Traffic Control/Technical Operations Human Factors	5,709	5,709			
Aeromedical Research	10,394	10,394			
Weather Program	15,436	15,436			
Unmanned Aircraft Systems Research	15,567	15,567			
Alternative Fuels for General Aviation	10,000	10,000			
Commercial Space Transportation Safety	4,200	4,200			
Wake Turbulence	4,728	4,728			
Information/Cyber Security	4,596	4,596			
Advanced Vehicle Technologies & Operations	11,750			11,750	
Aviation Systems Performance Analysis	18,365			18,365	

RD&T Program Name	FY 2026 Pres. Budget (\$000)	SAFETY (\$000)	INFRASTRUCTURE (\$000)	INNOVATION (\$000)	EFFICIENCY (\$000)
System Planning and Resource Management	3,894				3,894
Aviation Grant Management	800				800
William J. Hughes Technical Center Laboratory Facilities	6,597			6,597	
Advanced Technology Development and Prototyping	32,500			32,500	
William J. Hughes Technical Center Laboratory Sustainment	19,900		19,900		
William J. Hughes Technical Center Infrastructure Sustainment	23,000		23,000		
Separation Management Portfolio	13,800			13,800	
Traffic Flow Management Portfolio	9,000			9,000	
On Demand NAS Portfolio	10,000			10,000	
NAS Infrastructure Portfolio	17,100			17,100	
Laboratories and Support Portfolio	7,000			7,000	
Unmanned Aircraft Systems (UAS)	16,000			16,000	
Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio	10,500			10,500	
Center for Advanced Aviation System Development (CAASD)	55,000		55,000		
Airport Cooperative Research Program	15,000	5,070	9,101	603	226
Airport Technology Research Program	41,827	18,281	21,283	2,263	
Administrative	15,358			15,358	
Totals	450,985	146,945	128,284	170,836	4,920

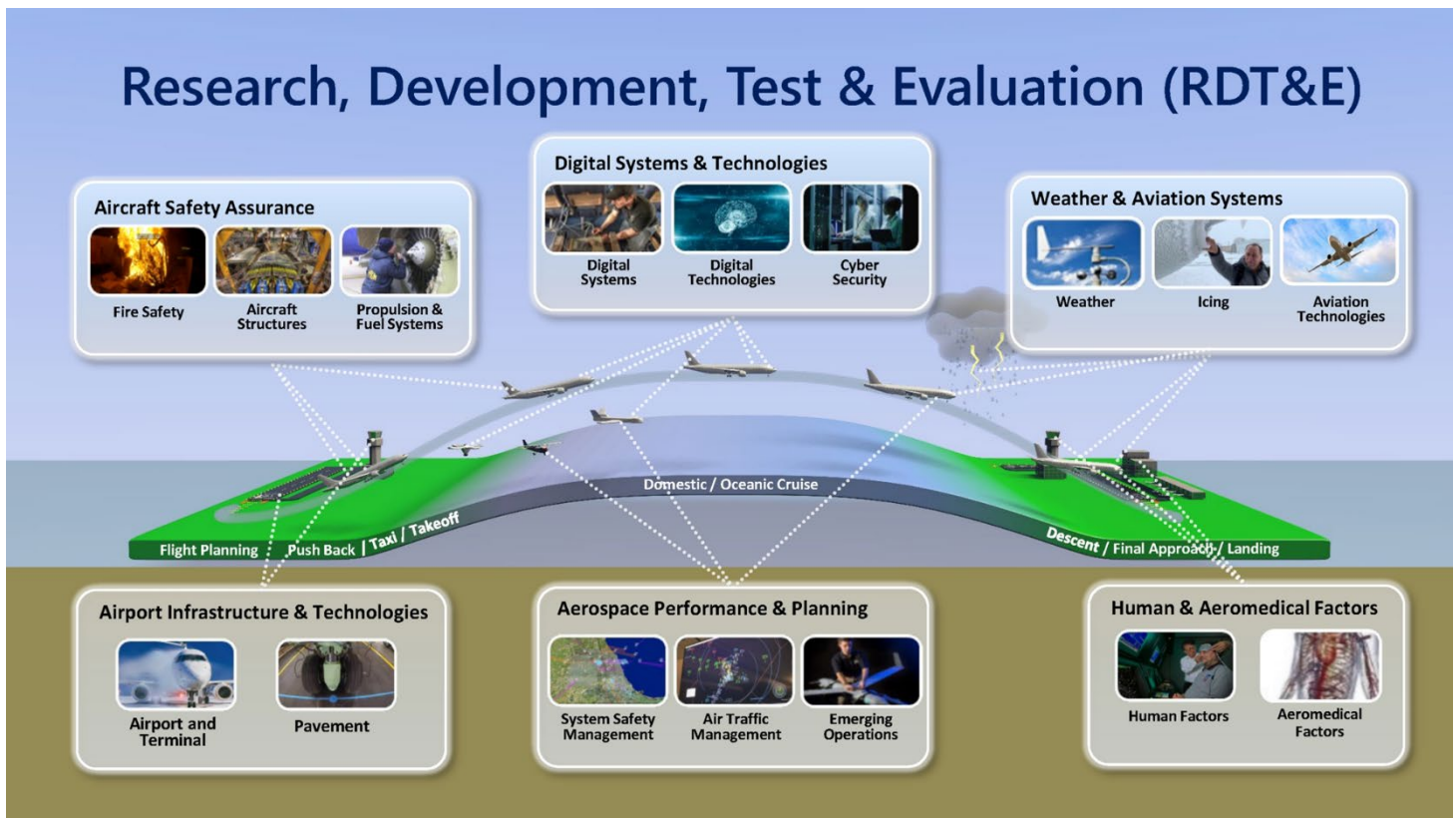
The AMRP reflects funding as found in the annual Presidents' budget request per 49 U.S.C. Chapter 65 Sec. 6501 Research Planning. The enacted numbers will be posted as part of the Presidents' budget request for the ensuing fiscal year.

Chapter 1 – FY 2026 RD&T Programs

FAA RD&T Domains

FAA research and development (R&D) goals address aviation and space research needs including air and space vehicles, airports and airport systems, spaceports, human operators, air traffic systems, air traffic information, and the customers they serve — the flying public. The goals span multiple research domains: a grouping of programs with a common focus area or body of knowledge. The research domains are:

- Airport Infrastructure and Technologies
- Aircraft Safety Assurance
- Digital Systems and Technologies
- Weather and Aviation Systems
- Human and Aeromedical Factors
- Aerospace Performance and Planning



Airport Infrastructure and Technologies

United States Department of Transportation FY 2026 Annual Modal Research Plans

Airports Cooperative Research Program Requested: (\$15,000,000)

Program Description:

The Airport Cooperative Research Program (ACRP) is designed to address needs that are not being addressed by other federal research programs, and that cannot be undertaken cost-effectively by individual airports.

The ACRP is an industry-driven research Program managed by the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine. It was authorized by section 712 of Vision 100 – Century of Aviation Reauthorization Act. The Secretary of Transportation maintains a memorandum of agreement among the Department of Transportation, FAA, and the National Academy of Sciences to implement the ACRP. The FAA Associate Administrator for Airports, as delegated by the Secretary, also appoints the 13 members of the ACRP Oversight Committee (AOC).

The ACRP is a national resource for the airport industry, providing valuable information, guidance and practical tools to airport owners and operators (as well as consultants and contractors) by performing industry-driven research identified as critical by airport operators, industry, and users.

ACRP advances safety, economic impact and global competitiveness, workforce development, and emerging technologies and processes by providing applied research products to the airport industry that address these issues. Research continues in the use of emerging technologies, improved governance, transparency, and ensuring data privacy and cybersecurity of airport operations.

Major Program Objectives:

The ACRP's mission is to develop near-term, practical solutions to problems faced by airport operators. The ACRP uses contractors selected in a competitive process to conduct research, which is overseen by industry experts and designated FAA subject matter experts. Research results are published in the form of handbooks and best practices. To date, the vast library of publications includes the areas of safety, airport management, airport financing, airport environmental quality, airport compliance, and airport planning. These publications are available to the public on the ACRP website and for purchase in hard copy.

The ACRP's main goal is to provide resources to support applied research on a wide variety of issues faced by airport practitioners, including all levels of professional staff within the airport community, from CEOs, airport managers, executive directors, to mid-level managers, non-supervisory technical and professional staff, trainees, students, and interns. These professionals represent airports, suppliers, public safety agencies, airlines, airport tenants, local and regional government authorities, industry associations, and many other stakeholders in the airport community. Each of these practitioners has different interests and responsibilities, and each is an integral part of this cooperative research effort. Although the exact projects selected for research are chosen by an industry-led oversight committee, the committee endeavors to address topics that advance the policy objectives of the Department of Transportation. In addition, the National Academies of Science ensure that research conducted is done in a way that addresses the Department's goals and ensures that research is conducted in a transparent, objective, and academically sound manner.

Anticipated Program Activities:

The AOC will meet in July of 2025 to determine FY 2026 research funding, projects, and priorities.

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

ACRP research results in a body of knowledge that is available to the public at no charge. Most research projects result in a report, synthesis, or legal digest that can be used to inform airport decision making on topics including airport operations, administration, planning, safety/security, design, finance, energy, and economics. Since Program inception, 285 reports have been published and ACRP publications have been downloaded over one million times. Ninety percent of airports believe that ACRP is valuable to the industry and conducts research that airports do not have the ability to conduct on their own.

ACRP research products are immensely valuable to the modification and modernization of airport regulations. While ACRP funded research does not directly result in regulations, the results of the research are used by FAA staff to inform revisions to advisory circulars that provide the best means of compliance for airports. These regulations include those governing airport emergency services, emergency planning, and emergency response; ensuring safe and sustainable airport infrastructure maintenance; and airport compliance with a myriad of environmental regulations, policy, and best practices. ACRP products also form a useful adjunct to regulations, providing the best industry practice where regulation is not appropriate.

Potential Economic or Societal Impacts:

The U.S. airport industry represents 11.5 million jobs and over \$1.4 trillion in annual economic output. ACRP research is designed to be applicable to most – if not all – airports and provides best practices, research, and data-driven solutions for airport operators to address common problems throughout the industry. Over 90% of Americans live within 30 miles of an airport considered part of the National Airspace System, meaning that the impact of airports' economic decisions and environmental actions extend to nearly every American. Ensuring that these decisions are made in an informed, fair, sustainable, and safe manner is a key feature of ACRP.

Potential Progress Toward Achieving Modal Strategic Goals:

The ACRP intends to continually address the Department's strategic goals. In FY 2026, ACRP meets the goals of "Safety," "Infrastructure," "Innovation," and "Efficiency" by providing applied research products to the airport industry.

Collaboration Partners:

ACRP is intended to be a collaboration between the government and the airport industry. Its governing body, the AOC, directs the Programs' priorities and identifies the most valuable airport research.

The FAA Associate Administrator for Airports, as delegated by the Secretary of Transportation, appoints the 13 members of the AOC. The AOC includes representatives from industry, academia, and national associations representing public airport operating agencies, airport executives, state aviation officials, and scheduled airlines. Representatives from both the FAA and the Environmental Protection Agency are participants in both the AOC and the project research panels. This enables members to understand the research initiatives and processes and ensures awareness of the products and results. It also allows members to participate in the research proposal or problem statement drafting and voting. In addition, AOC representatives and stakeholders are often the end users of the research products distributed.

The AOC is composed of 13 voting members and includes seven members who are chief executive officers, managers, or members of the governing boards of airports (three from large hubs, two from medium-sized hubs, and two from small hubs, non-hubs, or general aviation airports). There are five members who represent other airport stakeholders such as air carriers, consultants, universities, suppliers, or researchers. Finally, the FAA Administrator or his/her designee - presently delegated to the Deputy Associate Administrator for Airports – serves on the AOC. No single entity has more than one member on the AOC.

In addition, the following individuals serve as “ex-officio,” non-voting, members of AOC:

- The Administrator of the EPA or his/her designee
- The Administrator of the National Aeronautics and Space Administration (NASA) or his/her designee
- The chief executive of the Airports Council International–North America (ACI-NA) or his/her designee
- The chief executive of the American Association of Airport Executives (AAAE) or his/her designee
- The chief executive of the National Association of State Aviation Officials (NASAO) or his/her designee
- The chief executive of the Airlines for America or his/her designee
- The Executive Director of the Transportation Research Board or his/her designee

United States Department of Transportation FY 2026 Annual Modal Research Plans

Airports Technology Research Program Requested: (\$41,827,000)

Program Description:

The Airports Technology Research (ATR) Program supports the safe and efficient integration of new technologies into the airport environment by evaluating new technologies and methods to inform policies, standards, and regulatory guidance in response to increasing air traffic and industry demands.

The ATR Program focuses on new technology, testing, evaluation, and analysis to both update existing standards and to provide support services addressing site-specific problems at airports. For example, the ATR Program supports Unmanned Aircraft Systems (UAS) integration at airports; the development of new infrastructure design standards for Advanced Air Mobility (AAM); the integration of new firefighting foams used in Aircraft Rescue Fire Fighting (ARFF) response; and pavement research focusing on extending airport pavement life beyond the current 20-year design life.

Major Program Objectives:

The ATR Program directly supports the development and updates of the FAA's Airports regulatory guidance for airport safety and airport infrastructure, such as engineering briefs and advisory circulars (ACs). ATR Program research results and objectives are ultimately reflected in these ACs, which form the technical guidance used by airports across the nation.

On the infrastructure side, key FY 2026 objectives include searching, testing, and applicability of various recycled pavement materials and new construction methods and techniques that may be integrated into the design and construction of airport pavements. These methods and techniques will extend airport pavement life and improve construction efficiency. Since construction and rehabilitation of airport pavements represents a very large annual capital investment at airports (over \$ 2.5 billion), the use of these non-traditional pavement materials and construction methods will enhance airport safety, efficiency, and increase capacity.

On the airport safety side, in FY 2026, the ATR Program will remain engaged in solar lighting performance testing, continued in-house firefighting agent testing, reducing the risk of wildlife strikes by aircraft, researching infrastructure needs of rapidly emerging AAM vehicles, integrating UAS operations at airports, and developing tools to make better use of incident and accident data to direct research more effectively.

The Program also provides an environment where companies of all sizes can test new ideas and products to meet FAA standards. This encourages companies to be innovative in product development and competitive at the global level.

Anticipated Program Activities:

- Evaluate use of Cold Central Plant Recycling in airport pavements
- Evaluate the use of new materials to extend airport pavement life
- Leverage machine learning solutions to support innovative airport pavement design
- Continued development of airport pavement Life Cycle Assessment (LCA) framework
- Research to support development of AAM infrastructure airport guidance
- Development of Fluorine Free Foams airport guidance for aircraft rescue firefighting
- Development of UAS airport applications integration guidance

- Safe integration of autonomous ground vehicles at airports
- Solar-powered airfield lighting systems
- Maintenance of safety databases including Foreign Object Debris and Wildlife Strikes

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

Research outputs include the development of infrastructure standards for AAM vehicles, which include fueling infrastructure for electric and hydrogen powered aircraft, testing data of new firefighting agents, field performance assessment of solar technology for runway and taxiway lights, and testing and evaluation of new pavement materials. Recent advancements in solar technology present an opportunity for airports to produce on-site electricity and reduce long-term costs. In FY 2026, the ATR Program will also investigate autonomous vehicle technology and identify potential applications that could enhance the safety and efficiency of airport operations.

Overall, the ATR Program focuses on improving airport safety, and researching new technologies, materials, and processes that increase capacity and make airport operations more efficient. The Program also provides technical solutions to continuous airports modernization – directly supporting aviation’s economic growth.

Potential Economic or Societal Impacts:

In FY 2026, the ATR Program will continue research on the economic and societal impacts of AAM to airport infrastructure, including Vertical Take-Off and Landing vehicles, alternative fuels such as electric and hydrogen, and identifying ARFF response hazards with new aircraft types. Economic and societal impacts from integrating UAS applications (such as using UAS for wildlife monitoring and dispersal, pavement inspections, perimeter security, and ARFF response and post-accident investigation) will also be researched. Another research initiative will be to evaluate the impacts of integrating solar lighting into airport infrastructure. The economic and societal impacts of using new pavement materials and new construction methods and techniques to make airports safer and more efficient will also be analyzed. Continued research on the impacts of integrating autonomous ground vehicles in the airport environment (such as baggage handling and lawn maintenance equipment) is a focus for FY 2026.

Potential Progress Toward Achieving Modal Strategic Goals:

The ATR Research Program directly supports the Department of Transportation’s “Safety,” “Infrastructure,” “Innovation,” and “Efficiency” goals. Progress in the ATR program areas is made continuously, including advancements in the mitigation of runway incursions, collecting field performance data for the use of solar powered lighting technologies at airports, and actively testing pavement materials for durability at the FAA’s pavement research testing facilities.

Collaboration Partners:

In addition to the Research, Engineering, and Development Advisory Committee, the ATR Program has direct interactions with airport consultants, airport authorities, academia, airport industry manufacturers and suppliers, the paving industry (e.g., American Concrete Pavement Association, Asphalt Institute and National Asphalt Pavement Association), as well as federal partners (e.g., Department of Homeland Security, Department of Justice, Department of Defense, Department of Education). These stakeholders provide direct inputs into current needs, future trends, and FAA AC deficiencies while helping to shape the ATR Program’s research needs today and into the future.

Interagency Agreements:

U.S. Army Engineer Research and Development Center: This agreement enables collaboration and technical exchanges in airport and airfield pavement research. This collaboration benefits both organizations in the sharing of critical technical information.

Tyndall Air Force Base: This agreement enables collaboration between the FAA and the U.S. Air Force on ARFF research, using the ARFF training facility located at Tyndall Air Force Base. This collaboration provides the FAA with access to a state-of-the-art facility.

United States Department of Agriculture (USDA): This agreement enables collaboration between the FAA and USDA on the development of wildlife hazard assessment and risk mitigation plans at and near airports. This collaboration provides the FAA with access to USDA expertise.

Smithsonian Institution: This agreement enables collaboration between the FAA and Smithsonian Institution on the processing of bird remains that are collected after a collision with an aircraft. This collaboration supports a better understanding of bird strike risks near and at airports.

Department of Energy, National Renewable Energy Laboratory (NREL): This agreement enables collaboration between the FAA and NREL to research and determine AAM vehicle infrastructure needs due to increased electrical power demand and the potential introduction of hydrogen.

Volpe Center: This agreement enables collaboration between the FAA and Volpe Center to develop prioritized, risk-based tools, and recommendations to address severe weather impacts at vulnerable airports.

Cooperative Research and Development Agreements (CRADAs):

The Boeing Company: The FAA and the Boeing Company are investigating the possible need for the creation of new FAA airport design standards based on anticipated future aircraft design trends.

Dallas-Fort Worth International Airport Board (DFW): This CRADA between the FAA and DFW provides a mechanism for research and exploratory development efforts in aircraft rescue and firefighting utilizing the infrastructure of the DFW Fire Training and Research Center.

Memoranda of Understanding (MOU):

French Civil Aviation Authority (Direction Generale de l'Aviation Civil or DGAC): This MOU supports technical information exchanges in airport pavement design. This collaboration benefits both organizations in the sharing of critical technical information.

Federal Highway Administration (FHWA): This MOU supports technical information exchanges in full scale pavement testing, pavement instrumentation, pavement materials, and pavement design. This collaboration benefits both organizations in the sharing of critical technical information.

UAS Detection and Mitigation Vendors: These agreements support participation in the FAA's UAS Detection and Mitigation Research Program, which involves the deployment of technology at select U.S. airports to enable the FAA to evaluate technologies in the operational environment. The Program goal is to develop performance standards for these types of systems. This Program is in direct support of section 383 of the 2018 FAA Reauthorization Act.

Other Transaction Authority (OTA):

National Concrete Pavement Technology Center (CPTech): The FAA has a cooperative agreement with Iowa State University, National Concrete Pavement Technology Center, to support research aimed at improving the design, construction, rehabilitation, and repair of concrete airfield pavements and to aid in making them safer, more cost effective, and durable. This agreement is in direct support of section 1014 of the 2024 FAA Reauthorization Act (P.L. 118-63).

National Asphalt Pavement Association (NAPA): The FAA has a cooperative agreement with NAPA to support research aimed at improving the design, construction, rehabilitation, and repair of asphalt airfield pavements and to aid in making them safer, more cost effective, and durable. This agreement is in direct support of section 1014 of the 2024 FAA Reauthorization Act (P.L. 118-63).

Aircraft Safety Assurance

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Fire Research and Safety **Requested: (\$6,647,000)**

Program Description:

The Fire Research and Safety Program conducts research to prevent accidents caused by in-flight fire and to improve survivability during a post-crash fire. The Program supports the FAA's Associate Administrator for Aviation Safety, who is responsible for issuing regulations, standards, and guidance material to ensure the highest level of safety in commercial aviation. Research efforts specific to hazardous material transport are completed in coordination with the Department of Transportation's (DOT) Pipelines and Hazardous Materials Safety Administration (PHMSA) and the FAA Office of Hazardous Materials.

The Program benefits the public by evaluating potential fire threats on commercial aircraft through laboratory testing. The aviation industry also benefits from the development, validation, and transfer of cost-effective aircraft fire safety technology. This Program is necessary because of the catastrophic consequences of an uncontrollable aircraft fire, including loss of life and the destruction of the aircraft. An example of this Program's results is demonstrated through participation in the Society of Automotive Engineers' (SAE) G-27 committee, an international organization focused on efforts to develop a packaging standard for the safe shipment of lithium batteries on aircraft. The International Civil Aviation Organization (ICAO) requested this standard after the ban on the carriage of lithium batteries as passenger aircraft cargo. Following this ban, the Fire Research and Safety Program proposed a test standard and conducted extensive testing to understand the details and develop pass/fail criteria. The PHMSA is also participating in the development of the standard and, if adopted, would have the responsibility to change the hazardous materials shipping regulations to mandate its use.

Major Program Objectives:

The primary goals of this research are the prevention of catastrophic aircraft accidents caused by in-flight fires and increased survivability during a post-crash fire. Other benefits derived from this Program include the introduction of enabling technologies to prevent fire accidents in freighter aircraft and hidden in-flight fires in passenger-carrying airplanes, and the development, validation, and transfer of cost-effective aircraft fire safety technology to the aviation industry.

The FAA's William J. Hughes Center for Advanced Aerospace has unique aircraft fire testing capabilities that do not exist anywhere else in the world. The Commercial Aviation Safety Team, Safety Enhancement team recognized this fact, which recommended the FAA Fire Research and Safety Program conduct the research on new or improved fire standards for cargo containers and cargo fire suppression systems. The FAA Associate Administrator for Aviation Safety relies on objective research results to make decisions on required changes to certification methods as aircraft manufacturing incorporates new materials and processes that may have unforeseen consequences with respect to aircraft fire safety. Global aircraft manufacturers have no incentive to conduct research that might limit the safe use of these new materials and processes.

Major Fire Research and Safety Program objectives are consistent with the DOT's strategic research and policy objective to implement measures that mitigate or eliminate incidents among aviation operations and the traveling public. These efforts include testing and evaluation of new and emerging fire and smoke detection technologies; testing new fire-resistant cargo container materials and their efficacy in containing cargo fires, including the hazards associated with the carriage of hazardous materials; and supporting the development of a safe packaging standard for lithium batteries on passenger aircraft.

Anticipated Program Activities:

- Aircraft and occupant survivability
- Cargo safety
- Propulsion and fuels

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

The Fire Research and Safety Program generates valuable and impartial test data from laboratory and full-scale fire tests performed at the FAA Technical Center Fire Safety laboratories. Test data from aircraft materials and component flammability tests will provide insight for the revision of FAA aircraft materials flammability standards to address existing and emerging technologies and manufacturing processes including 3D printing of aircraft cabin interior components. Test data from aircraft cargo compartment fire tests will provide metrics for developing technical standards for new fire detection and suppression technologies and for fire resistant cargo containers, with the goal of enabling the safe shipment of lithium batteries. Data from engine and nacelle fire tests will provide a basis for the development of consensus-based fire test standards for engine components and for new, environmentally friendly fire suppression agents for engines.

The goal of the Program is to reduce the risk of catastrophic in-flight fires and to improve occupant survivability in post-crash fires resulting from survivable aviation accidents. Program data will have an impact on aircraft certification regulations and guidance, thus affecting the design of components and systems to ensure an equivalent level of safety.

Potential Economic or Societal Impacts:

Program economic benefits include the potential reduction in the certification cost for flammability requirements due to proposed improved flammability standards based on research to develop new flammability test methods while eliminating redundant requirements. Societal impacts include continued occupant safety from in-flight and post-crash fires as new technologies, systems, and materials are incorporated into modern aircraft designs.

Potential Progress Toward Achieving Modal Strategic Goals:

The primary goal of the Fire Research and Safety Program is the prevention of catastrophic aircraft accidents caused by in-flight fires and increased survivability during a post-crash fire. This goal is aligned with the DOT strategic goal of “Safety” and directly contributes to the key performance indicator to maintain the commercial air carrier fatality rate at or below the target of 4.9 fatalities per 100 million persons on board.

Collaboration Partners:

The Program collaborates with domestic and international partners to coordinate aircraft fire safety forums and triennial conferences that are well attended by aircraft and aviation system manufacturers, operators, foreign regulatory authorities, and other research institutes and universities. Forum and conference topics cover the full range of aircraft fire safety research, conducted by the FAA and other attendees.

Program partners include:

- *International Civil Aviation Organization (ICAO)*: Research conducted to document the fire hazards involved in the air transport of lithium batteries has been presented to the ICAO Dangerous Goods Panel and Airworthiness Panel as part of the decision-making process that led to a ban on the shipment of these types of batteries on passenger aircraft until a safe shipping method is developed. Research has also been

conducted to support the development of a safe shipping method through contributions to the SAE International committee tasked with developing the new standard.

- *European Aviation Safety Agency*
- *DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)*
- *Boeing Commercial Airplanes:* Testing has been conducted at the FAA in partnership with Boeing and fire suppression suppliers to evaluate proposed halon replacement fire suppression systems for engines and cargo compartments. The data generated from these tests will allow system certification to progress within the FAA.
- *Airbus:* Testing has been conducted at the FAA in partnership with Airbus and fire suppression suppliers to evaluate proposed halon replacement fire suppression systems for engines. The data generated from these tests will allow system certification to progress within the FAA.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Propulsion and Fuel Systems

Requested: (\$4,200,000)

Program Description:

The FAA establishes rules for the certification and operation of aircraft engines, fuels, and fuel management systems that enhance the airworthiness, reliability, and performance of air transport. The Propulsion and Fuel Systems Program conducts research that provides the FAA with the basis for new or revised engine certification and continued airworthiness standards. This research also supports FAA actions in response to National Transportation Safety Board safety recommendations. Moreover, it enables the preparation of advisory circulars that provide the industry with technical information on acceptable means of compliance with regulations. While increasingly rare, engine failure remains a major cause of aviation incidents. As new propulsion concepts emerge, such as open and multi-rotor, potentially powered by new fuels such as sustainable aviation fuel or hydrogen in complex, increasingly electrified architectures, new hazards and failure modes arise that may not be fully addressed by current regulation, standards, or advisories. Such gaps need to be identified, prioritized, and addressed as needed through collaborative research where the FAA plays a key role through its unique capabilities. Benefits accrue in the form of reduced risk of engine failures and fewer accidents, leading to fewer injuries and fatalities.

Major Program Objectives:

The Propulsion and Fuel Systems Program supports the Administration's principles regarding safety and American competitiveness. The Program conducts research on new and legacy aircraft propulsion systems to develop the technical basis for rules, policy, and guidance used for certification and continued airworthiness.

The Program is focused on three key elements: safe electrified propulsion, safe hydrogen propulsion, and multi and open rotor safety. The first two areas support safe implementation of emerging technologies that will play a key role in the aviation of tomorrow, including new business models such as advanced air mobility. The third area enables streamlined, model-based certification for multi-rotor aircraft, currently proposed in a variety of transport and cargo applications, as well as high efficiency open-rotor engines. The Program will develop data, models, and means of compliance methods to reduce and eliminate hazards associated with these areas.

The electrified propulsion effort will focus on the durability, endurance, and reliability of key powertrain components, such as batteries, electric motors, power converters, and high voltage interconnect systems under cycling conditions (altitude/pressure, temperature, humidity, load, and vibration) representative of proposed aircraft operations. Such components are expected to be present across the entire spectrum of electrified configurations, from full electric/batteries or fuel cells to various parallel or series hybrid electric architectures.

The safe hydrogen propulsion effort will address well recognized and emerging safety risks associated with gaseous and liquefied hydrogen storage, distribution, and use in aircraft propulsion systems. Key risks for hydrogen use are fire and explosion, although additional concerns exist with respect to material compatibility (e.g., embrittlement and permeation), crashworthiness, installation, fueling and handling, as well as cryogenic exposure physiological hazards. Hydrogen is much easier to ignite, burns faster, hotter, and remains flammable over a much wider range of concentrations in air than hydrocarbons. Colorless and odorless, hydrogen diffuses faster than other fuels. Once initiated, a hydrogen fire may only be safely extinguished by shutting off the fuel supply. Consequently, it is critical to understand, detect, and control leakage from fuel system components under realistic operating conditions, including hydrogen use as cryogenic coolant in systems exposed to turbine exhaust gases. In addition, risks will be addressed arising from requirements of engine start-up and altitude relight where hydrogen could ignite

uncontrollably within the propulsion system. Finally, the crashworthiness of large, liquefied hydrogen tanks will be addressed to ensure survivability in the event of an emergency landing.

Multi and open rotor safety builds on methodologies developed to mitigate the risk of uncontained engine failures, such as the LS-DYNA® software that is used by industry to simulate rotating parts liberation, impact, and penetration. Open rotor, as well as multi rotor systems (as proposed in advanced air mobility applications) pose concerns with respect to cascading failure of the propulsion system, as well as cabin and fuel tank safety, especially when coupled with use of hydrogen tanks. This Program develops advanced analysis methods and modeling tools to evaluate propulsion containment systems, shielding for critical areas, and vulnerability analysis tools necessary to protect the aircraft and its passengers.

To accomplish these objectives, research will be pursued through government and industry collaboration to ensure that a consistent level of safety is widely adopted by the engine industry.

Anticipated Program Activities:

- Safe electrified propulsion
- Safe hydrogen propulsion
- Multi and open rotor safety

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

Program research activities are focused on the certification and continued airworthiness of aircraft propulsion systems including traditional gas turbine engines and innovative electric propulsion designs. Data from these activities will support the issuance of new regulations, standards, advisory materials, and software having broad applications across the FAA and aviation community. Specific outputs include data and models of battery performance aging under aircraft load and environmental conditions, electric drivetrain performance under simulated flight conditions, guidance for safe wire spacing and maintenance intervals for high voltage cabling, assessment of methods for efficient and accurate hydrogen leak detection at both micro and macroscale, definition of levels and impact of such leaks, tools for assessment and mitigation of aircraft fire and explosion hazards, crashworthiness of liquid and gaseous hydrogen tanks, and simulations of multirotor configuration cascading failure. The Program will support the development of electric propulsion standards related to the safe use of high voltage interconnect systems, large aircraft electric engines, hydrogen-powered fuel cells and combustion engines, as well as hybrid electric systems.

Potential Economic or Societal Impacts:

Research conducted by this Program will result in the continued safe operation of legacy engines and pave the way for streamlined adoption of new propulsion solutions that will enable future aircraft to provide convenient and cost-effective service to all communities. This expansion to previously underserved markets will present new opportunities for economic growth and prosperity.

Potential Progress Toward Achieving Modal Strategic Goals:

One of the objectives of this program is to address innovation through research into electrically propelled aircraft systems. This Program will make progress towards removing barriers to new entrants in aviation by conducting research to support expanded access and use of electric-powered transportation and supporting infrastructure. It will also advance the development and deployment of alternative fuel technologies. It will accomplish these research objectives by ensuring new electric technologies have a safe and clear path of integration into the National Aerospace System.

Collaboration Partners:

FAA researchers are working extensively with traditional turbine engine manufacturers and new industry entrants proposing unconventional and more efficient alternatives. To ensure safe introduction of these novel propulsion technologies, the FAA collaborates with large engine original equipment manufacturers that pursue hybrid electric or hydrogen propulsion concepts, as well as new entrants that use multicopter, distributed electric propulsion architecture powered by batteries, fuel cells, combustion engines or hybrid combinations thereof. The FAA also collaborates with other governmental agencies, both foreign and domestic (e.g., NASA, Department of Defense, Department of Energy National Renewable Energy Laboratory (NREL), European Union Aviation Safety Agency, Civil Aviation Authority of the United Kingdom, Transport Canada), universities, standards organizations (e.g., SAE, European Organization for Civil Aviation Equipment.) and other entities to share data and leverage prior and current research.

Program partners include:

- Airbus
- Wisk
- Boeing
- RTX
- Pratt & Whitney
- General Electric
- Department of Energy/NREL
- Department of Defense (United States Air Force Research Laboratory)
- NASA (Glenn, Ames, Johnson)
- Foreign Regulators (EASA, Transport Canada, CAA UK)
- Joby Aviation
- MagniX
- ZeroAvia Piasecki Aircraft
- Stanford University
- University of Maryland
- Massachusetts Institute of Technology
- Washington University

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Advanced Materials/Structural Safety

Requested: (\$4,240,000)

Program Description:

The Advanced Materials and Structural Safety Program conducts research to support FAA safety and regulatory activities in the technical areas of composites and other advanced materials and processes, and their impact on flight safety. The overall goal of this research is to support the development of standardized certification protocols and safe maintenance practices for advanced materials and structural applications. This research program is a proactive approach to preventing accidents rather than the reactive approach to preventing the recurrence of accidents pursued in the past. The Program coordinates its efforts with industry to provide data to support the FAA's oversight role of ensuring new technologies are adopted safely, as well as its mandate not to place an undue burden on industry.

Major Program Objectives:

The Advanced Materials and Structural Safety Program research objectives are to understand and document fundamental behaviors of materials and structures; establish methods of compliance to regulations; document background information on lessons learned and best practices in achieving form, fit, and function for a lifetime of structural application; and develop and maintain an educated workforce. The Program strives to understand the risks associated with introduction of new materials, manufacturing methods, and structures, and develops ways to mitigate them. Major program objectives are to:

- Develop methods to characterize and control new materials and processes to achieve consistent part performance
- Investigate long-term behavior and aging mechanisms of materials and structures to develop appropriate life management practices
- Develop certification methods that ensure safe and efficient introduction of new materials and structures in future aviation products
- Understand smart manufacturing and its regulatory and safety implications

Program objectives are driven by industry advancements in the construction of aircraft structures, systems, and engines presented for certification. The FAA must ensure that the changes maintain an equivalent or improved level of safety for the traveling public compared to that achieved with current operational aircraft. Program objectives align with the Department of Transportation (DOT) strategic research and policy objective of advancing transportation safety by building an evidence basis to support performance-based federal safety standards and regulations for transportation technologies.

The Program supports development of industry handbooks and other standardization activities, and promotes knowledge sharing for advanced materials and structures, including evaluation of emerging supporting technologies with industry as well as internally within the FAA. This objective helps strengthen the use of informed, data-driven decision-making and use of comprehensive approaches such as safety management systems.

Anticipated Program Activities:

- Aging behaviors of advanced materials and structures
- New manufacturing process controls and guidelines
- Behavior of advanced materials in large scale structures

- Modern inspection methods evaluations

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

A National Transportation Safety Board review of accidents provides additional impetus to understand advanced materials as new technologies emerge. The Advanced Materials and Structural Safety Program research has identified and investigated many issues that were either unknown or poorly understood. By taking a proactive approach, the Program will ensure civil aircraft manufactured with advanced materials are safe and reliable. This Program saves lives by preventing accidents.

The Advanced Materials and Structural Safety Program coordinates its efforts with industry to support the FAA's oversight role of ensuring new technologies are adopted safely, as well as meeting its mandate not to place an undue burden on industry. Program research aims to provide a proven means of compliance with regulations for material process characterization and control, resulting in public databases and specifications that are widely used by the aviation industry. Research also aims to develop more efficient certification procedures for rotor blades, in-situ monitoring for additive manufacturing, and composite repairs. These enhanced methods promote standardization and efficiency while achieving equivalent levels of safety. Program outputs are needed by FAA personnel to develop policy, guidance, and training; drive industry group engagement; and inform continued safety evaluations. Materials and structures are a common technology across all product types and new applications (e.g., Advanced Air Mobility). Program output supports multiple DOT safety research priorities and objectives to advance transportation safety by evaluating the safety of existing aviation technologies and supporting the safe integration of emerging technologies.

Potential Economic or Societal Impacts:

The use of advanced materials is central to a vibrant aviation industry in the United States. As the methods of structural verification are being extended to new components and aircraft applications, it is important to understand acceptable safe design limits that have not been explored with composite materials and structures to advance air transportation safety. This research enables the introduction of advanced materials, processes and structures into aviation products by investigating fundamental behaviors, providing public material data and specifications, and documenting best practices and lessons learned. These activities collectively lead to increased standardization and certification efficiency, while maintaining safety.

Potential Progress Toward Achieving Modal Strategic Goals:

Data produced, testing protocols developed, and best practices documented by this Program to evaluate structural behavior and characterize material properties of advanced materials are published by consensus-based international standards organizations. This information is currently used as guidance for industry to certify existing and new aviation products. In this context, progress was made to develop a repeatable qualification framework including specifications and statistical allowables, to generate data for use in qualifying composites, and to publish this data in shared/public databases and industry standards that ultimately help standardize certification of aviation products that use composite materials.

Collaboration Partners:

The Advanced Materials and Structural Safety Program is a collaborative effort between the FAA, aviation industry partners, other government agencies, and academia including the DOT-FAA Joint Centers of Excellence (COE) for Advanced Materials (JAMS). JAMS was established through a competitive bidding process in 2004. The 2024 FAA Reauthorization Act mandates the FAA to maintain the COE to conduct research on advanced composites and to advance use of additive manufacturing in aviation. Currently, there are seven active member universities and numerous cost-sharing industry partners collaborating with FAA on JAMS research projects.

Additionally, Program research outputs are often incorporated into the Composite Materials Handbook (CMH-17), which serves as an industry consensus document on advanced materials and manufacturing processes. FAA chairs the CMH-17 organization and utilizes the handbook to publish program activity output, such as material data and best practices to support consensus-based industry guidance.

The current list of partners includes over 30 corporations, industry standards bodies, government agencies, and other academic and research institutions listed below.

- European Aviation Safety Agency
- Transport Canada Civil Aviation (via Collaborative Research and Development Agreement - CRADA)
- Boeing (via CRADA)
- Airbus
- Bombardier
- Spirit Aerospace
- Sikorsky (via CRADA)
- Columbia Helicopters (via CRADA)
- US Coast Guard
- DOD (via the Joint Material and Database Development (JMADD) program)
- America Makes (via JMADD)
- University of Washington (via JAMS)
- Wichita State University (via JAMS)
- Washington State University (via JAMS)
- Mississippi State University (via JAMS)
- Auburn University (via JAMS)
- University of California San Diego (via JAMS)
- University of Utah (via JAMS)
- National Institute of Aviation
- NASA (via the Hi-Rate Composite Aircraft Manufacturing project)
- Supernal (via CRADA)
- Jet Zero
- Technical University of Denmark
- Polish Institute of Aviation
- Toray Industries, Inc.
- SAE International
- ASTM International
- CMH-17
- Metallic Materials Properties Development and Standardization
- Sekisui Aerospace

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Continued Airworthiness

Requested: (\$8,198,000)

Program Description:

The Continued Airworthiness Program promotes the development of technologies, procedures, technical data, and performance models to prevent accidents and mitigate accident severity related to civil aircraft failures as a function of their continued operation and usage. The Program will prioritize research against persistent and active risks, spanning across the breadth of the FAA's aviation safety portfolio. The Program focuses on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, development of inspection technologies, and the safety of mechanical systems.

The quest for improved fuel, operational efficiency, and lower environmental impact is driving the evolution of aircraft at an unprecedented rate. Advances are being made in every aspect of aircraft design and manufacturing methods including new structural alloys and repair methods, additive manufacturing, and new fastening methods; structural technologies such as structural bonding and welding; and avionics. There is also a high level of interest from the aviation industry in increasing the use of modeling and simulation and advanced inspection methods. The FAA must ensure that these new technologies are safe, not only as they enter the airspace, but also throughout the life of the aircraft. This requires a deep understanding of the effects of aging, environmental exposure, and in-service damage to ensure that they are adequately addressed during the certification process.

The Continued Airworthiness Program works with industry and other U.S. government agencies to perform the research required to develop such a body of knowledge. The data developed and insights gained are used to create and update guidance and policy, inform airworthiness directives, enhance the elements of implementation of existing continued operational safety (COS) programs, and create industry standards. The Program focuses on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, continued safety of aircraft engines, development of advanced inspection technologies, and mechanical systems.

Major Program Objectives:

The Continued Airworthiness Program supports the FAA aviation safety oversight responsibility to ensure that aircraft maintain operational safety as they age. The FAA accomplishes this in two ways: first, by anticipating aging issues during the certification process and ensuring that they are adequately covered in the operations and fleet lifecycle management for specific aviation applications; and second, by monitoring the in-service data as it is accumulating, finding issues at the earliest possible point, and ensuring that they are effectively managed through advisories, directives, regulation, or other guidance.

It is also important to conduct research to understand what makes the current systems safe, so that effective mitigations can be leveraged for other risks. The Program, in partnership with oversight systems, must correlate a comprehensive risk picture with the performance of safety controls.

Since its establishment, the Program has led extensive studies on the in-service behavior of airframe structures and aircraft systems, and more recently added safety-critical turbine engine components to the scope. The knowledge and information produced directly supported a wide range of FAA safety rulemaking, including the Aging Aircraft Safety Rule (2005), the Widespread Fatigue Damage Rule (2010), the Damage Tolerance Data for Repairs and Alterations rule under 14 CFR Part 26 (2007), Order 8110.104, Responsibilities and Requirements for Implementing Part 26 Safety Initiatives (2007), as well as related guidance materials and advisory circulars for aircraft and turbine engine structures and components.

Anticipated Program Activities:

- Evaluate the certification and continued airworthiness issues associated with conventional and emerging metallic technologies
- Reliability of structural health monitoring (SHM)
- Airframe structures modeling and simulation validation and credibility-assurance framework (CAF)
- Addressing premature in-service cracking of certain structural aircraft aluminum components due to environmentally assisted cracking (EAC)
- Advanced inspection, damage tolerance and risk assessment methods for engine life limited parts (LLPs) and fan blades
- Research methods for expanding data collection in support of continued airworthiness improvements
- Evaluate technologies and methods to reduce time between detection and mitigation

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

The Program produces data on the safety, reliability, maintenance, and performance of both existing and emerging structural materials and technologies, including safety-critical airframe structures and propulsion system components. This data is used to create industry standards, FAA guidance, and to develop airworthiness directives and regulations. These documents are essential to the FAA's mission of ensuring the safety of the National Airspace System.

Potential Economic or Societal Impacts:

This Program enables the improved effectiveness and efficiency of the FAA's certification process, as well as the effectiveness of existing COS program implementation methods. It helps the FAA ensure that aircraft are safe when they enter service, remain safe during their operational life, and do not place an undue burden on industry. By doing so, it both ensures the safety of the American flying public and supports vast improvements in aviation industry efficiency that have been realized in recent years. The interplay between the two certification goals - safety (certification effectiveness) and speed (certification efficiency) - has been increasing as aircraft have started to evolve at an unprecedented rate. The aviation industry is under increasing pressure from rising fuel prices, increasing demand for environmental responsibility, and rising global competition. To meet these demands, the industry is adopting new technologies in almost every facet of the aircraft and propulsion systems including materials, structures, manufacturing, repairs, and maintenance. The FAA must have the knowledge to ensure proper certification processes, issue and maintain guidance, and foster development of industry standards to improve certification effectiveness and efficiency to benefit the agency and the U.S. aviation industry. In addition, the FAA must also effectively address safety issues that arise during operations through updates to guidance, airworthiness directives, and other means. This Program works closely with industry in its final stages of research and deployment of new technologies. Through this collaboration, the FAA ensures early stakeholder engagement and information exchange, that it has sufficient knowledge to adjudicate certification applications in a timely manner, and a common understanding of the safety issues. Also, working with industry in a cost-sharing agreement both leverages the FAA research funds, allowing the program to do more, and ensures that research efforts are focused on emerging technologies that have a strong industry buy-in and therefore a high likelihood of being implemented on a large scale across the aviation sector.

Potential Progress Toward Achieving Modal Strategic Goals:

This program is crucial to the FAA's effort to ensure that new technologies are safe as they enter operations and that they remain safe during their operational life. Therefore, it supports the Department of Transportation's operational goal of "Safety."

Collaboration Partners:

The main source of public and stakeholder input comes from industry outreach and working groups, public standards committees, and technical coordination with other U.S. government agencies. The Program routinely participates in both FAA and industry activities, such as aviation rulemaking advisory committees, Commercial Aviation Safety Team, SAE International, American Society for Testing and Materials, American Society of Mechanical Engineers (ASME), RTCA, and other aerospace standards organizations. Through these groups, the Program gathers input from those most affected by the research and ongoing programs.

The Continued Airworthiness Program also participates in various interagency groups including NASA, the Department of Defense (DoD), National Institute of Standards and Technology, and the U.S. Coast Guard. The Program also teams with original equipment manufacturers (OEM) and tier one manufacturers such as Boeing, Bombardier, Bell, Sikorsky, Airbus, Gulf Stream, Dassault, Embraer Honeywell, Teledyne, Arconic, Ametek GE, magniX, Supernal, Denso, and various others through direct contracts and cooperative research and development agreements (CRADA). Finally, the Program collaborates with several industry working groups (e.g. Aerospace Industries Association (AIA) Rotor Integrity Steering Committee, Aerospace Industries Association Rotor Manufacturing team, AIA Inspection Team, Jet Engine Titanium Quality Committee, Jet Engine Nickel Quality Committee) and consensus-based public standards development organizations. This Program is also informed by the outputs of the recently completed major industry-government working group efforts such as Aviation Rulemaking Advisory Committee Transport Airplane Metallic and Composite Structures Working Group.

Collaborative research with industry includes the following areas:

Structural Integrity:

- The *Damage Tolerance and Durability Issues for Emerging Metallic Technologies* research is being conducted in close collaboration with industry through CRADAs. These cost-share agreements leverage resources to address areas of mutual interest that benefit all partners that include cost savings, utilization and sharing of available facilities, and expansion of general knowledge base. Partnerships with Bombardier, Arconic (formerly ALCOA), Constellium, and Embraer are assessing emerging metallic structures technology through testing and analysis of advanced fuselage configurations using the FAA's Full-Scale Aircraft Structural Test Evaluation and Research and structures and materials labs. Industry contributions include material and fuselage panels for testing, engineering time for analysis, and providing supporting data.
- The *MMPDS Support and Design Values for Emerging Materials* research leverages FAA resources and funding through government-industry consortia in the development of the Metallic Materials Properties Development and Standardization (MMPDS) handbook, recognized worldwide as the premier source of metallic material allowables¹. The government steering group includes the FAA, NASA, and DoD while the industry steering group consists of 35 companies representing the major material suppliers and manufacturers of aircraft and aerospace vehicles worldwide.
- The *Assessment of Damage Mechanisms for Certain Aircraft Structural Aluminum Alloys due to the EAC Degradation Mechanism* is being conducted in close coordination with U.S. Air Force (USAF) Research Laboratory, European Union Aviation Safety Agency (EASA), several industry stakeholders including Boeing, Airbus, Embraer, Arconic and Constellium, and academic institutions.
- The *Reliability of SHM* research is being conducted in close collaboration with industry through CRADAs with Boeing, Embraer, Metis Design, Acellent, and Simmonds Precision Products Inc., a Collins Aerospace Company. This activity produces data to aid in the development of industry standards for SHM systems in

¹ For more information on metallic material allowables, see mmpds.org.

collaboration with the SAE Aerospace Industry Steering Committee for SHM, as well as FAA guidance and training.

- Viability of *Using SHM for Large-Scale Damage Monitoring of Aircraft Structures* research is being conducted to assess the feasibility of using SHM methods to monitor fatigue-related progressive damage of metallic aircraft structures that may be consistent with the wide-spread fatigue damage mechanisms. The initial study will focus on chem-milling related cracking of fuselage structures subject to an FAA Airworthiness Directive (AD). This work will be done in close collaboration with industry, including Boeing and Southwest Airlines, that will support the project through providing product-specific technical expertise and test articles, as well as with American Institute of Steel Construction-SHM committee subject matter experts.
- Development of the experimental data in support of the *Airframe Structures Modeling and Simulation Validation and CAF* will be performed in close collaboration with the ASME Verification, Validation, and Uncertainty Quantification-90 subcommittee, including several major aircraft OEMs (e.g. Boeing, Airbus, Textron, Embraer, Dassault), other government agencies (e.g. NASA, USAF), national aviation authorities (EASA, Transport Canada Civil Aviation, National Civil Aviation Agency of Brazil) and research partners (e.g. SwRI and National Research Council of Canada).
- The *Airframe Structure Modeling and Simulation Validation* research will be performed in close collaboration with industry partners to generate data necessary to evaluate the effectiveness of experimental validation frameworks for advanced modeling and simulation applications.

Digital Systems and Technologies

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Digital System Safety **Requested: (\$5,375,000)**

Program Description:

The Digital System Safety Program aims to understand and mitigate safety risks in digital airborne systems and equipment and provide a safety assurance framework to enable FAA approval and use in a safe operational environment. Airborne system designs have become increasingly dependent on highly integrated software and hardware architectures that share power, computing, networking, input/output, and other resources to support the needs of multiple aircraft functions. Additionally, the increased use of commercial-off-the-shelf devices and proposals to use new and novel airborne electronic hardware and software implementation techniques such as artificial intelligence (AI) and machine learning (ML) were not envisioned by traditional development assurance methodologies. The main goal of the Digital System Safety Program is to analyze airworthiness and certification aspects of these highly integrated, complex digital aircraft systems, including development assurance processes, and evaluate methods to improve and streamline certification efforts.

The Digital System Safety Program takes a proactive approach by analyzing the safety implications and assurance challenges of emerging technologies such as AI and ML. This forward-thinking analysis allows the Program to develop innovative criteria and concepts to address these challenges before they become roadblocks. Ultimately, the Program's research supports the Department of Transportation's (DOT) broader safety objective of ensuring automation enhances safety and paves the way for performance-based, rather than prescriptive, regulations.

Major Program Objectives:

Research conducted within the Digital System Safety Program differs from industry research. The Program's focus is considering new technology, materials, and procedures while maintaining or increasing current safety levels. The Program's main sponsor is the regulatory community, which can be hindered by proprietary and intellectual property rights. The programs under this budget line item (BLI) provide the aviation community with publicly available data and insight for consistent aircraft certification safety. The Digital System Safety Program demonstrates a commitment to exploring new technologies and improving safety practices through research and collaboration. This aligns well with the DOT's objective of designing a future-proofed transportation system through purpose-driven innovation.

The research requirements will provide additional insights into the safety vulnerabilities of complex digital systems that are developed, integrated, or verified using unproven processes, techniques, and methodologies that could introduce a safety risk for undetected errors with failure manifested at the aircraft level. Digital Systems Safety research will be used to develop policy, guidance, and training for new technologies and techniques to ensure their safe use in aircraft systems. The Program also seeks to understand, address, and provide an annual measurement indicator of Safety Data Sheets-related ongoing operational safety issues.

Anticipated Program Activities:

- Evaluate AI/ML applied to airborne systems and equipment
- Use of AI to improve safety

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

The Program's focus on "alternative means" for approving complex systems can lead to the development of new guidance for the assurance of emerging technologies. This will likely involve leveraging advancements in areas like AI and ML used to enhance development assurance processes. Also, the research on AI/ML safety will directly support the modification and modernization of FAA policy concerning these technologies. By identifying and mitigating potential safety risks, the program will pave the way for clear and comprehensive guidance related to AI/ML integration in airborne systems. This will provide a solid foundation for the safe and secure implementation of these powerful technologies.

Potential Economic or Societal Impacts:

Investing in research that improves airborne system safety unlocks significant economic and societal benefits. By developing robust criteria for evaluating the use of AI/ML in airborne systems and equipment, this Program empowers the FAA to facilitate the timely and safe integration of advanced digital technologies in air transportation. This paves the way for a more efficient and reliable aviation system, fostering economic growth and societal progress through reduced operational costs, and enhanced passenger confidence.

Potential Progress Toward Achieving Modal Strategic Goals:

This Program supports the Department of Transportation's goal of "Innovation." Advances in electronic hardware and software implementation techniques (such as AI and ML) have the potential to transform the aviation industry. These powerful tools allow evolving, highly integrated systems to leverage the increased volume, velocity, and veracity of data across the aviation ecosystem. The research products of this Program will facilitate the safe integration of these innovations to support the needs of the future air transportation system.

Collaboration Partners:

The main source of public and stakeholder input is from FAA Subject Matter Experts (SMEs) on the BLI Planning Teams. These SMEs routinely participate in both FAA and industry activities, such as Aviation Rulemaking Advisory Committees, Commercial Aviation Safety Team, SAE International, RTCA and other aerospace standard organizations. Through these venues, the members gather input from those most affected by the research and present, ongoing programs.

Industry, academia, and other agencies are actively involved in cooperative research tasks to conduct research and develop consensus standards for digital systems assurance of software and hardware. Work is also done with NASA Langley, Naval Air Warfare Center, National Resource Council of Canada, Aerospace Vehicle Systems Institute (a consortium of industry original equipment manufacturers such as Boeing, Airbus, Embraer, Honeywell, GE, and Collins Aerospace), other government agencies, academia (such as George Washington University, Carnegie Mellon University, Rowan University), and standards bodies (such as RTCA and SAE International).

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Information/Cyber Security

Requested: (\$4,596,000)

Program Description:

The Information/Cybersecurity Program is pivoting its focus to address evolving threats associated with the use of standardized signals. The Program's goal is to mitigate safety risks to aircraft operations that derive from cyber vulnerabilities, including the manipulation of signals to the aircraft from unauthorized transmitters.

The second focus area for Information/Cybersecurity Program research involves "aircraft supersystems." Drones and other operational concepts are introducing connections to the aircraft from ground control stations or networks that can affect the safety of the aircraft operation. Traditional aircraft cyber strategies that isolate safety-critical aircraft networks are not readily adapted to extending those networks off the aircraft, which can involve the use of commercial off-the-shelf equipment and cloud services.

Major Program Objectives:

Standardized signals are those radio frequency signals to and from the aircraft for which the FAA or Federal Communications Commission (FCC) specifies signal characteristics, system functionality, and performance. These include communications, navigation, surveillance signals, which are standardized internationally and for which cybersecurity safety cannot be the sole responsibility of the aircraft designer or operator. Historically, these signals (including the Global Positioning System (GPS)) were viewed as "trusted" and outside the scope of standards bodies considering methods for aircraft systems information security protection. Recent events, both domestically and abroad, have made it readily apparent that signals received by the aircraft cannot in all cases be trusted. Radio altimeter, weather radar, and standardized "command and control" (C2) and "detect and avoid" are also considered standardized signals, whose characteristics are defined by FCC requirements and FAA standards (through technical standard orders). Where cyber safety is managed outside of the signal itself, such as end-to-end proprietary encryption on a C2 link, there may be no relevant cyber safety issue to address, but the signal itself should be considered to ensure coverage of any risks. Program objectives will include:

- Cataloging vulnerabilities of the usage of standardized signals through threat informed risk assessments
- Evaluating through experimentation the operational impacts and potential mitigations (both aircraft and connections)
- Scaling experiments according to the vulnerability or mitigation to be evaluated
- Exploring cybersecurity strategies to strengthen the safety posture of aircraft supersystems which rely on connections to and from the aircraft for operation (considering, at a minimum, the use of commercial-off-the-shelf and the interaction/usage of cloud services)

Anticipated Program Activities:

- Exploitation of standardized aircraft signals
- Exploration of cybersecurity protection means for aircraft supersystems that rely on connections to and from the ground

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

The goal of the Information/Cybersecurity Program is to support the development of standards and guidance as they pertain to cybersecurity safety of aircraft operations. More specifically, the immediate focus is on developing

authenticated GPS services and mitigating manipulated/spoofed GPS signals and data to improve the cyber resiliency of position, navigation, and timing systems.

Potential Economic or Societal Impacts:

The aviation ecosystem is constantly in a state of change and enhancement, increasing in connectivity and complexity, and continually opening more avenues to cyber threats. These threats pose a risk to the public's expectation of safety with respect to the National Airspace System.

Potential Progress Toward Achieving Modal Strategic Goals:

Aligned to the Department of Transportation's goals of "Safety" and "Efficiency," this Program focuses on resolving aviation safety community and industry-defined cyber security challenges for components of the aviation ecosystem. With this focus, the most critical dependency exists with the ability to engage industry stakeholders and demonstrate effectiveness in resolving the challenges they face through adoption and adaptation of evolving CSDS and AI/ML technologies. In the early stages of CSDS program execution, the FAA has been highly successful in meeting this challenge through active engagement with Boeing, United Airlines, Port Authority of New York/New Jersey, Airline Industries Association, and the Cyber Safety Commercial Aviation Team and other industry partners.

Preliminary research has been performed in the area of Aircraft Log Anomaly Detection, and the results have been coordinated with the relevant stakeholders. This enabled industry to see the value of the technology being generated by the FAA and identify future requirements to incorporate more complex AI/ML solutions. Significant progress is also being made with other stakeholders as they become aware of the Program's value, and multi-year research plans are being identified as a result. Relationships with standards bodies also have been established, and they are requesting information to align with their objectives, with results from the research already informing an important standard for Information Security Event Management. Successful performance of these research plans will ensure that key elements of the aviation ecosystem will have data-driven, intelligent cyber solutions that provide more secure and resilient systems now, and in the future.

Collaboration Partners:

Program collaborators include:

- Massachusetts Institute of Technology / Lincoln Laboratories
- Embry-Riddle Aeronautical University
- Original Equipment Manufacturers (Boeing, Airbus)
- Airlines (United, Jet Blue)
- Suppliers (General Electric Aviation, Collins Aerospace, Astronautics Corporation of America)
- Aviation - Information Sharing Analysis Center
- Aerospace Industries Association
- International Civil Aviation Organization
- Radio Technical Commission for Aeronautics (RTCA)
- Cyber Safety Commercial Aviation Team
- Airports
- Airlines Electronic Engineering Committee
- Airlines for America
- Department of Homeland Security Aviation Cyber Initiative
- Office of the Secretary of Defense Manufacturing Technology Office

Weather and Aviation Systems

United States Department of Transportation FY 2026 Annual Modal Research Plans

Aircraft Icing Requested: (\$2,798,000)

Program Description:

The FAA establishes rules for the certification and operation of aircraft in icing conditions. The agency uses the Aircraft Icing Program research results to generate advisory circulars and other forms of technical information to guide certification and airworthiness specialists and inspectors on acceptable means for meeting requirements. This research and the guidance materials generated from this research help to reduce aircraft accidents and incidents caused by aircraft icing.

Major Program Objectives:

The Aircraft Icing Program will improve existing capabilities and develop new engineering tools to support improved means of compliance and new guidance material for engine and airframe certification and operations in super cooled small and large drops, mixed-phase, and ice crystal icing conditions. The outputs will support improved safety through the issuance of new guidance materials and industry standards.

The main goal in Aircraft Icing Program research is to improve aviation safety related to aircraft icing. This includes developing a better understanding of the effects of environmental icing, data in support of new regulations and guidance materials, support for improvements to engineering tools for certification and operations and improving icing weather information for decision-making in terminal areas and in-flight avoidance of high ice water content ice crystal conditions.

The Aircraft Icing Program focuses primarily on providing information the FAA needs to ensure that the industry complies with certification and operational requirements. Much of this information is also useful to industry in its efforts to ensure safety. The Aircraft Icing Program seeks and receives valuable input and insights from the industry through meeting with industry working groups and committees and participation in national and international conferences.

Anticipated Program Activities:

- Safe operations with de-icing/anti-icing fluids
- Ice crystal icing (ICI) effects on engine performance
- Icing risks for powered lift aircraft
- Icing effects on the design of more efficient airplanes

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

Engine icing research will build on knowledge of engine ice accretion and shed parameters within engines, which are needed to develop and validate the tools needed to provide policy and guidance. This should reduce the ICI risk to all aircraft. The ground ice protection research will provide information for the annual ground icing notice used by the FAA's Flight Standards organization, improve aircraft dispatch efficiency, and improve environmental impact through more efficient use of de-icing/anti-icing fluid. Powered lift icing research should help enable a safe and efficient introduction of new powered lift aircraft into the National Airspace System (NAS).

Potential Economic or Societal Impacts:

Research conducted by this Program will result in the continued safe operation of aircraft in icing conditions and a reduction in aircraft icing accidents and incidents. The testing of de-icing and anti-icing fluids also provides an economic impact due to the ability to takeoff without undergoing a wing inspection. Modeling research, including supercooled large drop icing, should increase the efficiency of modern and more sustainable aircraft into the NAS.

Potential Progress Toward Achieving Modal Strategic Goals:

The primary goal of this research is the reduction of aircraft accidents and incidents caused by aircraft icing. This goal is aligned with the Department of Transportation's strategic goal of "Safety" and results in a positive benefit on the environment through the reduced use of fluids, the collection of atmospheric data, and the collection of atmospheric and icing data on aircraft systems. Icing research also provides the scientific and engineering basis for policy decisions on current aircraft but also ensures the safe integration of emerging technologies such as Advanced Air Mobility (AAM).

Collaboration Partners:

The Aircraft Icing Program attends industry working groups and committees to get input directly from those most affected by the issues it is researching. In addition, it meets regularly with Flight Standards and industry representatives at meetings arranged by Flight Standards, often in response to requests from industry representatives.

The Aircraft Icing Program partners with aircraft manufacturers and airline operations. Manufacturers contribute mainly through expert input, and sometimes through the participation of company personnel in projects. For example, Boeing personnel played a very important role in the planning and conduct of the vertical tail test campaigns.

The Aircraft Icing Program partners with external research agencies like NASA and the National Research Council of Canada to streamline research activities, prioritize, and close technology gaps impacting safety.

In cooperation with Flight Standards, the Aircraft Icing Program meets regularly with airline representatives, receiving their expert input. In addition, some airlines have made their own aircraft available for recent testing.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Weather Program

Requested: (\$15,436,000)

Program Description:

The Weather Program performs applied research to enhance safety and operational efficiency in adverse weather conditions in the National Airspace System (NAS), which collectively aligns with Department of Transportation (DOT) research priorities. Beginning in FY 2024, the Weather Program consists of two research programs: the Aviation Weather Research Program (AWRP) and the Weather Technology in the Cockpit (WTIC) Program. The Weather Program evaluates the National Transportation Safety Board (NTSB) recommendations and, as applicable, performs research to implement the recommendations while also assessing the potential benefits of using innovative approaches.

The Weather Program facilitates the transition of legacy capabilities to meet requirements, often through collaborative and complementary initiatives with the National Weather Service (NWS), as well as focused initiatives to help mitigate safety and efficiency issues associated with well-documented weather problems. The Program leverages advances in meteorological science to enhance observation methods, improve weather prediction models, and produce increasingly accurate forecasts of convective weather (i.e., thunderstorms), turbulence, icing, and low cloud ceiling and restricted visibility conditions. The National Oceanic and Atmospheric Administration (NOAA)/NWS platforms and forecasters use algorithms developed by the AWRP to provide regulatory forecast products and NAS decision aids. The timely dissemination and presentation of such information provides decision support input to enable traffic flow managers, controllers, pilots, and airline operations personnel to implement tactical and strategic traffic management initiatives to avoid encounters with severe weather, reduce delays, and mitigate safety risks.

Weather Program research also develops, verifies, and validates recommendations for incorporation into government and commercial weather standards, guidance documents, and pilot training to enhance the safety and efficiency of commercial, business, and general aviation operations. The standards and guidance documents focus on the minimum weather information and technology functions, and human-machine interfaces to enable safe and efficient operations relative to adverse weather avoidance. Weather-related standards and guidance are needed for new entrant aircraft including Advanced Air Mobility (AAM) and Unmanned Aircraft Systems (UAS). Other evolving areas needing new weather standards and guidance to enable safe operations include weather applications of artificial intelligence and uses of machine-to-machine weather interfaces.

Major Program Objectives:

The FAA's Weather Program enhances safety by improving observations, diagnoses, and forecasts of weather information to support operational planning and decision making by users including air traffic managers, flight dispatchers, and pilots. It also addresses needs for enhanced cockpit weather technology, information, and human factors principles to improve operational efficiency and safety and reduce flight delays via efficient routing/rerouting in adverse weather.

The main objectives of the AWRP are to mitigate the impact of weather on the NAS; mitigate weather-related NAS safety and traffic flow efficiency issues; support the evolution of legacy weather capabilities into decision-support weather processes; improve the accuracy and relevancy of legacy weather products and services mandated by FAA regulatory guidance and/or international agreements; and support the achievement of the FAA weather vision with minimal or no new prescriptive regulations.

The main objectives of the WTIC Program are to enhance aviation safety by resolving gaps in cockpit weather information and technology that are causal factors in prior accidents/incidents or have the potential to be a causal factor in future accidents/incidents. The gaps needing to be resolved by the WTIC Program have been identified by WTIC gap analyses, NTSB accident investigations, stakeholder inputs, and research experiments. Another objective is to develop weather training using augmented, virtual, and mixed reality to enhance pilot weather knowledge and pilot experience in making safe adverse weather avoidance decisions. An additional Program objective is to increase the quality of cockpit weather automation and information by developing techniques for enabling pilots to easily monitor automation performance and the quality of weather data inputs. It also seeks to enhance the aviation weather infrastructure by using non-traditional sources to gather information that provides utility to pilots in making adverse weather avoidance decisions. Though the quality of these sources has historically been too uncertain for aviation, the WTIC Program uses crowd sourcing algorithms, artificial intelligence (AI), machine learning (ML), and big data to recognize outlier data and to converge on accurate observation data. A high-level objective for WTIC research is to use AI and ML to assist pilot situational awareness of adverse weather to enable strategic planning, enhancing safety and reroute efficiency.

Market surveys conducted by the Weather Program indicated that industry has little experience, expertise, budgets, and incentive to perform applied aviation weather research without government funding. Additionally, the limited budgets of airlines and other aviation users to spend on weather information leads to a low return on investment that is not enough to initiate or sustain an industry effort. In cases where industry develops new products, data, or techniques, the resulting output is usually proprietary, which limits use by the government. Without oversight and the ability to test the output for accuracy and conformity to standards and safety regulations, it is generally not suitable for use by the NWS. Therefore, the only viable option is for the Weather Program to conduct and manage weather research to meet FAA requirements.

Anticipated Program Activities:

- Develop enhancements to low-level numerical weather prediction model aviation forecasts
- Improve inflight icing diagnosis and forecasts to align with aircraft certification criteria
- Develop probabilistic forecasts for turbulence severity in support of International Civil Aviation Organization World Area Forecast System requirements
- Innovate use of emerging technologies into cockpits to enhance adverse weather avoidance by piloted, remotely piloted, and automated aircraft
- Research the uses of augmented, virtual, and mixed reality to enhance pilot weather knowledge and pilot access to safe experiential training in adverse weather conditions that replicate causal factors in weather-related accidents

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

Gridded and station-based forecasts of high-impact cloud ceiling and restricted visibility (and flight categories for the continental United States every 15 minutes out to 3-6 hours), resulting in improved safety for helicopters, drones, and other small aircraft through the availability of improved and more frequent weather information. Technical transfer package of algorithms that derive turbulence information from aircraft equipped with Automatic Dependent Surveillance-Broadcast (ADS-B) resulting in increased accuracy versus Pilot Reports and a ten-fold increase in the number of turbulence reports from all types of aircraft, providing better situational awareness to pilots and reducing injuries to aircrews and passengers.

Focus on onset, duration, dissipation, and location assessment of convective weather hazards (i.e., thunderstorms) in NAS sensitive/high demand regions that will result in improving convective weather forecasts, enhancing efficiency and the safety of aircrews and passengers. A technical transfer package for Pilot Cognitive Assistance Tools for use in cockpits to enhance general aviation safety, reducing cognitive workloads in decision-making in the presence of adverse weather, and a technical transfer package for a self-authoring tool to enable development of augmented reality weather training without programming expertise.

Weather Program research outputs are anticipated to increase safety in adverse weather for all part type aircraft, enhance reroute efficiency reducing commercial flight delays, increase weather observation data via innovative techniques, and enhance pilot weather training via the use of augmented, virtual, and mixed reality. Since the Weather Program produces standards, guidance, technical transfer packages, and white papers, the research results will foster industry competition as well as stimulate the economy as the research is incorporated into industry products.

Based on prior demonstrations, the Weather Program estimates that the technical transfer package for incorporating convective information from satellites, and the increase in turbulence information from the vertical rate information in downlinked ADS-B reports, will reduce flight delays and equate to a social cost savings of approximately \$5 million. Reducing or eliminating gaps in cockpit weather information has the potential to reduce weather-related injuries, deaths, and service disruptions. Based on demonstration results from providing convective products in the cockpit in oceanic flights, the savings from reduced incidents and injuries due to convection were projected as [\\$5.54 million in the Atlantic Ocean and \\$1.35 million in the Pacific Ocean](#). Increased observation data will also significantly increase access and safety for rural communities that rely heavily on aviation for basic goods and services.

Potential Economic or Societal Impacts:

The AWRP has and will continue to develop and enhance analysis and forecast capabilities that will benefit the American public. This includes applied research on naturally occurring atmospheric hazards including turbulence, convective activity, icing, and restricted ceiling and visibility. As these capabilities are transitioned onto new or existing FAA platforms and systems, or by transition to NWS platforms or procedures that deliver aviation weather services required by FAA regulation, greater benefits to the American public will continue to accrue. These benefits include:

Increased general aviation (GA) safety, as focused efforts will continue to target enhancements to in-flight icing, turbulence, and restricted ceilings and visibility diagnosis and forecasts. Enhancements to convective weather forecasts will minimize gate-to-gate delays and improve flight efficiencies. Enhancements to turbulence analyses and forecasts to increase safety of passengers and crew, safety of GA operations, and increased NAS capacity. Enhancements to icing analyses and forecasts to increase safety and decrease flight times especially for GA and commuter passengers. All product enhancements that benefit GA will also support the safe integration of UAS and AAM operations in the NAS, since they will operate in similar envelopes as GA.

Since Weather Program research is focused on integrating and using enhanced weather information from traditional and non-traditional sources, the research has a direct social and economic benefit. Specifically, WTIC research directly complements industry research and is intended for use by industry to enhance the utility of their cockpit weather products and information to make aviation safer. Research performed by the WTIC Program is based on inputs from industry safety groups, pilot unions, GA, business aviation, and other aviation stakeholders. This approach has ensured that successful research is used by stakeholders, and it enables feedback to assess its benefits. WTIC Program research is unique to the FAA in that it is primarily transitioned to commercial products and procedures versus FAA systems and procedures, thus it has a greater benefit to stimulate the economy and to foster competition.

Potential Progress Toward Achieving Modal Strategic Goals:

Results from the Aviation Weather Research Program include advanced weather prediction models with high resolution and rapid updates, as well as radar applications that enhance the forecast of aviation weather hazards, continue to be transferred for implementation into NWS operations. Additionally, enhanced forecast capabilities in the areas of turbulence, in-flight icing, and ceiling and visibility continue to be transferred to the NWS Aviation Weather Center where they are being disseminated for use by NWS weather forecasters, airlines, GA, aircraft

dispatchers, and FAA air traffic management (ATM). AWRP convective weather research capabilities continue to be transitioned to FAA platforms for operational use by ATM. The operational implementation of these capabilities contributes to enhancing NAS safety.

Aligned to the Department of Transportation's strategic goals of "Safety" and "Innovation," WTIC Program research results have been incorporated into various standards and guidance documents through industry and FAA standards development organizations including RTCA. These successes and processes are established in the WTIC Program, and this trend is expected to continue. WTIC has numerous research projects in progress that are anticipated to be transitioned to third parties over the next one to five years. Much of the WTIC research is positioning the Program for longer-term research and greater innovation.

Collaboration Partners:

Recommendations from attendees of annual weather research workshops, including airlines, GA, NWS, and FAA Air Traffic Management, are considered in developing the Weather Program research portfolio. Guidance from research evolution plans developed with inputs from airlines, NOAA, and FAA air traffic management have also been utilized to facilitate the identification and selection of research in the Weather Program portfolio. Finally, Weather Program personnel attend scientific conferences and symposia to learn about the latest aviation weather advances, new techniques, shortfalls in weather support and services, and emerging concerns. During these activities, Weather Program personnel meet with other aviation and weather subject matter experts to discuss and gather inputs from both national and international user and research perspectives. Program partners include NOAA, NASA, U.S. Air Force, Australia Bureau of Meteorology, FAA Center of Excellence of General Aviation, RTCA, International Air Transport Association, and the World Meteorological Organization.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Alternative Fuels for General Aviation

Requested: (\$10,000,00)

Program Description:

Current leaded aviation gasoline (avgas) is the only remaining transportation fuel in the U.S. that contains lead additives. Globally, as transportation sectors have transitioned away from leaded fuels, the need for lead additive has significantly reduced. Currently, there is only one provider of the lead additive. That sole provider supplies the entire volume of lead additive for leaded aviation gasoline. The continued availability of the lead additive is an item of concern for the aviation community as it is not anticipated to be available in perpetuity. Additionally, in October 2023, the Environmental Protection Agency (EPA) announced a final endangerment finding that emissions of lead from aircraft operating on leaded fuel cause or contribute to air pollution which may reasonably be anticipated to endanger public health and welfare under the Clean Air Act. This initiated a parallel timeline between the EPA and FAA for joint rulemaking to address the endangerment findings. Due to these actions and corresponding market forces, the availability of leaded avgas is anticipated to be eliminated in the future. Safe alternative fuels must be in place before leaded gasoline becomes unavailable.

The Alternative Fuels for General Aviation Program is actively engaged in the development of unleaded fuels for safe introduction to the fleet. FAA engagement includes participation in the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative, in which the FAA partners and collaborate with the EPA and the aviation industry on research, testing, and qualification of viable, safe, hi-octane unleaded avgas replacements to eliminate the use of leaded aviation gasoline by 2030. Additionally, the FAA is pursuing fleet authorization for those fuels that meet the technical and safety requirements for a hi-octane unleaded fuel as determined using the FAA Piston Aviation Fuel Initiative (PAFI) test protocols and process.

The current fleet of over 220,000 general aviation aircraft operates on a wide range of engine and fuel system technologies. In collaboration with industry, Program research will develop the required technical data to support fleet authorization of unleaded fuel, examine engine modifications and aircraft operational changes that may be required for unleaded fuels. Additionally, research efforts will support the deployment of unleaded fuels to gain service experience and support the mitigation of in-service issues that may be observed. This will assist in increasing industry and stakeholder readiness for the future deployment of hi-octane unleaded fuels, while enhancing U.S. competitiveness in the global aviation industry. This research will provide necessary data to support FAA certification for the safe integration of unleaded fuels into current and future aircraft.

Major Program Objectives:

The Alternative Fuels for General Aviation Program will support the EAGLE Initiative as it leverages and builds upon continuing industry collaboration. The Program objectives are to enhance and accelerate research in the areas of unleaded fuels for use in piston-engine aircraft; aircraft and engine modifications to allow safe operation on unleaded fuels; and innovative aircraft technologies.

For more information on the EAGLE Program, please see <https://www.faa.gov/about/initiatives/avgas>.
For more information on FAA/EPA collaboration, please see <https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-lead-emissions-aircraft>.

Anticipated Program Activities:

- Unleaded fuel co-mingling

- Early deployment demonstration projects and testing to support diagnosis and mitigation of in-service issues with the use of unleaded fuels
- Engine technology modifications and aircraft operating changes

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

Program outputs will include an extensive array of technical reports and data on the testing of unleaded fuels in a variety of fleet representative test articles and testing of technologies that could have transformative impacts. This will include data on engine performance, engine detonation, engine durability characteristics, and on the safety of flight in different aircraft models under differing weather conditions (normal day, hot day, cold day). The value and impact of this information will serve to support the authorization of fuels that will enable the general aviation fleet to conduct a safe and efficient transition to unleaded fuels.

Potential Economic or Societal Impacts:

The general aviation (GA) fleet of aircraft is a significant and integral element of the National Airspace System (NAS) and of the U.S. economy. Directly or indirectly, general aviation supported 1.2M jobs and contributed over \$247B to the U.S. economy making a positive \$75B impact on the U.S. balance of trade (GAMA, 2020). The GA industry, its economic contributions, and other benefits are at risk unless the fleet can transition to unleaded fuels before market and/or regulatory forces eliminate the availability of leaded fuel. In addition, the availability of well-vetted, unleaded replacement fuels will eliminate the need for operators to seek less safe alternative fuels that could potentially cause flight safety issues for the NAS. The GA community has access to over 16,000 public and private airports and landing facilities nationwide.

Potential Progress Toward Achieving Modal Strategic Goals:

The Alternative Fuels for General Aviation (GA) Program is working towards the Department of Transportation's strategic goal of "Safety" by working closely with the aviation industry on research to provide the data necessary for the FAA Administrator to authorize one or more unleaded replacement fuels for piston-engine aircraft in accordance with Section 827 of the 2024 FAA Reauthorization Act. The FAA has commenced actions under the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative to safely eliminate leaded aviation fuel by the end of 2030 without adversely affecting the existing piston-engine fleet.

Collaboration Partners:

The Alternative Fuels for General Aviation Program has always been a collaborative effort between the FAA, GA community stakeholders, fuel industry partners, other government agencies, and educational institutions including Centers of Excellence (COEs). Under EAGLE, the program has broadened and expanded the list of participating organizations as work towards the program goal of lead-free general aviation fuel by 2030 continues.

The current list includes over 80 corporations, industry standards bodies, government agencies, environmental groups and other organizations participating in EAGLE:

- ACAT
- Aeroplex
- Afton Chemical
- Air Repair
- Aircraft Owners and Pilots Association (AOPA)
- Airports Council International (ACI)
- Alaska Airlines Association
- American Association of Airport Executives (AAAE)
- American Bonanza Society

- American Petroleum Institute (API)
- ASTM
- AVFUEL Corp
- BP
- Burleson Consulting
- Calumet Specialty Products
- Canadian Owners & Pilots Association (COPA)
- Cardinal Flyers
- Center for Environmental Health
- Cessna
- Cessna Pilots Association
- Chevron
- Cirrus Aircraft
- Cirrus Owners & Pilots Association
- City of Santa Monica
- Commemorative Air Force
- Continental Aerospace Technologies
- County of Santa Clara
- Delta Hawk
- Dixie Services
- Earth Justice
- Enstrom Helicopter
- Environmental Defense Fund
- Epic Aviation
- Ethyl Corp
- European Union Aviation Safety Agency (EASA)
- Everts Air
- Experimental Aircraft Association (EAA)
- ExxonMobil
- Flint Hills Resources
- Friends of the Earth
- General Aviation Manufacturers Association (GAMA)
- General Aviation Modifications, Inc. (GAMI)
- Haltermann Solutions
- Hartzell Propeller
- Innospec
- International Council on Clean Transportation
- Long Beach Airport
- Los Angeles World Airports (LAWA)
- Lycoming Engines
- Malibu M-Class Owners & Pilots Association (MMOPA)
- McCauley Propeller
- Meggitt Polymers & Composites
- Montgomery Gibbs Environmental Coalition (MGEC)
- Mooney Aircraft
- NASA
- National Academy of Sciences
- National Air Transportation Association (NATA)
- National Association of State Aviation Officials (NASAO)
- National Business Aviation Association (NBAA)

- National Research Council Canada (NRC)
- Phillips 66
- Piper Aircraft
- Precision Airmotive
- Precision Engine Machine Company
- Robinson Helicopter Company
- Rotax Engines
- RTCA (formerly Radio Technical Commission for Aeronautics)
- SAE International
- Shell Oil Products US
- Signature Flight Support
- Swift Fuels LLC
- Textron Aviation
- Titan Aviation Fuels
- Total Energies
- Town of Middleton, WI
- Transport Canada
- Twin Cessna Flyers
- U.S. Department of Transportation
- Van Nuys Airport
- Vertical Aviation International (VAI)
- VP Racing Fuels
- World Fuel Services

United States Department of Transportation FY 2026 Annual Modal Research Plans

Advanced Vehicle Technologies & Operations Requested: (\$11,750,000)

Program Description:

Efforts under the Advanced Vehicle Technologies and Operations (AVTO) Program support the FAA's mission to provide the safest, most efficient aerospace system in the world. In addition, AVTO activities reflect the FAA's vision to demonstrate global leadership in the safe integration of new users and technologies into the National Airspace System (NAS). The AVTO Program includes data collection and analysis activities that provide valuable insight into the safety and performance of new civil aviation technologies. This Program also supports related work done by the FAA's Center of Excellence for Alternative Jet Fuels and Environment (ASCENT). Critical research outputs from ASCENT enhance understanding of new vehicle technologies, informing standards and operational procedures development.

Major Program Objectives:

The AVTO Program supports the Continuous Lower Energy, Emissions, and Noise (CLEEN) program, which is ongoing through multiple administrations, including the current administration's first term. The forthcoming CLEEN Phase IV will seek to support technology testing opportunities that provide the FAA with data for technology validation and standards development. These activities deliver critical insights into new and emerging technologies, enhancing both aviation safety through a more robust understanding of these technologies and American aviation industry competitiveness through potentially streamlined certification.

The AVTO Program also enables cross-agency collaboration with relevant FAA offices on optimized aircraft, helicopter, and advanced vehicles operational procedures. This coordination facilitates agency-wide understanding of how these new technologies perform, enabling safety across our aviation system as these technologies are integrated. AVTO activities ensure that U.S. aviation continues to safely integrate new users and technologies while optimizing system efficiency, serving as a global leader.

Anticipated Program Activities:

- Support Phase IV of CLEEN program with focus on data gathering for FAA processes
- Support safety and performance evaluation of new technologies
- Support agency collaboration on operational procedure optimization for improved systemwide efficiency

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

AVTO Program outputs primarily include testing data and research analysis on new aviation technologies. This includes performance testing, risk analysis, and integration considerations for a variety of advanced and emerging aircraft, engine, and vehicle technologies, including supersonics and UAS/AAM. These outputs provide critical insight into the resulting implications for airspace system integration of new technologies. The AVTO Program provides a unique technical perspective, enabling testing capabilities that inform and improve agency-wide understanding of the performance of these technologies. The AVTO Program supports the research and development goal to improve airport operations, air traffic, and airspace management capabilities (Goal 1) by improving airport operations, air traffic, and airspace management capabilities through the critical operations research under ASCENT. These efforts supply data and analysis that can be coordinated with relevant agency partners to optimize operational procedures for a variety of vehicles.

Program efforts provide performance data and safety insight into new technologies, facilitating their safe integration into the NAS. The data and analysis outputs of the AVTO Program will facilitate potential subsequent standards development for new technologies. Testing and analysis activities under this Program accelerate the safe introduction of new technologies for aerospace vehicles, directly reflecting Goal 2 of FAA's research and development goals (accelerate the use of new technologies for aerospace vehicles, airports, and spaceports). The AVTO Program also enables improved agency and interagency coordination and efficiency in new operational procedure development.

Potential Economic or Societal Impacts:

The AVTO Program reflects the FAA's mission to provide the safest, most efficient aerospace system in the world by supporting key testing and analysis of civil aviation technologies and facilitating critical cross-agency coordination on operational optimization. AVTO efforts under ASCENT provide workforce development in the transformative field of aerospace through R&D support for the nation's future aerospace engineers. AVTO activities also provide valuable testing capabilities to ensure American leadership in aviation technological innovation.

Potential Progress Toward Achieving Modal Strategic Goals:

Continuous Lower Energy, Emissions, and Noise aircraft and engine technologies continue appearing in new aircraft with some technologies retrofitted into today's fleet. The GE TAPS II Combustor entered the fleet in 2016 on the LEAP engine installed on Airbus 320neo, Boeing 737 MAX, and COMAC C919, while the GE TAPS III combustion system will be implemented in the GE9X-powered Boeing 777X, set to enter service in 2026. ASCENT is assessing the benefits from the introduction of CLEEN I and II technologies. Modeling estimates that CLEEN Phase I and II technologies combined will save 51.1 billion gallons of fuel through 2050, saving airlines over \$200 billion in fuel costs (assuming a jet fuel price of \$2/gallon with no inflation). An interim assessment indicates that the CLEEN Phase I and II technologies could yield a 10% reduction in 65 DNL noise contour area by 2050 compared to the continued evolution of aircraft technologies absent CLEEN's research & development investments. These improvements could enable greater operational flexibility for operators, opening new markets and expanding aviation accessibility. Additional ASCENT research is being conducted on technical aspects pertaining to noise reduction technologies, emerging entrants, propulsion-airframe integration, new combustion concepts, and supersonics. These investments strengthen America's economic growth by advancing U.S. leadership and accelerating U.S. innovation in the competitive aerospace industry

Collaboration Partners:

The Program has many collaboration partners including ASCENT, the Department of Transportation Volpe Center, NASA, the Department of Education (DOE), the Department of Defense (DoD), and the broader aviation industry. The Program benefits from these varied partnerships, which ensure that the research is well-balanced, relevant, and addresses the needs of a broad range of stakeholders.

The Program incorporates input received from stakeholders, such as industry and other agencies, including NASA, DOE, and DoD, most of which are collected during formal review processes conducted during program reviews and interagency processing of agency programs and documents. The Program also takes into consideration the input received from experts, such as the members of ASCENT, CLEEN, and those that participate in FAA and industry events.

United States Department of Transportation FY 2026 Annual Modal Research Plans

Aviation Systems Performance Analysis Requested: (\$18,365,000)

Program Description:

The Aviation Systems Performance Analysis (ASPA) Program supports the FAA’s mission to provide the safest, most efficient aerospace system in the world. Part of the FAA’s vision is to demonstrate global leadership in how new users and technologies are safely integrated into the NAS. The ASPA Program supports this vision by advancing the agency’s understanding of civil aviation technologies, including conventional aircraft, emerging entrants, and other novel technologies. This Program also supports work done by the FAA’s Center of Excellence for Alternative Jet Fuels and Environment (ASCENT), and the Department of Transportation’s (DOT) Volpe Center. This critical research provides data to address knowledge gaps, ensuring that tools and standards development are data driven and that new technologies are safely integrated using the best available science.

Major Program Objectives:

The ASPA Program supports the Aviation Environmental Design Tool (AEDT), an integrated aviation modeling tool that is used to evaluate a wide range of scenarios and technologies, including supersonics. The tool is built using data on noise aviation and exhaust gases, including how they are generated and propagate beyond the vehicle. AEDT analyses inform decision-making on technology development, operational procedures, regulatory compliance, and international and domestic standards relating to civil aviation. Aviation noise and exhaust gases are regulated at the vehicle level as a part of airworthiness certification, and FAA actions that require modeling as part of their analysis must use AEDT. Standards development, domestically through the FAA and internationally through the International Civil Aviation Organization’s (ICAO) Committee on Aviation Environmental Protection (CAEP), rely on the availability of sound technical data. Research under this Program provides data to develop more robust analysis tools as well as providing inputs to potential standards development.

Program research also focuses on understanding new technologies through testing and analysis. This includes fuel testing to ensure novel jet fuels are safe for use. Opposition to airspace redesigns often centers around aviation impacts, especially vehicle noise. Similar challenges are anticipated with new entrants such as unmanned aircraft systems (UAS), advanced air mobility (AAM), civil supersonic aircraft, and commercial space vehicles. The Program enables critical data collection to advance our understanding of how these new technologies operate, supporting their safe integration into our aviation system. The ASPA program coordinates across partners to efficiently align federal activities. Efforts across the ASPA program ensure that the U.S. continues to demonstrate global leadership in this space, providing resources to facilitate key technical analyses.

Anticipated Program Activities:

- Support development of tools and standards for aviation system modeling
- Support evaluation of emerging entrants including performance characterization
- Support safety and performance testing of novel jet fuels
- Support aviation system modeling, including analyses required per regulation

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

Outputs of the ASPA Program span research areas that include vehicle performance and operational characteristics for conventional and emerging vehicles, jet fuel properties and safety, and other aviation topics such as noise. ASPA Program activities include data collection on vehicle performance that is then integrated into relevant modeling tools that are used in standards development. These efforts inform airworthiness certification, ensuring that these processes use the most up to date science. The ASPA Program also supports testing and analysis of new UAS/AAM technologies. Vehicle testing provides necessary data on aviation noise and other impacts, such as exhaust gases and contrails. Fuel testing under the ASPA Program provides critical data on fuel physical and chemical properties as well as fuel performance characteristics, key to ensuring the safe operation of current and future aircraft using both conventional and novel jet fuels. The data and modeling outputs of the ASPA Program deliver key value for the aviation system, facilitating more robust agency tools and safe deployment of new aviation technologies. Outputs from ASPA activities include operational characteristics and vehicle noise profiles, helping inform the safe potential future integration of these vehicles. These efforts ensure that new vehicle standards, including both domestic and international standards, use the most advanced science and that aviation system modeling tools are appropriately updated.

Potential Economic or Societal Impacts:

The ASPA Program supports the FAA's mission to provide the safest, most efficient aerospace system in the world by advancing the understanding of civil aviation, including current vehicles and new technologies. Program efforts provide critical resources and technical analyses that ensure U.S. global leadership in the development of standards for existing aircraft and new entrants, putting America first in international agreements under ICAO CAEP, where international aircraft standards are developed. ASPA activities also support workforce development in the transformative field of aviation, providing valuable opportunities for the nation's next generation of scientists and engineers through ASCENT. Activities under this Program accelerate the safe introduction of new technologies for aerospace vehicles and air/spaceports, directly reflecting the FAA's R&D goals, including accelerating the use of new technologies for aerospace vehicles, airports, and spaceports (Goal 2). Program research aids the development of standards for existing aircraft and new entrants, facilitating their safe integration into our aviation system. The Program also supports Goal 5 of the NARP by improving integrated modeling capabilities and system-wide analysis through the critical research under ASCENT and the DOT Volpe Center. Their efforts supply data that address information gaps, ensuring that tools and standards are developed using the best available science.

Potential Progress Toward Achieving Modal Strategic Goals:

The Program continues to advance the FAA's global leadership on both domestic and international standards setting through data gathering and analysis. The research includes ground tests and in-flight measurements that enable greater understanding of aviation exhausts and their role in forming condensation trails (contrail). ASCENT work studies how contrail formation is affected by technology, fuel composition, and operations. This work is critical to address both public concerns on contrail composition and persistence as well as to defend against premature efforts to penalize airlines for potential contrail effects. Progress on alternative aviation fuels, including aviation biofuels, has continued with annual domestic procurements growing steadily starting from 4.6 million gallons in 2020 to 139 million gallons in the first seven months of 2025. Research efforts under this Program have significantly reduced fuel volumes required for new approvals. Additional research studies material compatibility of novel fuels to identify potential risks and enhance safety. These fuels enable U.S. energy dominance, growing economic opportunities for U.S. farmers and strengthening U.S. leadership in energy production technologies. Finally, the Program supports data gathering to improve current modeling and facilitate the safe integration of new technologies, including supersonics, advanced air mobility, and unmanned aircraft systems. This work positions the U.S. as a global leader in aviation systems modeling and strengthens U.S. technical leadership within ICAO CAEP.

Collaboration Partners:

The various activities under ASPA benefit from a range of FAA, interagency, and external partners. The Federal Interagency Committee on Aviation Noise includes the Department of Defense, Department of the Interior, DOT, Environmental Protection Agency, NASA, and the Department of Housing and Urban Development. Coordination

and collaboration with NASA continue to expand across fields that include AAM and supersonics. A strong data sharing partnership enables greater value for research efforts by facilitating the efficient dissemination of results and analysis. NASA is developing analytical tools to evaluate aircraft performance, including fuel burning and noise. These tools have been integrated through FAA funding into Environmental Design Space, which is used by both NASA and the FAA to evaluate aircraft and engine technologies.

The program incorporates input received from stakeholders, such as industry and other agencies, most of which are collected during formal review processes conducted during program reviews and interagency processing of agency programs and documents. The program also takes into consideration the input received from experts, such as the members of ASCENT, ICAO CAEP working groups, and those that participate at FAA and industry events.

Human and Aeromedical Factors

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Flight Deck/Maintenance/Systems Integration Human Factors

Requested: (\$12,410,000)

Program Description:

The Flight Deck/Maintenance/Systems Integration Human Factors Program addresses research, engineering, and development requirements defined by technical sponsors in the FAA's Aviation Safety (AVS) organization. These requirements are driven by the human factors needs of personnel who are responsible for the certification and approval of equipment and continued airworthiness of aircraft, certification of pilots and mechanics, and approval of certain flight operations. This human-centered approach will address issues associated with regulatory aspects of design, training, operations, maintenance, and oversight, including complex systems and human-system integration, and it will provide strategic solutions to improve aviation safety.

Major Program Objectives:

Funding will support human factors research related to the safe integration of technologies and procedures in National Airspace System (NAS) operations, and the documentation of human factors/human performance data that supports a transition towards more proactive safety management. The Program will also provide a research foundation which informs AVS personnel who develop, update, and utilize human factors-related regulations, guidance, procedures, standards, Orders, job aids, data, processes, industry standards, and other aviation safety documentation.

Anticipated Program Activities:

- Identify state-of-the-art oversight methods and tools to improve upon the workforce skills adapting safety management system requirements
- Human factors design standards for new and advanced flight deck alerting systems
- Pilot interactions with advanced technologies in flight operations
- Assess data that could indicate characteristics of automated systems that enhance pilot performance
- Integrating human factors into aircraft certification and flight standards policies and processes

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

The American flying public depends on the FAA to ensure the safety of flight operations. The Flight Deck/Maintenance/Systems Integration Human Factors Program provides a research foundation which informs AVS personnel who develop, update, and utilize human factors-related regulations, guidance, procedures, standards, orders, job aids, data, processes, industry standards, and other aviation safety documentation. The Program addresses critical areas of flight safety that are directly relevant to the flying public, including research to better integrate human factors throughout aircraft design and certification.

Potential Economic or Societal Impacts:

The Flight Deck/Maintenance/Systems Integration Human Factors Program manages research that is intended to facilitate a positive societal impact on the safe integration of technology, procedures, users, and operations into the NAS.

The Program provides a foundation to integrate human factors in performance-based standards, policies, regulations, guidance, training, industry standards, and other material. Planned research will assess safety trends, potential human factors/human performance vulnerabilities, and mitigations to enhance safety. Planned research

aims to improve the understanding of human-machine interfaces/interactions, emerging challenges involving innovations and digitization, as well as human capabilities, limitations, and other factors.

Potential Progress Toward Achieving Modal Strategic Goals:

The Flight Deck/Maintenance/Systems Integration Human Factors Program manages research that is intended to facilitate a positive societal impact on the safe integration of technology, procedures, users, and operations into the NAS. It aligns to the Department of Transportation's strategic goal of "Safety."

The Program provides a foundation to integrate human factors in performance-based standards, policies, regulations, guidance, training, and other material. Planned research will assess safety trends, potential human factors/human performance vulnerabilities, and mitigations to enhance safety. Planned research aims to improve the understanding of human-machine interfaces/interactions, emerging challenges involving innovations and digitization, as well as human capabilities, limitations, and other factors.

Collaboration Partners:

The Flight Deck/Maintenance/Systems Integration Human Factors Program maintains a diverse research portfolio that capitalizes on robust partnerships with multiple Department of Transportation entities, other U.S. government agencies, federally funded research and development centers, government and industry working groups, international entities, industry, and academia. These partnerships have contributed significantly to the program's success. Partnerships include:

- Industry: Part 121 and Part 135 operators; original equipment manufacturers; avionics suppliers and service providers
- Labor: Aircraft Owners and Pilots Association, Air Line Pilots Association, and others
- Federally Funded Research and Development Centers: MITRE Center for Advanced Aviation System Development
- Academia: Universities; Center of Excellence for Technical Training and Human Performance
- Government: Department of Transportation Volpe National Transportation Systems Center
- Joint Working Groups: RTCA, SAE International, and others
- Intergovernmental Organizations: International Civil Aviation Organization

United States Department of Transportation FY 2026 Annual Modal Research Plans

Air Traffic Control/Technical Operations Human Factors Requested: (\$5,709,000)

Program Description:

The purpose of the Air Traffic Control/Technical Operations (ATC/TO) Human Factors Program is to provide scientific and technical information that the Air Traffic Organization (ATO) technical sponsors will apply in their work to improve the safety and efficiency of complex ATC systems. The Program will produce information supporting the FAA's needs by measuring and enhancing the performance of individual controllers and specialists. It also improves the integration of National Airspace System (NAS) technologies for controllers and technicians, capitalizing on the human contribution to safety in ATC operations, and supporting data-driven decisions related to the workforce, including selection methods, job placement, performance measurement, and training.

The Program strives to provide useful human factors research and development (R&D) results that support the agency's development and implementation of new technologies and procedures in the NAS, in accordance with FAA Order 9550.8 Human Factors Policy, as the agency evolves the NAS for the future. The Program invests in purpose-driven research and innovation to meet the ATO's present human factors challenges by addressing the research topics identified in 49 USC 445. It also addresses the ATO's human factors research needs that are driven by Department of Transportation priorities, evolution of the workforce, and advancing technologies and associated procedures that are expected to be implemented in the NAS over the next several years. Thus, the program supports ATO efforts to achieve the air transportation system of the future so that the NAS can serve the flying public today and, in the decades, to come. Research addresses workforce challenges that are especially acute in the large terminal radar air traffic control facilities and in several of the busy air route traffic control centers. The FAA must hire, place, and train thousands of new air traffic controllers and technical operations specialists, while continuing to provide safe and efficient air traffic services to NAS users. In addition, the Program provides technical guidance that helps FAA acquisition programs to incorporate human factors requirements and methods that will ensure user acceptance and NAS performance with the increasing reliance on automated capabilities, including those that incorporate artificial intelligence and machine learning (AI/ML) technologies. In addition to addressing the human-machine teaming challenges posed by the introduction of these advanced automation tools and capabilities, the Program is also responsible for proactively identifying the potential for human error, and for recommending mitigations. This program addresses ATO challenges in five human factors R&D focus areas:

1. Improved safety, reduced hazards, and error mitigation in ATC
2. Automation effects and controller performance
3. Improved design and operation of ATC systems
4. Improved air traffic controller selection and training
5. Workforce optimization

Major Program Objectives:

The ATC/TO Human Factors Program responds to R&D requirements defined by offices in ATO and other FAA technical sponsors. The Program addresses human factors and training challenges through targeted research that yields an understanding of human performance, and those factors that contribute to facility-specific impacts, especially for high-impact facilities. In the training domain, the Program conducts research to evaluate the effectiveness of realistic simulation capabilities that provide a medium for training complex task performance where ATC system safety depends on job task performance. Effective use of simulation may reduce the time required for air traffic controllers to reach certification and will increase their readiness to perform in an increasingly automated task context.

In support of system acquisitions managed within the ATO program management office (PMO), this Program focuses on integration of human factors considerations to enhance human-technology interactions. Human performance research aims to enhance overall system performance, reducing errors, increasing safety, and helping reduce life cycle ownership costs. The Program, through the FAA's PMO coordination, provides human factors R&D results that support the development and implementation of new technologies and procedures in the NAS. The Program ensures that the proper roles and responsibilities are assigned to the ATO workforce so that air traffic controller and technician capabilities are compatible with the advanced technology they use in their jobs, enabling air traffic system performance to achieve operational requirements and fulfill safety and efficiency objectives. In terms of research program execution, the program leverages university partnerships to bring new science in the field of AI/ML into practice by identifying human factors, challenges and guidance for system designers that will help to mitigate them. The program also strengthens internal federal human factors research laboratory capabilities at the FAA William J. Hughes Technical Center for Advanced Aerospace and the Civil Aerospace Medical Institute to address these emerging challenges.

This Program continues to provide human factors subject matter expertise to the Joint Resources Council and coordinates with the PMO human factors office in reviewing how acquisitions have complied with human factors design requirements. The program also continues international collaborative research efforts with Eurocontrol and the Single European Sky Air Traffic Management Research human factors experts.

Anticipated Program Activities:

- Empirical basis for decisions to modernize evaluation and assessment criteria for permissible noise levels in Human Factors Design Standard Section 5.11.5 *Noise*
- Technical basis for decisions to incorporate cognitive task analysis data into business process models for new and emergent air traffic technology

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

The Program will generate a human factors handbook for ATC system designers that provides guidance on implementing advanced automation with AI and ML capabilities. This work is essential to provide human factors awareness and strategies to leverage benefits of these capabilities and to mitigate potential challenges to effective human-automation interaction in the ATC domain. This guidance will enable the ATO's program management teams to implement the system design characteristics and functions that yield effective human-system performance in the evolving NAS. Improved design for performance will reduce error likelihood and increase efficiency.

In addition, the Program will provide a human factors assessment method and recommended approaches for the adoption and implementation of augmented reality/virtual reality technologies to support ATC and technical operations personnel training and remote maintenance technical support services. These technologies may significantly reduce training costs and time required to achieve full performance levels in these critical aviation occupations.

Potential Economic or Societal Impacts:

Economic benefits are accrued from increased performance of the evolving NAS system through implementation of better user interface designs and procedures, as well as improved training effectiveness. Societal impacts include increased safety and more efficient air traffic service through better ATC system design and training that yields safe and effective air traffic controller performance.

Potential Progress Toward Achieving Modal Strategic Goals:

The research Program continues to develop human factors guidance for future programs to improve the ATC system, aligned to the Department of Transportation strategic goal of “Safety.” Recent accomplishments include guidance to support adoption and implementation of new technologies and innovative practices for air traffic controller training

Collaboration Partners:

The Research, Engineering, and Development Advisory Committee, particularly the Human Factors Subcommittee, provides public input to the program. While the work contributes to improving NAS performance, safety, and efficiency and thus ultimately benefits users of the NAS and the public, the sponsors and stakeholders on this research program are not members of industry, but primarily managers and employees of ATO organizations. This is true because the ATC/ATO Human Factors the ATO research sponsors and deputy vice presidents for the ATO’s service units generate the Program’s research requirements.

Below is a list of some of the work groups in which human factors research team members participate. All these groups involve other FAA organizations, though some include non-FAA government employees. The advantages of these partnerships include the opportunity to interact with individuals who have different expertise than our employees and learn about other projects that may be relevant. Interaction may provide opportunities for working together to accomplish similar research or other goals.

- FAA On-the-Job-Training Safety and Technical Training Workgroup
- FAA Air Traffic Training Summit
- FAA Collegiate Training Institution Training Summit
- Department of Transportation/FAA/NASA Aerospace Medicine Research Alignment and Collaboration Working Group (AMRAC)
- FAA Institutional Review Board
- Research, Engineering, and Development Advisory Human Factors Subcommittee- observer
- ATO Research Roundtable - observer
- Mike Monroney Aeronautical Center NextGen Integration Committee
- Eurocontrol Coordination Plan 3.2

The Program has partnerships with grant recipients, centers of excellence participants, and federally funded research and development center employees. and has provided support to these participants and employees by providing them with access to simulation or testing equipment, designing scenarios, helping them gain access to research participants, collecting data, providing output files for use, and in some cases analyzing data.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Aeromedical Research

Requested: (\$10,394,000)

Program Description:

The Aeromedical Research Program focuses on advancing aviation safety emergency preparedness, safety management, health safety, and pilot medical fitness through targeted initiatives. The Program supports several key activities, including developing safety standards for next-generation seating and occupant protection, optimizing evacuation strategies through passenger behavior studies, and enhancing health safety in commercial aviation by assessing potential aircraft environmental hazards while developing the evidence base for disease outbreak preparedness initiatives. Additionally, the Program works to modernize pilot medical certification by identifying neurocognitive impairment markers and researching alternative fitness assessment methods. The Aeromedical Research Program also facilitates the development of artificial intelligence (AI)-driven certification models, improves pilot health monitoring through public-private data sharing, and integrates medical and operational data for proactive risk management. The expected outputs from these activities include summary technical reports, datasets, models, simulations, prototypes, and system designs, all contributing to the improvement of aviation passenger safety, system resilience, and operational efficiency. This Program involves multi-year efforts organized around five major activities aimed at strengthening aviation health and safety protocols.

Major Program Objectives:

The Aeromedical Research Program is a multi-year initiative designed to enhance aviation safety, modernize pilot medical certification, and strengthen public health resilience through targeted applied research.

One major objective focuses on advancing aviation crashworthiness by developing performance-based safety standards for next-generation seating and rotorcraft occupant protection. Through modeling, simulation, and biodynamics research, the Program aims to improve survivability during aviation mishaps.

Another key objective supports emergency preparedness and evacuation. This includes optimizing evacuation strategies by studying passenger behavior, emergency exit use, and ditching equipment performance. The results of this research will inform technical standards and operational guidance, improving emergency outcomes and reducing injury risk. This aligns with the RD&T Plan's focus on human factors and system performance, providing critical insight into how behavioral dynamics and design features affect safety during high-stress scenarios.

The Program also addresses safety management and health protection by assessing cabin environmental conditions—such as air quality, cabin temperature, and radiation exposure—and refining disease transmission models and ventilation assessments. These efforts enhance the evidence base for managing health risks in flight and improving preparedness for future disease outbreaks. This objective supports RD&T priorities in data-driven system safety and public health resilience by enabling aviation systems to better manage biological and environmental hazards.

Modernizing pilot medical certification is a fourth major objective. This includes identifying neurocognitive impairment markers, expanding the use of alternative testing methods, and exploring the feasibility of remote aviation medical exams. These initiatives aim to ensure that only medically fit pilots are certified while reducing administrative burdens and improving access. The work aligns with the RD&T Plan's emphasis on human-technology interactions, enhancing both the scientific rigor and fairness of medical fitness assessments.

Finally, the Program supports the development of a data- and AI-driven aerospace medical safety assurance system. This objective integrates medical and operational data, establishes public-private data sharing partnerships, and builds predictive tools for certification risk assessment. These innovations embody the RD&T Plan's Transformation goal and contribute to the "Future System-of-Systems" grand challenge by enabling proactive, real-time risk management in aviation medical oversight.

Together, these objectives position the Aeromedical Research Program as a vital contributor to national efforts to modernize transportation safety. Its focus on actionable science, integrated systems, and emerging technologies reflects DOT's commitment to building a safer, more resilient, and people-centered transportation future.

Anticipated Program Activities:

- *Crashworthiness and Seating System Safety:*
 - Automotive hybrid III evaluation for aircraft seat certification
 - Replacement of cushions in energy absorbing seats
 - Develop modeling and simulation guidance to support performance-based rules for aircraft seating systems
 - Occupant protection for legacy rotorcraft
- *Emergency Preparedness and Evacuation:*
 - Effect on the size of furniture on egress pathways
 - Emergency egress for disabled persons
 - Over-wing escape route markings
- *Aircraft Cabin Environmental Health:*
 - Health and safety impacts of aircraft cabin air temperatures (section 323)
 - Radiation exposure (section 322)
- *Communicable Disease Preparedness:*
 - Communicable disease preparedness: TRIP-X improvements and validation
 - Communicable disease preparedness: aircraft cabin disease dispersion study for model validation
- *Pilot Health and Medical Certification:*
 - Identify neurocognitive test and obtain pilot normative data for medical certification
 - Validation and transition of three alternative neurocognitive tests
 - Aviation medical examiner office-based pilot functional capability assessment for certification
 - Vulnerability assessment of FAA computerized color vision tests
- *Medical Risk Assessment and Decision Support:*
 - Pilot medical disclosure decision making model for safety risk assessments
 - Develop pilot medical certification artificial intelligence use cases
- *Data Sharing and Public-Private Collaboration:*
 - Aeromedical information sharing and data analysis public private partnership – Phase 2

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

The Aeromedical Research Program is expected to generate a diverse set of outputs, including technical reports, validated datasets, simulation models, prototype tools, AI-driven algorithms, and frameworks for data sharing. These products will inform the development of next-generation safety standards for aircraft seating, enhanced evacuation protocols based on passenger behavior, and refined models of disease transmission within aircraft cabins. Additional outputs will support modernization of pilot medical certification through neurocognitive

impairment markers, alternative assessment methods, and remote exam technologies. Collectively, these deliverables will enable more precise risk assessments, improve access to certification, and support data-driven regulatory decision-making.

The expected outcomes include improved crash survivability, faster and safer emergency evacuations, better detection and mitigation of in-flight environmental and health risks, and more efficient and effective pilot medical certification processes. In the long term, the Program will influence technologies and practices by accelerating the adoption of AI-enabled certification tools, enhancing public-private health data integration, and supporting performance-based safety oversight. These impacts align with the RD&T Strategic Plan by advancing proactive safety management, enabling people-centered innovation, and strengthening aviation system resilience.

Potential Economic or Societal Impacts:

This Aeromedical Research Program provides significant benefits to the American public by improving aviation safety, emergency preparedness, aircraft cabin health safety, and pilot medical fitness. It enhances passenger protection through new safety standards for seating, ensuring a safer and more inclusive travel experience. Emergency preparedness efforts will lead to more efficient emergency responses and reduce injuries and fatalities. Additionally, research on aircraft cabin health safety risks will improve risk management and strengthen airline resilience to disease outbreaks, such as pandemics. Advancements in pilot medical certification will enhance flight safety by ensuring pilots are medically fit to operate aircraft. Furthermore, AI-driven certification models and public-private data-sharing partnerships will improve risk management and aviation health protocols. This Program is necessary to address evolving aviation challenges, integrate emerging technologies, and maintain the United States' leadership in aviation safety and preparedness.

Potential Progress Toward Achieving Modal Strategic Goals:

This Program will enable DOT to make progress toward achieving its strategic goal of "Safety." In terms of Safety Data, the Office of Aerospace Medicine will use the results of genetic biomarker research to improve assessment of the contribution of impaired performance from cannabis use to aviation accidents. Research outcomes will eventually be transitioned into the Civil Aerospace Medical Institute's forensic sciences laboratory for use in accident investigations. The Office of Aerospace Medicine will also use disease transmission risk modeling activity outputs to inform the National Aviation Preparedness Plan, and transition tools and data for use in airline safety management systems. In terms of Safe Design and Safety Data objectives, the Aircraft Certification Service will certify seats using data obtained from testing accomplished with the automotive Hybrid 3 anthropometric test device. Lastly, the Aircraft Certification Service will accept analytical data to certify aircraft seating systems.

Collaboration Partners:

The Program maintains robust partnerships with multiple partners:

- *Government:* National Transportation Safety Board, National Aeronautics and Space Administration, Department of Defense, Department of Homeland Security, Department of Health and Human Services, and the National Highway Traffic Safety Administration
- *Academia:* University of North Dakota
- *Industry:* The Boeing Company, Mayo Clinic, and SAE International
- *International:* National Research Council of Canada

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Aviation Grant Management

Requested: (\$800,000)

Program Description:

The Aviation Grant Management Program supports grant lifecycle administration and management including pre-award, post-award, closeout, records management, program management, compliance and information technology. The Program is administered under regulatory compliance 2 CFR 200 to support and stimulate a public purpose.

Major Program Objectives:

The Program will aid in building and sustaining an infrastructure that encompasses the entire lifecycle of grant management. Program priorities support the FAA's strategic goals by ensuring a comprehensive approach to award grants to the next generation of aviation professionals, while supporting aviation-related research.

The Program enables collaboration and coordination between government, academia, and industry to advance aviation technologies, expand FAA research capabilities, support professional development of aircraft pilots, and increase interest in aviation maintenance careers.

The Aviation Grant Management Program will provide support to administer grants for eligible projects that educate, develop, and recruit aviation professionals, as directed by Congress in section 440 of the FAA Reauthorization Act of 2024, amending section 625 of the 2018 Act. The Aviation Grant Management Program fosters programs that are essential in shaping the future aviation workforce and evolving technology.

Funding will be used for grant recipient awards and program management support to include program management, a grants management system, and associated resources.

Anticipated Program Activities:

- Aviation Workforce and Research Grant notice of funding opportunities and awards

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

The Aviation Grant Management Program was established by Congress under the FAA Research, Engineering, and Development Authorization Act of 1990 (P.L. 101-508) and the Aviation Security Improvement Act of 1990 (P.L. 101-604). It will support projects creating pathways into the aviation workforce to maintain a safe and efficient National Airspace System (NAS). The Program benefits the flying public by increasing the number of grant awards to create a pipeline of aviation professionals and by conducting research to enhance the NAS and to support the next generation of aviation technologies. The Aviation Grant Management Program fosters transparency in funding decisions. The Program is necessary to meet the congressional mandate of the FAA Reauthorization Act of 2024.

Potential Economic or Societal Impacts:

The aviation industry is facing a worker shortage due to several factors, including an aging workforce approaching retirement, high training costs, and a lack of new talent entering the field. This shortage is particularly severe in critical roles such as pilots and maintenance technicians, even as passenger demand continues to rise rapidly. The Aviation Grant Management Program will benefit the next generation of aircraft pilots and maintenance technicians by cultivating a workforce pipeline. The Program aims to provide meaningful educational experiences to stimulate interest and encourage students throughout the nation to prepare to enter this career field. The Program also supports activities to facilitate the transition of individuals to careers in aviation maintenance, including members of the armed forces.

Potential Progress Toward Achieving Modal Strategic Goals:

Aligned to the Department of Transportation strategic goal of “Efficiency,” the Aviation Grant Management Program has issued workforce grants, to recipients with a 12–24-month period of performance. The proactive outreach and engagement of potential grant recipients have increased since last year for the workforce grants. Research grant awards require additional and frequent competitive funding opportunities to expand and allow for a continually diversified pool of recipients. Developing strategies, collaboration, and initiatives to prepare potential grant recipients for funding opportunities is essential.

Collaboration Partners:

Not Applicable

Aerospace Performance and Planning

United States Department of Transportation

FY 2026 Annual Modal Research Plans

System Safety Management/Terminal Area Safety

Requested: (\$9,096,000)

Program Description:

The System Safety Management/Terminal Area Safety Program focuses on research that will enhance the safe movement of aircraft through the National Airspace System (NAS), supporting the oversight of aviation product/service providers as well as providing for better tools and techniques for pilots and operators. The research supports the development of analytical tools that aid and support the high safety standard for the NAS. To achieve this result, the System Safety Management/Terminal Area Safety Program funds research to develop more effective helicopter simulators, proactive flight risk detection, monitoring and mitigation tools to better support helicopter and fixed wing aircraft pilots, immersive and higher fidelity simulator models and training capabilities, vision enhancing technologies for flights in low or reduced/degraded visibility, and cost-effective flight data recording/monitoring solutions. Research outcomes aim to reduce the number of fatal accidents and enhance the safety of operations for fixed wing aircraft, helicopters, and vertical flight vehicles (e.g., tiltrotors, vertical take-off and landing vehicles) operate in and around the terminal airspace. This research also supports safety by providing tools and techniques for air traffic safety oversight, helping to identify potential hazards and issues before changes are made to the NAS.

Major Program Objectives:

The System Safety Management (SSM) Program is designed to improve safety through developing safety data collection methods, advanced safety data and risk analysis techniques, and prototypes of risk-based decision-making capabilities to identify and analyze emerging safety issues in a cooperative nature with aviation stakeholders. The program provides an ability to analyze trends across the aviation community that is much more effective than monitoring individual certificated entities (e.g., air operators and air traffic facilities).

The Terminal Area Safety (TAS) Program improves the safety of operations at or near an airport. Program research focuses on developing training solutions and identifying effective technologies to mitigate key causes of fatal accidents such as loss of control, low altitude operations, unintended flight into instrument meteorological conditions, runway excursions, and runway overruns. These are the leading causes of fatalities in worldwide commercial transport, general aviation, and rotorcraft operations.

This Program evaluates potential solutions to reduce fatal accidents through extending simulator models to allow for better upset and anomalous flight condition training; exploring alternatives to determine runway slipperiness; developing objective motion criteria to minimize inappropriate simulator training; enabling safe helicopter approaches when using advanced vision systems; exploring consistent operational standards for a stable approach to reduce runway excursions and heliport/vertiport overruns; exploring immersive technologies for future flight training; examining the components of future vertical flight infrastructure; and developing a logical go-around training curriculum that mitigates operational go-around risks. This Program also performs flight tests to re-evaluate wet runway wheel braking coefficient models as well as rotorcraft and vertical flight tests to evaluate flight data monitoring devices, vision systems technologies, vertical flight infrastructure, and countless other project areas. These projects address the principal causes of fatalities in commercial transport.

Anticipated Program Activities:

- Measure effects of wake vortex encounters from operational flight data

- Incorporate additional helicopter operational data into the Aviation Safety Information Analysis and Sharing system
- Improve collision risk estimates in the terminal area

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

The research provides significant value, taking advantage of emerging technologies such as machine learning, artificial intelligence, advanced data analytics and virtual reality to provide better decision making, pilot training, and the application of smarter safety tools. When these programs are complete, the resulting impact on regulatory and training changes will increase overall safety while enhancing the managing and piloting of aircraft throughout the NAS.

The System Safety Management/Terminal Area Safety Program supports multiple goals to improve air traffic, and air space management capabilities, data driven safety risk management, to accelerate the use of new technologies for aerospace vehicles and improve human performance.

Potential Economic or Societal Impacts:

The NAS is certainly the safest airspace system in the world. Flight in general is a very safe mode of transportation for passengers and freight alike. However, aviation is rapidly changing such that the NAS needs to expand to meet the needs of today's customer and the flying public. Therefore, research being conducted to enhance pilot training, utilize enhanced vision systems, engage in the use of data science tools for more effective oversight and modeling of the NAS will result in reducing accidents, delays, and increase NAS efficiency as it expands, solving problems proactively.

Potential Progress Toward Achieving Modal Strategic Goals:

System Safety Management and Terminal Area Safety research methods are shifting. As the research moves forward, machine learning and artificial intelligence tools and techniques will be increasingly leveraged to take advantage of the large amounts of data available, which aligns to the Department of Transportation goal of "innovation" and "investing in transformative technologies." As research moves forward, it enables the capability of supplementing actual flight tests and similar field exercises with appropriate modeling and simulation activities, using data science and data analytics to drive performance-based metrics that influence future regulatory, policy, and guidance changes. Higher fidelity simulators and virtual reality will be leveraged to support enhanced pilot training and certification.

Collaboration Partners:

- SAE G10/A4 Committee on Head-Worn/Heads-Up Displays
- European Organization for Civil Aviation Equipment Working Group 79 & RTCA SC-213 on Enhanced/Synthetic/Combined Vision Systems
- United States Helicopter Safety Team
- Vertical Aviation Safety Team
- Georgia Institute of Technology
- George Mason University
- Rowan University
- Vertical Aviation International
- Sikorsky, Airbus Helicopters, Leonardo, Bell, Robinson
- Collins, Honeywell, Thales, Elbit Systems/Universal Avionics
- Lifeflight of Maine
- TruthData
- MITRE

- Advanced Simulation Technologies, Inc.
- NASA
- Netherlands Aerospace Centre
- Mike Monroney Aeronautical Center
- Loft Dynamics

United States Department of Transportation FY 2026 Annual Modal Research Plans

Commercial Space Transportation Safety Requested: (\$4,200,000)

Program Description:

The Commercial Space Transportation (CST) Safety Program priorities include safety of all commercial space operations, including integration into the National Airspace System (NAS), spaceports, and incorporating systemic safety initiatives. CST research focuses on specific research needs in different industry segments including (1) risk-based decision-making techniques and analytics; (2) certification using new technologies, standards, or processes; (3) artificial intelligence; and (4) human-machine teaming and new technology interfaces. CST research is executed through research contracts addressing near-term needs of the FAA Office of Commercial Space Transportation (AST), and by addressing mid-term research questions of common interest to FAA AST, government partners, and industry.

Major Program Objectives:

Statute directs AST to license commercial space launch and reentry operations only to the extent necessary to ensure compliance with international obligations of the United States, and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States. Statute further directs AST to encourage, facilitate, and promote commercial space launches and reentries performed by the private sector.

AST's research activities will find innovative solutions to increase safety, efficiency, and U.S. global leadership in CST. The Program optimizes AST's mission execution through the development of improved regulations, safety assessment tools, and public safety technologies. Funding supports safety research, addresses lessons learned, and enables the FAA to keep pace with the dynamic CST industry. This research benefits all stakeholders within different CST industry segments.

By focusing research on issues directly related to public safety and the trending needs of the rapidly growing CST industry, AST can refine regulations and maintain public safety without hindering industry innovation. Additionally, these efforts help ensure that the FAA continues to lead the world on commercial space standards and keeps the U.S. space industry at the forefront of this exciting field.

Anticipated Program Activities:

- Commercial space safety analysis improvements
- Licensing enhancements
- Human spaceflight participant research
- Commercial space safety infrastructure

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

Enhanced analytical capabilities allow for more precise evaluations and predictions through more reliable modeling which ultimately reduces risk to public safety. These improvements help to streamline processes, ensuring increased efficiency and reduced license processing times as the number of commercial space operations continues to rise annually. Licensing enhancements employing artificial intelligence and machine learning techniques will improve productivity and reduce license application processing times through increased automation. This increased automation will expand AST bandwidth to accommodate the growing number of license applications, while ensuring alignment with emerging and developing technologies.

Human spaceflight participant research addresses both public and occupant safety by developing voluntary consensus standards for commercial human spaceflight and developing a safety framework that will update the recommended practices for human space flight occupant safety. Research into the commercial space safety infrastructure aims to identify existing knowledge, safety gaps in the current infrastructure, and allow prioritization of improvements that continue to reduce public safety risks. This Program will also enhance the integration of commercial space operations within the NAS through optimized processes and technology, allowing for augmented data availability to the spaceports, and improved communication and coordination during launch and re-entry operations.

Potential Economic or Societal Impacts:

The Program aligns with AST's mission to enable safe space transportation and vision to address industry needs. Potential economic impacts of this research include augmented support of commercial space activity as the number of launches, re-entries, and spaceports continues to grow. Research that enables streamlining and enhances efficiency reduces the financial burden related to the license application process through automation, optimized workflows, effective resource utilization, and improved strategic planning to meet future demands. Enhanced safety modeling and analytical capabilities will bolster AST's ability to define and refine public hazard areas and integrate commercial space activity with the NAS and reduce the risk to public safety.

Potential Progress Toward Achieving Modal Strategic Goals:

To date, specific examples of progress made by the CST research program toward the Department of Transportation strategic goal of "Innovation," specifically "3.2: Enable Transportation Technology and Adoption" are evidenced by an increase in the number of launch operators and increasing numbers of standards for human spaceflight. In general, CST research enables better standards and regulations that protect the public while ensuring continued innovation in the industry. This work increases the CST contribution to economic strength and global competitiveness while the number of safe operations continues to grow.

Collaboration Partners:

The Commercial Space Transportation Safety Program has multiple stakeholders informing the research program content, including the Commercial Space Transportation Advisory Committee, the Commercial Spaceflight Federation, and industry members.

Specific program partners include contractors (ARCTOS, AS&T, Bangham), federally funded research and development centers (Aerospace Corp., MITRE), Government Partners (Department of Defense, NASA).

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Wake Turbulence

Requested: (\$4,728,000)

Program Description:

The Wake Turbulence Program provides air traffic control (ATC) wake-hazard-mitigating, aircraft-to-aircraft separation recommendations for new and currently operating aircraft (both legacy and new entrants). Additionally, the Program provides ATC procedural and technology-based wake hazard mitigating solutions. Wake turbulence data collection sites are operated near the San Francisco International (SFO). The Program uses the site data to develop wake hazard risk assessments as part of the FAA's review of proposed changes to ATC's aircraft-to-aircraft separation procedures and ATC automation systems. Additionally, the data analysis (collected under varying weather conditions) provides insight into the development of dynamic flight capacity, increasing wake-hazard-mitigating ATC procedures and supporting upgrades to ATC automation systems.

Major Program Objectives:

The Wake Turbulence Research Program provides aircraft-generated wake turbulence research that matures wake mitigation operational concepts to the point that they can be implemented by FAA orders and enter the FAA Facilities and Equipment (F&E) development and implementation process to meet National Airspace System (NAS) enhancement requirements. This Program supports the objective to accommodate increased flight demand during peak demand periods at capacity-constrained airports. It provides increased access to airport runways and airspace through modifications to ATC wake separation standards and procedures while maintaining or enhancing NAS safety.

Anticipated Program Activities:

- Airport-or airspace-specific ATC wake hazard mitigation procedural solutions and associated infrastructure modification recommendations
- Wake hazard mitigation separation recommendations for new aircraft types entering the NAS
- Wake hazard safety assessments of proposed changes to ATC separation services
- Wake track data collections, analyses, and modeling for ATC wake hazard mitigations

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

The Wake Turbulence Program continues to provide aircraft type wake hazard mitigation recommendations to the ATC aircraft separation service to allow for safe maximum flight capacity for major hub airports and air corridors, resulting in fewer flight delays. The Program plans to assess 160K aircraft wake tracks at SFO and provide airport- and airspace- specific wake hazard mitigations. These wake hazard mitigation recommendations allow for safe maximum flight capacity for major hub airports and air corridors, resulting in fewer flight delays.

The Program will create models to analyze wake generation and response to a wake encounter for new aircraft types without requiring extensive and costly wake data collection campaigns. It will also evaluate algorithms that use high-resolution rapid refresh forecast data and Automatic Dependent Surveillance–Broadcast real-time weather data to predict the location of generating aircraft wake hazard zone to allow for safe, increased airport and air corridor flight capacity, resulting in fewer flight delays.

Potential Economic or Societal Impacts:

The Wake Turbulence Program provides the necessary data, modeling, and analysis to advance capacity-efficient ATC wake mitigation solutions that will safely allow more flights during peak periods in the NAS. The Program's research products, when implemented either directly into ATC operations or through follow-on engineering development programs, provide the flying public with:

- Reduced passenger and air cargo flight delays when weather or other conditions occur during airport rush periods
- Decreased time in the air for passengers during heavy travel periods due to more ATC flight capacity on heavily used air traffic routes
- Reduced risk of hazardous wake encounters for aircraft operators

Potential Progress Toward Achieving Modal Strategic Goals:

The Wake Turbulence Program research analyzes and collects data to establish ATC wake mitigation separations for new series of aircraft entering operational service. The Program's analysis capability was used to establish wake turbulence separation requirements for the Airbus A380, Boeing 747-800, Boeing 787, and the Airbus A350 series aircraft prior to these aircraft entering NAS service. This Program continues to determine wake separations for manufacturers' newly developed aircraft that will enter the NAS and continues to address new entrants such as large UAS and Urban Air Mobility (UAM) vehicles. Without this program, the FAA will not be able to execute its regulatory role in establishing ATC wake separation standards for new aircraft designs/series integrated into the NAS.

Wake Turbulence research also addresses the role that wake separation standards will play in ATC operations. The Program's research has produced validated concepts for applying aircraft performance characteristics and runway crosswind information to reduce the required wake mitigation separations applied to aircraft arriving and departing an airport's runways. Research products have been transitioned into the FAA F&E projects: Wake Re-Categorization, Wake Turbulence Mitigation for Departures, and Wake Turbulence Mitigation for Arrivals. Standards, processes, and decision support tools from these projects have been demonstrated operationally with many now being implemented nationally. To support the Department of Transportation's goal of "Infrastructure" specifically, "2.1 Construct Projects to Expand System Capacity," these products will provide ATC with tools to allow them to safely increase an airport's runway throughput for both arrival and departure operations when an airport is busiest. Aircraft manufacturers, airport authorities, and air carriers agree that squeezing more operations onto an airport's existing runways results in major flight delay reductions during and after a bad weather event that occurs at or near an airport.

Collaboration Partners:

The Program interacts with numerous stakeholders and aircraft manufacturers. For example, the current Program structure allows for a non-biased approach to the application of new aircraft wake separation standards. The Program conducts the data collection and analysis of a new aircraft type and presents the findings to the safety office without private sector involvement. The FAA is therefore able to conduct the research and recommend the appropriate separation standard without bias.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Unmanned Aircraft Systems Research

Requested: (\$15,567,000)

Program Description:

The Unmanned Aircraft Systems (UAS) Research Program supports the FAA priority to safely integrate UAS by studying the safety implications of new aircraft operational concepts and technology on the National Airspace System (NAS) and supporting the development of new and modified regulatory standards. UAS are fundamentally shifting the aviation landscape and have the potential to provide a wide range of benefits to society. However, there are technical and regulatory challenges that must be overcome as the FAA works to safely integrate these new technologies into the NAS.

Safe, efficient, and timely integration of UAS into the NAS poses substantial technical challenges to the FAA and the aviation industry. UAS often incorporates new or novel technologies to achieve unique operational capabilities that challenge the expectations of current NAS users. These unique capabilities have demonstrated potential to address commercial applications as well as scientific research needs. Integrating UAS will present a challenge to the entire NAS due to the various sizes of UAS (less than a foot up to the size of a commercial jet), a wide range of maximum take-off weights (less than a pound to the weight of a large jet), large performance disparities compared to existing certificated aircraft, and capabilities of operating in all classes of airspace.

Major Program Objectives:

The UAS Research Program enables the planning and prioritizing of UAS research to address challenges, inform decisions, and collaborate with partners. The FAA is incrementally expanding the operational envelope, allowing for new entrants including UAS with increasing levels of complexity, to operate over people, at night, and Beyond Visual Line of Sight (BVLOS), while fully maintaining critical safeguards for existing NAS users. The FAA is applying many UAS-related research initiatives across different research organizations, such as academia, NASA, UAS test sites, and standards bodies. It is leveraging technological advances from industry, lessons learned from approved operations, and expertise from around the world. It is expected that the demand for UAS and advanced air mobility (AAM) integration will accelerate as technology advances and market opportunities evolve.

Advancing UAS integration requires research to inform FAA's data-driven decision-making. Research is the key to solving integration challenges and unlocking the potential of UAS and AAM societal and economic benefits. Based on industry and public demand, FAA is following an integration cadence based on risk. Low-risk operations are integrated first (e.g., recreational, and commercial visual line of sight operations), followed by increasingly complex and higher-risk operations (e.g., commercial BVLOS and cargo operations). There is increased commercial demand for conducting these higher risk operations for the purposes of infrastructure inspection, maintenance, and surveillance. Results from FAA-sponsored research are being used to shape rulemaking, guide decision-making, and grow the UAS and AAM industry. The UAS Research Program continues to remain agile and adaptive to keep up with the pace of industry innovation and respond to FAA, Department of Transportation, White House executive priorities, and Congressional mandates.

Anticipated Program Activities:

- Evaluate UAS disaster preparedness and emergency response operations
- Analyze UAS traffic and collision risks
- Derive safety requirements for BVLOS system mode transitions
- Derive requirements for multi-vehicle architectures
- Derive avoidance requirements for integrated drone and remotely piloted AAM operations at scale
- Derive requirements for precision navigation and landing systems in the presence of GPS interference and radio altimeter radio frequency inference conditions
- Validate detect and avoid requirements for approaches, patterns, and landings

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

Research is the foundation of UAS integration activities. Research enables informed policies, procedures, regulations, and operations to support the safe and secure integration of UAS into the NAS. These UAS research outputs will make significant contributions to multi-vehicle system architectures, advanced automation, and enhanced safety mechanisms for BVLOS operations. The potential outputs from these research initiatives are expected to yield crucial requirement recommendations that will mitigate risks unique to multi-vehicle operations and enhance operational safety. These outputs will not only inform critical FAA priorities including BVLOS operations but will also shape industry standards and underpin policy and rulemaking efforts.

The anticipated research effects will result in significant changes to existing regulations and the development and acceptance of standards to integrate emerging technologies and operational paradigms. For example, by establishing comprehensive requirements for terrain and obstacle avoidance and off-board detect and avoid systems, the FAA can ensure that the NAS accommodates emerging entrants without compromising safety. These regulatory updates and the creation of new guidelines are critical in enabling the seamless integration of advanced unmanned systems into the NAS, fostering a safer and more efficient aerospace environment. This proactive approach to understanding and shaping the regulatory framework will not only mitigate potential risks associated with advanced UAS operations but also pave the way for future technological integrations.

Potential Economic or Societal Impacts:

The safe integration of unmanned aircraft into the NAS is a significant challenge and depends on research to inform standards, policy, rulemaking, guidance, training, requirements, and operational procedures. Research outcomes will continue to inspire the confidence of the American public that UAS operations can be safely, securely, and efficiently integrated into the NAS. The research will facilitate approval and use of systems that mitigate risk and help reduce the severity of UAS accidents in the NAS. This work will also contribute towards the advancement of BVLOS operations, which is a key FAA priority, and critical to the UAS industry. This research will also contribute to the safe integration of AAM operations, which will transform the way our society and many businesses operate. Societally, these initiatives promise to enhance public safety and operational efficiency, reducing risks associated with densely populated air traffic environments and enabling new services such as faster emergency response and efficient urban mobility solutions. Furthermore, the development of these advanced systems is envisioned to lead to more environmentally sustainable aviation practices, aligning with broader goals of reducing carbon emissions in transportation.

Potential Progress Toward Achieving Modal Strategic Goals:

This UAS Research Program will provide data to inform ongoing FAA policy decisions, rulemaking, training/qualifications, and performance-based standards to enable the FAA to safely get to “YES” (i.e., repeatable approvals of UAS operations). As UAS operations mature and become more fully integrated into the NAS, the FAA will continue to mature operational requirements, work to develop repeatable and scalable approval processes, assess and invest in required infrastructure and systems, and continually analyze the costs and benefits for the FAA, its partners, and other UAS stakeholders. To that end, the focus of FAA research is to inform policy and develop

system and procedural requirements for integrating UAS and AAM operations safely, securely, and seamlessly within the NAS. This aligns to the Department of Transportation’s goal of “Innovation,” specifically “3.2 Enable Transportation Technology Development and Adoption.”

Collaboration Partners:

The FAA leverages a wide spectrum of UAS research already in progress across government agencies, industry, academia, and international partners. The FAA also collaborates with standards bodies and independent research organizations to inform people about rulemaking and operational changes that will enable safe UAS integration into the NAS.

Program partners include:

- Department of Commerce
- Department of Defense
- Air Force Research Lab
- Department of Energy
- Department of Homeland Security
- NASA
- Department of Interior
- Department of Justice
- Department of Transportation
- Pipeline and Hazardous Materials Safety Administration
- FAA Center of Excellence for UAS Research: Alliance for System Safety of UAS Research Excellence
- National Institutes of Standards and Technology

United States Department of Transportation FY 2026 Annual Modal Research Plans

Advanced Technology Development & Prototyping Requested: (\$32,500,000)

Program Description:

The FAA's Advanced Technology Development and Prototyping (ATDP) Program develops and validates technology and systems that support air traffic services. These initiatives support the requirements associated with the evolving air traffic system architecture and improvements in airport safety and capacity. A key element of this Program is to promote safe and efficient airspace, provide the means to recognize and respond to needs, and use a data-driven approach to evaluate the results to integrate systems. This Program lays the foundation for the assessment of new innovations and possibilities that could improve safety and capacity measures around our nation's airports and the National Airspace System (NAS), with integration of resource management support.

Major Program Objectives:

Individual projects under the ATDP Program develop and maintain mathematical and simulation software models of the NAS. These models evaluate system-wide benefits associated with the implementation of various solutions. These models are particularly useful in evaluating mid-term and long-term benefits associated with other enhancements.

Another key component of ATDP is developing and improving FAA systems that meet the regulatory requirement for reporting traffic operations, counts, delays, and safety information. These systems must continue to support the growing demands of the NAS. Work under the ATDP Program improves the efficiency and integration of data collection and processing for accurate, timely, and improved NAS reporting capabilities. This research aids in assessing airline operations performance and provides objective data, promoting connectivity, to support the need for improved traffic flow and efficiency measures within the NAS. Projects under the ATDP Program will ensure that the essential hardware and software components are integrated and operational to accurately collect and report operational and safety data associated with air traffic operations. Program data will allow for continued assessment of NAS innovation performance and ensure that those technologies achieve the transformations as planned.

Additionally, ATDP includes integrated services and analysis functions to provide a wide array of support services for more than 55 implementation programs and over 20 pre-implementation programs. This is accomplished through four key mission areas: Integrated Resource Management; Program Acquisition Support; Program Health Management; and Planning, Analysis, and Integration. All program management office programs such as Safety, Information Security, Human Factors, Integrated Logistics Support, Requirements Management, Configuration Management, and Risk/Issues/Opportunity Management use technical services provided by ATDP. Similarly, the process is used for safe integration of emerging aviation technologies and business models into the NAS.

Anticipated Program Activities:

- Complete annual technical and operational test and evaluation report of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic
- Complete Runway Incursion Prevention Situational Awareness System removal and site restoration
- Complete annual report documenting results of human-in-the-loop testing human factors, safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface-based runway incursion indications
- Develop an initial proof-of-concept that integrates cooperative surveillance and speech recognition technologies with advanced ground surveillance sensor technology

- Continued support of NAS modernization through performance metric and reporting tool development, as well as to fulfill performance-reporting commitments under FAA international agreements
- Conduct analysis and risk mitigation activities for operational focus areas
- Continued implementation of airspace redesign efforts that frequently result in changes in the number and shape of operational positions, sectors, or facility boundaries

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

The ATDP develops and validates NAS-level operational concepts that are key to the FAA modernization programs and technologies that will be identified and assessed to prevent runway incursions at small-to-medium sized airports with historically high rates of runway incursions. Airspace redesign projects will support increased efficiency and enhanced safety by funding physical facility changes and will result in changes to the number and span of control of operational positions or sectors, including changes to sector, area, or facility boundaries. NAS deficiencies and gaps will continue to be evaluated, with proposals developed to address those gaps. NAS data outputs will support international performance benchmarking. The FAA, in coordination with other air navigation service providers, has developed a set of performance indicators that allows for a standardized comparison of performance.

This Program will conduct overall analysis and planning for NAS evolution by determining the required annual updates to the NAS enterprise architecture products including operational improvements, operational sustainment, and operational requirements. The Program executes research, engineering analysis, and evaluation in support of mission analysis and investment analysis. It also conducts shortfall analyses as part of service analysis and ensures the linkage of proposed solutions back to validated operational needs to support budget planning and investment decisions. Additionally, the integrated services and analysis provided by the Program will leverage technical safety, information security, human factors, integrated logistics support, and management services.

Potential Economic or Societal Impacts:

This Program will promote further development and use of emerging technologies in the aviation business sector. These technologies will replace antiquated systems and software with more efficient and cost-effective systems and procedures that enhance the NAS. The System Capacity, Planning, and Improvements Program provides a collaborative means for experts from the FAA, academia, and industry to develop recommendations for improving system capacity and efficiency and for ways to reduce delays at specific airports. System improvement recommendations lead to increased NAS efficiency. Methods for correlating airline schedules, weather events, and FAA actions with outcomes such as flight delay, cancellations, diversions, or extended routing are developed with dashboard-style reporting tools for both FAA management and commercial airlines to harmonize performance metrics.

Potential Progress Toward Achieving Modal Strategic Goals:

The ATDP is continually assessing emerging technologies for possible inclusion in the NAS to provide further enhancements that result in a safer and more efficient NAS and provide seamless connectivity of systems and information sharing. This Program evaluates and documents the concept of operations for those emerging technologies, aligning to the Department of Transportation's "Innovation" goal, specifically "3.2 Enable Transportation Technology Development and Adoption." After test and evaluation of those new advancements, the Program documents how those new technologies will improve the NAS and begins formal investment analysis processes. These efforts ultimately result in ongoing transformation and efficiencies for airlines, the flying public, and FAA air traffic control.

Collaboration Partners:

The ATDP Program leads government and industry/labor strategies to maintain and enhance safe surface operations. Through implementation of a data-driven, risk-based integrated systems approach, the ATDP Program

seeks to understand the causes, analyze the risks, and develop safety barriers to maintain the safest, most efficient levels of surface operations.

The ATDP program contributes to the FAA's support for the RTCA, a non-profit association that develops standards based on manufacturers, government, and aviation operator inputs. RTCA recommends operational improvements to increase the efficiency of air transportation. ATDP projects also support the objectives of the Runway Safety Council to develop, deploy, and monitor safety barrier effectiveness to eliminate serious surface events attributed to runway incursion, runway excursion, or surface incidents. In addition, the Program works with the European Union and Civil Aviation Authority of Singapore under memorandums of agreement to improve traffic flow initiatives in the Asia Pacific region, as well as to assess performance and develop business cases for the International Civil Aviation Organization in the North Atlantic.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Separation Management Portfolio

Requested: (\$13,800,000)

Program Description:

The Separation Management Portfolio conducts activities to reduce risk and support the safe and efficient separation of aircraft and other vehicles in the National Airspace System (NAS). Risk reduction activities may include concepts or technologies validation; demonstration and integration of operational capabilities; and an understanding of the human role through cognitive engineering experiments. This Portfolio evaluates and matures concepts and capabilities that focus on the enhancement of separation assurance using both ground-based automation and aircraft technology enhancements. This Portfolio will identify improvements to runway access using improved aircraft technology, and will update standards, safety analysis, and modifications to air traffic monitoring tools and operating procedures to enable more arrival and departure operations.

Major Program Objectives:

The main goal of the Separation Management Portfolio is to provide recommendations through research and technology development activities to improve the tools, standards, and procedures that air traffic controllers use to separate aircraft. Activities conducted under this Program reduce risk, define requirements, and demonstrate operational feasibility to support these recommendations.

As the demand for flights increases, concepts and capabilities that focus on enhancing separation assurance using ground-based automation and aircraft technology enhancements are critical. The Separation Management Portfolio supports the FAA's mission to provide the safest, most efficient aerospace system in the world by conducting research to enhance aircraft separation assurance by safely reducing separation between aircraft, and as a result improving capacity, efficiency, and safety in the NAS.

Anticipated Program Activities:

Closely Spaced Parallel Operations (CSPO):

- Conduct concept validation of integrated arrivals and departures
- Conduct automation review, and wake assessment for departure Minimum Radar Separation (MRS)
- Conduct arrival MRS site assessments and develop safety risk management artifacts to support NAS-wide separation standard change

Integrated NAS Design and Procedure Planning (INDP):

- Commence next Performance Based Navigation initiatives safety analysis and human-in-the-loop tests (e.g. Multiple Airport Route Separation (MARS) next phase or Established on Required Navigation Performance (EoR) dependent operations
- Complete EoR with xLS (approach landing system) concept validation steps and/or safety analysis mitigations reports
- Complete EoR WSR (while simultaneous runway operations) and MARS Phase II safety risk management artifacts to support NAS-wide separation standard change
- Complete MARS Phase I initial implementation guidance materials and concept validation launch site report

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

The Closely Spaced Parallel Operations (CSPO) Program conducts safety analyses that support procedural changes for adoption into the Air Traffic Controller Handbook 7110.65. These procedures primarily focus on decreasing separation during Instrument Meteorological Conditions (IMC). The results of these changes increase airport capacity by increasing aircraft throughput on closely spaced parallel runways. The Integrated NAS Design and Procedures Planning (INDP) Program develops concepts that leverage the accuracy of Performance Based Navigation procedures such as EoR and MARS. Procedural changes are adopted into the NAS and updates are made to the controller handbook 7110.65. The results of these changes increase capacity, efficiency, and predictability.

Potential Economic or Societal Impacts:

The CSPO Program increases capacity at airports that frequently experience IMC conditions. INDP Program work is expected to result in benefits such as track mile savings, more optimal flight paths using near idle descent, less fuel burn, and a smaller carbon footprint as compared to instrument landing system approaches.

Potential Progress Toward Achieving Modal Strategic Goals:

This Program aligns to the Department of Transportation's strategic goal of "Innovation." The INDP Program is focused on amending separation standards by leveraging the capabilities provided by modern day PBN-capable aircraft avionics with existing or modified air traffic control procedures, practices, and policies to increase operational efficiency while maintaining or improving safety in the terminal airspace - particularly on final approach. This CSPO program develops the performance requirements for innovative procedures, tools, and controller or pilot aids for reduced visibility operations that will increase operator capacity at airports with closely spaced parallel runways.

Collaboration Partners:

Capabilities developed by programs within the Separation Management Portfolio continue to positively impact the aviation industry and the flying public across the NAS. Partners include:

- FAA Lines of Business (including program management offices and the National Air Traffic Controllers Association): Collaborate with multiple internal lines of business such as air traffic, program management office, and aviation safety for policy development, concept maturation, and technical acceptance of investment capabilities.
- FAA and industry partnership to identify high-benefit, high-readiness capabilities for implementation in the near term. The FAA and industry jointly evaluate the effects of commitments on the NAS through the work of a Joint Analysis Team to understand the value of plan implementation.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Traffic Flow Management Portfolio

Requested: (\$9,000,000)

Program Description:

The Traffic Flow Management (TFM) Portfolio involves National Airspace System (NAS) operators and FAA traffic managers, along with advanced automation, in managing daily flight and flow decision-making, and airspace and airport capability issues (special activity airspace, weather, etc.) to improve the overall efficiency of the NAS. Pre-implementation research conducted under this Portfolio includes technology development activities for departure scheduling at smaller community airports, improved strategic flow services, and capabilities that will capitalize on future data communications capabilities; further integrated traffic flow management and metering operations; advanced trajectory-based operations leveraging the technologies of NASA's Airspace Technology Demonstration 3; and exploring technologies, infrastructure enhancements, and procedural changes for future traffic management needs.

Major Program Objectives:

The TFM Portfolio researches and implements capabilities that are expected to improve both the efficiency of individual flights and optimization of throughput. This work will make travel safer for the traveling public; help reduce passenger delays (leading to a better traveling experience) and contribute to less pollution as the result of improved prediction performance for TFM decision-support systems. These support systems include flexibility to avoid airspace constraints, better predict capacity demands, and ensure efficient utilization of NAS capacity.

The TFM Portfolio supports the average daily airport capacity metric by providing more efficient use of system capacity through maximizing airspace and airport throughput using time-based management. It also provides improved operational predictability through more accurate and efficient end-to-end strategic planning and scheduling. Enhanced flight efficiency is achieved by delivering more efficient flows into and out of major metropolitan areas through integrated operations. Increased operational flexibility is provided through increased user collaboration regarding preferred trajectories and priorities to support business objectives.

Anticipated Program Activities:

Surface Tactical Flow:

- Continue to explore emerging technology to develop applications or services for surface movements and standardized information exchange into FAA strategic planning flow systems
- Concept exploration and identification of feasible services that can benefit from a digital exchange data environment and artificial intelligence (AI)/machine learning (ML) prediction tools to assist and improve surface tactical flow management in medium sized airports

Strategic Flow Management Application:

- Conduct engineering analysis to identify and develop additional flow object capabilities
- Develop prototype for proof of concept to test the services/architecture across several use cases
- Continue developing and evaluating model of performance-based flow management metrics dashboard
- Develop the initial concept of use for a TFM agent that incorporates multiple flow sources, available data sources, and provides TFM recommendations based on system and data monitoring.
- Conduct engineering analysis of TFM rerouting capabilities to support rerouting around dynamic airspace restrictions including those in oceanic and domestic airspace

- Conduct an analysis of service expectations and performance metrics to determine if any tradeoffs exist amongst the performance metrics.
- Develop the initial concept of use for TFM rerouting capabilities

Advanced Methods:

- Develop prototype for the AI traffic flow management capability
- Conduct proof of concept demonstrations of the artificial intelligence traffic flow management capability
- Document concept of use to combine the use of the technologies with the operational goals of future flight and flow services including automated notification to users
- Develop proof of concept test environment and test application to conduct verification of AI-based model, algorithms, and technology aligning with the Responsible AI framework
- Examine new industry AI certification requirements, amend existing requirements for new technologies considered unique attributes to AI application, and refine the AI certification framework for the FAA
- Investigate the potential of developing a simulator for comprehensive validation of an offline reinforcement learning model specific to runway configuration

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

The Surface Tactical Flow Program under this Portfolio will complete and deliver a report on cloud-based technologies and services required to exchange data from Electronic Flight Bag applications in a timely and secure manner. In addition, the Program will conduct field prototyping and evaluation of terminal data exchange capabilities, and utilize mobile technologies through demonstration wrap-up, industry engagements, and technology transfer.

The Strategic Flow Management Application will include engineering activities for TFM capability modeling to include platform development and proof of concept activities. As future TFM concepts are identified, the FAA will need a modeling platform to thoroughly evaluate them and continue development.

The Strategic Flow Management Engineering Enhancement is a multi-year project that will support future work packages for TFM enhancements. The concept engineering work for the individual capabilities that comprise these future work packages will be conducted primarily through the Strategic Flow Management Application and Advanced Methods Programs.

The Advanced Methods Program will include developing a prototype capability for the advanced automation learning/data mining capability that utilizes historical and real-time data, as well as the complete analysis report on FAA automation systems and stored data for suitability with artificial intelligence technology.

Potential Economic or Societal Impacts:

The TFM Portfolio researches and implements capabilities that are expected to improve both the efficiency of individual flights and optimization of throughput. This work will make air travel safer for the traveling public; help reduce passenger delays leading to a better travel experience and contribute to less pollution as the result of improved prediction performance for TFM decision-support systems. These support systems include flexibility to avoid airspace constraints, better predict capacity demands, and ensure efficient utilization of NAS capacity.

Potential Progress Toward Achieving Modal Strategic Goals:

The TFM Portfolio provides improved operational predictability through more accurate and efficient end-to-end strategic planning and scheduling, supporting the Department of Transportation's "Efficiency" goal. Enhanced flight efficiency is achieved by delivering more efficient flows into and out of major metropolitan areas through integrated operations. Increased operational flexibility is provided through increased user collaboration regarding preferred trajectories and priorities to support business objectives.

Collaboration Partners:

The FAA and the aviation industry (including United Airlines, FedEx, and Delta Airlines) work together to identify high-benefit, high-readiness capabilities for near-term implementation. Partners include:

- Research, Engineering, and Development Advisory Committee (external): Provides advice and recommendations to the FAA Administrator on the needs, objectives, plans, approaches, content, and accomplishments of aviation research programs, and reviews and comments on the aviation research programs.
- FAA Lines of Business (including program management offices and NATCA): Collaborate with multiple internal lines of business such as air traffic, program management office, and aviation safety for policy development, concept maturation, and technical acceptance of investment capabilities.
- NASA: Collaboration to leverage cooperative research in an FAA operational environment.
- DOT Volpe Center: safety management system support.
- MITRE: Leverage research integration and data exchange and assist with technology transfer.
- Airlines: Cooperative evaluations and development of airline tools.
- Airport Authorities: Support of research activities and access to operational subject matter experts.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

On Demand NAS Portfolio

Requested: (\$10,000,000)

Program Description:

The On-Demand NAS Information (ODNI) Program conducts pre-implementation work to reduce risks in supporting the efficient and secure exchange of information within the FAA and between the FAA and other NAS users. The ODNI Portfolio conducts research that examines concepts and develops capabilities through validation activities and demonstrations with stakeholders to enhance information exchange within the NAS.

This Program provides flight planners, Air Navigation Service Providers (ANSP) staff, and flight crews with consistent, complete, and easily processed information on changes in NAS conditions. It also works toward developing international data standards that allow more users to share flight information and coordinate various activities related to flight, supporting collaborative decision-making.

As the NAS evolves, more structured digital information will become available, and technologies such as artificial intelligence (AI) and machine learning (ML) and cloud computing will enable airspace users to make decisions based on current information. The research conducted under this Program will leverage these technological advancements and standardize applications to support flight crew and air traffic control (ATC) decision-making. It will also use innovative technologies to create structured data, enabling the FAA to improve situational awareness and collaboration among various traffic management services through better access to a fully integrated information-sharing environment.

Major Program Objectives:

The main goal of the ODNI Program is to ensure the efficient and secure exchange of information within the FAA and between the FAA and other NAS users for collaborative decision-making. Developing a standard set of flight information will simplify the flight planning process and allow information to cross multiple ATC systems and domains with ease, leading to improvements in ongoing traffic management initiatives and decision-making. NAS efficiency, resiliency and flexibility are maximized through the reallocation of existing resources to address demand and capacity imbalances and create additional NAS agility in support of contingency operations. The incorporation of aircraft performance, flight intent, and improved flight crew situational awareness will result in increased predictability of future aircraft positions, allowing traffic managers to strategically manage the airspace based on anticipated aircraft locations. Adaptable architecture and cloud computing will enhance performance and assure interoperability and scalability. Incorporation of artificial intelligence and machine learning that leverage a network of information will enable enhanced trajectory negotiations while providing optimal traffic management solutions across the NAS.

Anticipated Program Activities:

Common Status and Structure Data:

- Develop business rules for building aeronautical information
- Develop airspace information to support new entrants (high altitude unmanned aircraft systems (UAS) operations in upper airspace)
- Perform engineering analysis on how to represent the new entrants' corridor as aeronautical information. Perform additional engineering analysis on representing corridor in the Aeronautical Information Exchange Model. Perform gap analysis to identify gaps, if any, within the Aeronautical Information Exchange Model with respect to corridor representation

- Develop proof of concept where the Letter of Agreement (LOA) origination tool is enhanced to support additional section(s) of the LOA document with updated database model to accommodate storing of new information
- Update the digital constraints concept of use to reflect the aeronautical information management modernization enhancements and new advanced technologies

Flight Object:

- Complete report documenting preliminary analysis of new entrant data requirements such as UAS, Class-E UAS traffic management and urban air mobility
- Complete flight information exchange model developmental release package including logical model to reflect the findings and development of new entrants such as UAS, Class-E UAS traffic management and urban air mobility assessment
- Conduct engineering analysis to understand requirements for the management of flight information which originates from sources other than the filed flight plan, e.g., flight data input/output or information through trajectory negotiation
- Continuing engineering analysis to identify additional flight object functional requirements for services to support NAS automation modernization and info-centric NAS architecture based on International Civil Aviation Organization's Flight and Flow Information for a Collaborative Environment Release 2 concept
- Technology transfer flight object package that further reflects additional emerging concepts to support the flight information management investment
- Develop flight object capabilities identified from the engineering analysis and update flight information management concept documentation to reflect changing operational environments where NAS flight plan filing and planning systems are transitioned to support Flight and Flow Information for a Collaborative Environment concept

Aeronautical Information Management Modernization Notice to Airmen (NOTAM) Modernization:

- Vendor NOTAM solution development
- Vendor program management and system engineering oversight
- Program management support for solution deployment and transition - modeling, analysis, design review, test planning support, technical reviews, security engineering, safety support, and technical interchange meetings
- Systems engineering support for solution development and deployment
- Testing support for solution deployment and transition

Flight Deck Collaborative Decision Making:

- Conduct engineering analysis on applications of AI and ML to support collaborative decision-making
- Develop prototype of AI/ML collaborative decision-making
- Develop laboratories and simulation architecture for AI/ML for collaborative decision-making
- Develop AI/ML collaborative decision-making prototype application environment

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

The Common Status and Structure Data (CSSD) Program provides requirements for ingesting, fusing, and distributing static and planned constraint information. This Program allows delivery of common status and structure data as well as integrated information products through web services. CSSD enables the FAA to provide integrated lifecycle management of the aeronautical information necessary to support future capabilities.

The Flight Object Program will define the mechanisms for capturing and sharing the most up-to-date information on any flight. This could include the development of a single common reference for system flight information to simplify the exchange of flight information that is redundant or inconsistently defined. The standards for flight information definitions must align with emerging International Civil Aviation Organization (ICAO) standards. The flight information exchange model (FIXM) standard will be the basis for that information exchange and will be an

international data exchange for the flight data. With the growth of the UAS industry, adjustment to the FIXM schema is likely required for the management of UAS operations. The FIXM development will continue to support these maturing UAS and new entrant needs.

The Aeronautical Information Management Modernization (AIMM) NOTAM Modernization Program objective is to transition legacy programs, systems, and services from the aeronautical information services product-based era in which they operate on legacy hardware infrastructure, to an innovative, modern, and resilient computing platform that enables real-time digital AI gathering and sharing using globally harmonized standards in alignment with the FAA's vision of the future NAS.

The Flight Deck Collaborative Decision Making (FD CDM) Program under this portfolio is developing standardized flight deck applications that enable enhanced participation by the flight crew. It will augment the ability of both controllers and pilots to aid in the safe and efficient movement on airport surfaces. The adoption of a resilient and adaptable micro services architecture will assure service performance, interoperability, and scalability. In addition, machine learning techniques are being studied and applied to provide better information and accommodate seamless integration between voice and digital communication.

Potential Economic or Societal Impacts:

The CSSD Program enables the key drivers of change in the areas of collection, management, and maintenance of aeronautical information in a manner that respects the principles of aviation while taking advantage of opportunities presented by technology, business innovation, and societal change. The CSSD Program focuses on performance based cooperative state information where NAS systems and infrastructure continuously share information such as health status, availability or performance degradation, among others, to support safe and efficient decision making.

In the digital world, an integrated information regime is needed to support the operators and systems collaboration and real time safety assurance. To support this vision, the Flight Object Program will define the mechanisms for capturing and sharing the most up-to-date information on any flight. Additionally, the Program will develop a single common reference for all system information about a flight and seek to eliminate the exchange of flight information that is redundant or inconsistently defined.

The FAA's mission is to provide the safest and most efficient airspace system in the world. To uphold the safety and efficiency of the NAS, it is essential that users have access to timely and accurate information regarding the current operational state to enable informed decision-making. A critical component of this information is aeronautical information, which includes NOTAMs that communicate dynamic changes.

The portfolio's Flight Deck Collaborative Decision-Making Program sets the framework and standards that flight operators will use to implement advanced automation capabilities and improve collaborative decision making. This will enable the creation and implementation of new and visionary applications that support the evolution of a data driven operational environment.

Potential Progress Toward Achieving Modal Strategic Goals:

As the FAA evolves, more structured digital information will be available and technologies such as IoT will allow airspace users to make decisions based on the most current information. The Programs within this portfolio are leveraging this information and adopting technological advancements such as machine learning and cloud computing, while working towards developing and standardizing applications that enable enhanced participation by the flight crew in the collaborative decision-making process. The Programs are also working towards the development of capabilities to allow dynamic reconfiguration of NAS infrastructure elements to meet changing

demand and capacity needs, which is aligned to the Department of Transportation’s “Infrastructure” goal, specifically “2.2 Improve System Condition and Reliability.”

Collaboration Partners:

- Research, Engineering, and Development Advisory Committee (external): Provides advice and recommendations to the FAA Administrator on the needs, objectives, plans, approaches, content, and accomplishments of aviation research programs, and reviews and comments on the aviation research programs.
- FAA Lines of Business: Collaborate with multiple internal lines of business such as air traffic, program management, and aviation safety offices for policy development, concept maturation, and technical acceptance of investment capabilities.
- International Civil Aviation Organization (ICAO) (external): Partnership with ICAO ensures that the FAA is part of international harmonization of data exchange and management, a key piece of the future of air traffic management and user collaboration.
- MITRE: Leverage research integration and data exchange and assist with technology transfer.
- Embry-Riddle Aeronautical University: Leverage university partnership to bring new technologies, concept maturation and strengthen research capabilities.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

NAS Infrastructure Portfolio

Requested: (\$17,100,000)

Program Description:

The NAS Infrastructure Program enhances and improves data communications, air traffic management, and weather management, which facilitates better decision-making among National Airspace System (NAS) users. It focuses on reducing aviation risks through pre-implementation activities related to weather and engineering, supporting infrastructure transformation and enhancement for both current and future Programs. Key Program capabilities are grouped into categories such as communications, navigation, surveillance, infrastructure, standards, and weather. Overall, the Programs enhance airspace capacity, efficiency, and safety, benefiting the public by optimizing airspace usage, increasing airport operational capabilities, and improving data and navigation management.

Major Program Objectives

The NAS Infrastructure Program contains key transformational and infrastructure sustainment capabilities that are critical to the success of the current and future NAS. This Program supports the FAA goal of expanding capacity by conducting pre-implementation activities geared toward the development of decision support tools that improve the strategic management of NAS operations. The Program's main goal is to support the improved capacity, efficiency, flexibility, environment, predictability, and safety of the NAS.

Anticipated Program Activities:

New ATM Requirements:

- *Advanced Air Ground Communications (Connected Aircraft)*
 - Develop concept and analysis of performance and implementation tradeoffs of various multi-path communications architectures
 - Complete an integrated framework update to include findings of smart routing test and analysis
 - Analyze air traffic control decomposition services against impacts or implications for connected aircraft construct
 - Develop database and tables of deconstructed controller information for use in third-party microservices
 - Continued development of performance-based standards for connected aircraft supporting non-safety communications
- *Artificial Intelligence for Air Traffic Control:*
 - Conduct engineering analysis to identify and document current traffic flow functions in the tactical phase
 - Analyze the functionalities, strengths, limitations, and data availability
 - Identify areas where decision-making can be enhanced or streamlined with the help of machine learning technology
- *Unmanned Aircraft Systems Operations Integration – Qualification of Third-Party Weather Providers (3PWP):*
 - Draft advisory circular for 3PWP providing observed weather information and update as needed

- Continue development of roadmap report, process plan reference document, 3PWP application package report, and weather data standards report
- Support the execution and refinement of the qualification process, based on internal testing based on internal testing
- Update previous roadmap to account for process and flowchart changes; and report on testing the 3PWP qualification process in the operational environment
- *Weather Transition:*
 - Development of improved weather performance requirements that enable enhanced forecasting capabilities in support of FAA operational decision-making
 - Identification and replacement of obsolete weather products with more efficient weather information already available from the meteorological community to ensure capability with existing FAA systems

Weather Forecast Improvements:

- *ATM Weather Integration*
 - *Weather Services for xTM*
 - Conduct shortfall analysis
 - *Cloud Services for Aviation Weather (CSAW):*
 - Complete artifacts in support of initial analysis and readiness decision (IARD) and achieve IARD for an initial CSAW capabilities (e.g., turbulence weather avoidance polygons)
 - Produce the following documents: functional architecture document, enterprise architecture views, program requirements document, information system security assessment, implementation strategy planning document
 - Continuing exploration of hosting various matured and translated aviation weather capabilities (e.g., convective or icing weather avoidance polygons) on CSAW platform and prioritize capabilities based on stakeholder input. use input to define new use cases or follow-on CSAW capabilities
- *International:*
 - Develop final functional and performance requirements for new or improved aeronautical meteorological information for inclusion in Amendment 83 to Annex 3
 - Develop initial draft standards and recommended practices for new or improved aeronautical meteorological information for inclusion in Amendment 83 to Annex 3
 - Develop initial draft standards and recommended practices for the provision of new or improved aeronautical meteorological information in International Civil Aviation Organization (ICAO) Meteorological Information Exchange model format for inclusion in Amendments 83 and 84 to Annex 3
- *Weather Community of Interest:*
 - Delivery of yearly technical letter of project history, problem statement adjudication, and accomplishments for the current fiscal year

Information Management:

- Develop guidance on identity management for modern NAS systems
- Analyze the as-is state of NAS service registries for future interoperability
- Analyze NAS needs to support common services
- Common service suitability analysis of candidate service
- Guidance on modern deployment methods and environments
- Conduct technical analysis that supports the FAA's participation in the ICAO Information Management Panel

- Investigate requirements for operational data management with a focus on data performance, security, and quality

Navigation Engineering:

- Engineering and analyses on innovative navigation performance for new entrants – low altitude/small drone operations and alternatives to GPS for drones
- Engineering and analyses to validate the performance of navigation aids for operations - exploring shortfalls of navigation interference in an urban environment

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

Program activities aim to generate substantial outputs, outcomes, and impacts on NAS technologies and practices. By developing concept-level requirements and investment analysis products for the NextGen Weather Processor and Common Support Services – Weather, the Program will optimize weather data processing and dissemination. CSAW open platform communications (OPC) will analyze shortfalls, define a concept of use, requirements, enterprise architecture views, system security assessment and perform IARD efforts allowing for the exploration of specific use cases for the creation and dissemination of OPC to NAS Air Traffic display and automation systems. In addition, integrating new weather products into the NAS will maximize operational benefits for dependent Programs such as the Traffic Flow Management System and Time-Based Flow Management.

Additionally, the down-selection of candidate input device technologies for NAS automation systems will drive improvements in system interactions and productivity. The initial analysis of artificial intelligence applications to support air traffic controller functions could revolutionize decision-making processes and operational efficiency. Collectively, these initiatives are poised to advance technological capabilities and practices within the NAS, leading to heightened safety, efficiency, and capacity in air traffic management.

Potential Economic or Societal Impacts:

The NAS Infrastructure Portfolio is poised to deliver substantial economic and societal benefits by advancing the efficiency, capacity, and safety of the NAS. By enhancing data communications, air traffic management, and weather management, the Programs support informed decision-making and risk reduction in aviation operations.

- The Weather Forecast Improvements Program, for example, aims to improve the accuracy and timeliness of weather predictions, thereby optimizing airspace usage and minimizing disruptions.
- The New Air Traffic Management Requirements initiative focuses on expanding airspace capacity by developing decision-support tools that leverage advanced technologies like artificial intelligence and unmanned aircraft systems, thereby increasing airport operational capabilities.
- Information Management efforts further enhance these benefits by streamlining data sharing and analysis across the NAS, reducing costs, and supporting modernization efforts.

Collectively, these Programs contribute to a harmonized and efficient global air transportation system, ensuring that both domestic and international airspace users can reap the full benefits of technological advancements and improved operational standards. This alignment not only bolsters the economic vitality of the aviation sector but also enhances societal welfare by ensuring safer, more reliable air travel. Navigation engineering enhances economic and societal impacts by improving navigation resiliency with expanded distance measurement equipment coverage. This supports reliable Performance-Based Navigation during Global Navigation Satellite System disruptions, reduces infrastructure costs, and fosters connectivity and commerce, contributing to more robust and dependable air travel.

Potential Progress Toward Achieving Modal Strategic Goals:

The NAS Infrastructure Program is achieving Department of Transportation strategic goals focused on “Innovation” in transportation. By prioritizing infrastructure efficiencies and modern technologies, the Program supports the development and adoption of advanced transportation systems. It’s initiatives in data communications, air traffic management, and weather management showcase the latest advancements, such as integrating artificial intelligence for smarter air traffic control and enhancing unmanned aircraft systems operations with reliable weather data from third-party providers. These efforts are crucial for expanding airspace capacity and improving airport operations. Additionally, investments in transformative technologies like the NextGen Weather Processor and Common Support Services – Weather ensure that weather data is processed and shared efficiently, leading to safer and smoother air travel. Together, these initiatives enhance the aviation sector and offer improved air travel experiences for both domestic and international passengers.

Collaboration Partners:

Current and future NAS Infrastructure Portfolio capabilities continue to bring positive effects to the aviation industry and the flying public across the NAS. The FAA and the aviation industry (such as United Airlines, FedEx, and Delta Airlines) work together to identify high-benefit, high-readiness capabilities for implementation in the near term.

Additional partners include:

- Research, Engineering, and Development Advisory Committee (external): Provides advice and recommendations to the FAA Administrator on the needs, objectives, plans, approaches, content, and accomplishments of the aviation research programs, and reviews and comments on the aviation research programs.
- ICAO (external): Partnership with ICAO ensures FAA’s part of international harmonization of data exchange and management, a key part of the future of air traffic management and user collaboration.
- Airline Electronic Engineering Committee (AEEC) (external): Partnership with AEEC support standards development to inform air/ground communications between FAA and airspace users in the future.
- FAA Lines of Business (internal): Multiple internal lines of business such as air traffic, program management office, and aviation safety collaborate for policy development, concept maturation, and technical acceptance of investment capabilities.
- National Oceanic and Atmospheric Administration (external): Coordination to identify improvements to aviation weather-observation sensor networks.
- Department of Defense (external): Coordination to identify improvements to aviation weather-observation sensor networks.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Laboratories and Support Portfolio

Requested: (\$7,000,000)

Program Description:

The Laboratories and Support Portfolio provides the NAS environments required to validate the broad framework of future concepts, technologies, and systems and to test the integration, development, and operations functions before they are introduced into the NAS. This Program provides three test platforms: the NextGen Integration and Evaluation Capability, the Florida Test Bed, and the Research & Development Operating Environments Cloud. The Program also includes the Operational Assessment of Performance Program which provides analyses in support of NAS modernization activities by providing a comprehensive evaluation of fielded capabilities. System analyses will focus on quantitative assessments of the operational impacts of fielded NAS modernization components as well as identifying operational shortfalls and improvement opportunities as the NAS continues to evolve.

Major Program Objectives:

The Laboratories and Support Portfolio provides targeted FAA research and development that will lead to new technology development and deployment in the NAS. Data generated by this Program will allow for the assessment of regulatory approaches, foster information sharing, and facilitate coordination and collaboration with industry and other stakeholders. Most importantly, this Program facilitates the testing and adoption of new technologies throughout the NAS. To aid in the testing and adoption of new technologies, the Program incrementally expands the capabilities of the testing platforms. These capabilities will also align with the NAS modernization demonstration projects and stakeholders' needs and vision.

Anticipated Program Activities:

NextGen Integration and Evaluation Capability:

- Provide necessary infrastructure enhancements for engineering development and validation exercises supporting NAS 2040 operations
- Support the maintenance of the Research and Development Operating Environment Cloud with the initial infrastructure supporting current FAA R&D initiatives
- Provide engineering support services for infrastructure and capabilities to support future concept demonstrations
- Provide necessary licenses, maintenance agreements, and equipment of the testing platform

Florida Test Bed (FTB):

- Provide engineering support services for infrastructure and capabilities to support future concept demonstrations
- Provide necessary licenses, maintenance agreements, and equipment for the testing platform
- Provide sustainment for the FTB facility which includes leases, utilities, maintenance, and inspections

Research and Development of Operating Environment (RD-OE):

- Continue to build and support the RD-OE infrastructure to support engineering development and validation activities in support of NAS 2040 operations

Operational Assessment of Performance:

- Investigate and evaluate performance of capabilities introduced into the NAS within the previous year, focusing on the variation in daily operations
- Analyze the potential operational needs/improvements supported by the vision and concept of operations for the NAS 2040 outlook vision

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

This Program will further research into advanced capabilities set to be integrated into the NAS. These capabilities include but are not limited to multi regional Trajectory Based Operations, Flight Deck Collaborative Decision Making, Automated Evolution Strategy, and Common Support Services – Flight Data. Additionally, the Program will assess the performance of previously fielded capabilities. These assessments provide leadership with useful information that helps inform their future decisions.

Potential Economic or Societal Impacts:

Not Applicable

Potential Progress Toward Achieving Modal Strategic Goals:

This Program has made progress toward the Department of Transportation goal of “Innovation” by providing a suitable environment for new and transformative concepts to be developed and validated. Additionally, the Program has facilitated the interaction of diverse stakeholders, allowing for the propagation of new ideas. Furthermore, the Program has supported and accelerated the research of future NAS capabilities.

Collaboration Partners:

This Program is a pathway to obtaining stakeholder input. For example, the NextGen Integration and Evaluation Capability laboratory is used to expose the air traffic management operational stakeholder community to emerging concepts and capabilities to obtain their assessment of the potential operational effectiveness and/or suitability of the concept for use in further maturation and development exercises or adoption and implementation.

The Florida Test Bed is a facility located at the Embry-Riddle Aeronautical University in Daytona Beach, FL. It supports the integration of new and emerging technologies into the NAS through demonstrations and evaluations. One of the main purposes of the Florida Test Bed is to provide an open-access location for industry, users, and vendors to demonstrate new capabilities and harness NAS architecture solutions. These demonstrations cultivate government, academia, and industry partnerships and facilitate decision making involving key stakeholders.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Enterprise, Concept Development, Human Factors & Demonstrations Portfolio

Requested: (\$10,500,000)

Program Description:

The Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio conducts enterprise-level activities, including developing concepts across the National Airspace System (NAS), human factors analysis of the future operational environment, and demonstrations of proposed system improvements to ensure operational feasibility and viability within the current and future NAS.

Major Program Objectives:

Program concept development efforts will evaluate capabilities that will support the NAS environment required to implement information-centric NAS and performance-based operations during all phases of flight, in various types of airspace, and high-altitude operations. These concepts enhance system capacity and efficiency while ensuring safe aircraft separation and reducing workload for controllers and flight crews. The work identifies future concepts and maturation activities that will contribute to NAS modernization. Human factors activities evaluate concepts for human factors implications and inform the maturation of these concepts into successful capabilities. Stakeholder demonstrations provide practical application and analysis of proposed future system improvements to validate and prove concept feasibility and determine which initiatives might be accelerated through fast-track modeling.

Anticipated Program Activities:

Enterprise Human Factor Development:

- Research into human factors considerations in transition to NAS service-based architecture
- Research into human factors considerations for human-automation teaming for air traffic control and air traffic management
- Research on human factors impacts of increasing data and communications availability in the NAS 2040 Vision
- Research on human factors impacts of increasing data and communications availability in the Info-Centric NAS
- Identify potential controller skill degradation due to increased task automation. Loss of proficiency in tasks that have been automated has been demonstrated in a wide range of activities
- Develop human factors recommendations for improved traffic management information presentation

Enterprise Concept Development:

- Complete update to smart airports concept of operations for small-sized airports.
- Final update to the FAA trajectory-based operations (TBO) concept of operations for alignment with global concepts (e.g., International Civil Aviation Organization (ICAO) TBO, connected aircraft, zero trust)
- Concept development for transitioning from Aeronautical Message Handling System (AMHS) to System Wide Information Management (SWIM) application due to flight plan 2012 cessation
- Begin research and gap analysis on ubiquitous communication in the NAS
- Complete concept maturation for transitioning from AMHS to SWIM application due to flight plan 2012 cessation
- Finalize research and draft a concept of operations for ubiquitous communication in the NAS

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

This Program is anticipated to lead to the completion of a human factors assessment regarding automation enhancement concepts across various domains. This research culminates in a comprehensive report on human factors considerations during the transition of the NAS. In support of these developments, guidelines will be established for human-automation teaming in air traffic management, addressing critical aspects of collaboration between human operators and automated systems. Additionally, training and mitigation strategies are to be devised to counteract controller skill degradation, ensuring that proficiency is maintained despite increasing automation. In parallel, the NAS 2040 concepts will be updated, integrating insights gained from related concept development initiatives. Efforts also include a functional analysis and concept of operations for smart airports, alongside an updated draft of the TBO concept of operations. Finally, a concept evaluation report is to be prepared to facilitate the transition from the AMHS to SWIM applications, following the cessation of the flight plan 2012.

Potential Economic or Societal Impacts:

The Enterprise, Concept Development, Human Factors, and Demonstrations Program promotes safety, efficiency, and a reduction in air traffic delays. The Program will continue to validate operational concepts to identify technical and operational requirements (paying particular attention to human factors considerations) and conduct stakeholder demonstrations to collaborate with users, operators, and other partners on emerging technologies and NAS-wide concepts to prepare the NAS for air traffic operations in 2040 and beyond.

Potential Progress Toward Achieving Modal Strategic Goals:

The Enterprise, Concept Development, Human Factors and Demonstrations Portfolio will advance the Department of Transportation's strategic goal of "Innovation" by transforming the aviation landscape, as evidenced by several key initiatives. The final functional analysis for Smart Airports marks a significant step in redefining airport operations to enhance efficiency and passenger experience. Additionally, the Smart Airports Concept of Operations aims to incorporate advanced technologies and processes, expanding its scope to include medium-sized airports, thereby broadening its impact across the aviation network. Parallel to these efforts, research and gap analysis on ubiquitous communication within the NAS is being initiated to ensure seamless connectivity and information sharing among all stakeholders. This endeavor includes transitioning from the Aeronautical Message Handling System to the System Wide Information Management application, a change necessitated by the cessation of flight plan 2012, which will streamline data exchange and enhance decision-making processes. Furthermore, the development and drafting of a concept of operations for ubiquitous communication in the NAS are being finalized, for a more integrated and resilient communication framework.

Collaboration Partners:

This Program utilizes input from FAA stakeholders, airspace users, and industry. It works collaboratively with all groups to understand the value and feasibility of new FAA concepts and capabilities to determine which concepts should be transitioned for further development.

Input from FAA stakeholders and industry partners is derived through participation in several collaborative communities and workgroups. Program partnerships provide advice, recommendations, identify high benefit capabilities, and ensure international harmonization. Partners include:

- Research, Engineering, and Development Advisory Committee (external): Provides advice and recommendations to the FAA Administrator on the needs, objectives, plans, approaches, content, and accomplishments of aviation research programs, and reviews and comments on the aviation research programs.
- RTCA (external): Provides recommendations on technical and operational standards to achieve the necessary improvements in the air transportation system, safety and efficiency. Input has deepened FAA understanding of technical maturity and resulted in changes to definitions and timing for operational concepts.

- ICAO (external): Partnership with ICAO ensures FAA's role in international harmonization of data exchange and management, a key part of the future of air traffic management and user collaboration.
- FAA Lines of Business (internal): Multiple internal lines of business such as air traffic, program management office, and aviation safety collaborate for policy development, concept maturation, and technical acceptance of investment capabilities.

United States Department of Transportation

FY 2026 Annual Modal Research Plans

Unmanned Aircraft Systems

Requested: (\$16,000,000)

Program Description:

The integration of Unmanned Aircraft Systems (UAS) and Urban Air Mobility (UAM) into the National Airspace System (NAS) involves a coordinated effort across multiple programs to enhance airspace management, safety, and efficiency. The UAS Flight Information Management System (FIMS), developed with NASA, supports UAS traffic management by coordinating operations below 400 feet, enabling operators to manage flights with real-time constraints. UAM explores innovative solutions for urban transportation, integrating crewed and uncrewed aircraft into the National Airspace System (NAS) with new traffic management techniques tailored for urban environments.

The Concept Validation and Requirements Development (CVRD) Program focuses on creating policies and infrastructure for safe Beyond Visual Line of Sight (BVLOS) operations. Upper airspace operations above flight level 600 is addressed by a program analyzing communication, navigation, and surveillance needs for managing diverse high-altitude operations. The Small UAS (sUAS) Implementation Program improves airspace access through initiatives like the low altitude authorization and notification capability and B4UFLY integration, while supporting broader safety compliance efforts with systems like the UAS Geospatial Information Management System (UGIMS).

These Programs collectively aim to address the unique challenges of integrating both traditional and emerging aviation technologies, ensuring safe, efficient, and seamless operations across all sectors of airspace. Through these efforts, the FAA, in collaboration with NASA and industry partners, is paving the way for the future of aviation, accommodating new vehicle types and operational paradigms.

Major Program Objectives:

FAA products, policies, and procedures must be reviewed and refined, or developed through supporting research, to permit UAS operations in the NAS. The UAS Research Program plays a critical role in enabling UAS operations in the NAS without affecting manned aircraft operations (e.g., creating disruptions or delays) and ensures that NAS operations will be as safe as or safer than today.

Anticipated Program Activities:

UAS - Flight Information Management:

- UAS Flight Information Management Concepts and Analysis:
 - Develop use cases for sustained control within UAS traffic management (UTM) Plan version 4.0 (e.g., BVLOS, historical query)
 - Complete reference implementation strategy Version 4.0 (e.g., BVLOS, historical query)
 - Complete Evaluation Report Version 5.0 (e.g., UTM Contingency Management, BVLOS Controlled Airspace Access).
 - Develop evaluation plan for integrated UTM operations

UAS - Concept Validation and Requirements Development:

- Evaluate surveillance infrastructure and services to support large UAS BVLOS operations
- Define surveillance performance requirements for large UAS BVLOS operations

- Update shortfalls and requirements
- Develop navigation concept of use

Small UAS Implementation:

- Deploy and enhance unmanned aircraft flight rules utility capability and begin integration into UGIMS environments
- Complete development of the UGIMS-related capabilities, including FAA-recognized identification areas and UAS facility maps and continue to develop UGIMS architecture
- Enhance the Geospatial Data Feed Service for UGIMS integration
- Contribute to the development of the UTM ecosystem and enhancements of contributing services as determined by the FAA Air Traffic Organization UAS services plan
- Enhance Drone Information for Security, Compliance, Verification, and Reporting (DISCVR) for additional remote ID and security requirements
- Expand the DISCVR user base within the FAA and other federal agencies, as needed
- Implement information security capabilities for UTM ecosystem.
- Contribute to the enhancement of the UTM ecosystem capabilities (e.g. pilot registry, critical infrastructure)
- Update the UTM ecosystem/infrastructure to support additional data exchange for small UAS for cyber security, supervised automation, etc.
- Development of BVLOS operational information exchange for UAS service suppliers
- Continue development of enterprise UAS/airspace system for the integration of temporary flight restriction/notice to airmen data to improve authorization capabilities
- Enhance UTM ecosystem capabilities, systems, and services (e.g., FAA DroneZone, low altitude authorization and notification capability)

UAS- Upper Airspace:

- Assess the exchange methods for expanded traffic management (ETM) operation
- Complete a gap analysis and recommend enhancements of the exchange methods for ETM operations
- Identify methods and criteria for designating cooperative areas in upper class E airspace

UAS - Urban Air Mobility:

- Develop and support UAM safety risk analysis (as needed for airspace changes proposal) version 2.0
- Complete system/subsystem specifications for UAM operations (version 2.0)
- Develop computer human interface requirements document (version 2.0)
- Develop use cases for UAM remotely piloted operations
- Develop UAM concept of operation (version 4.0)
- Update UAM prototype system (version 2.0)
- Execute operation evaluation of UAM in ATM and UTM environment
- Complete ACAS Xr algorithm supporting documentation for RTCA SC-147 MOPS approval
- Determine initial infrastructure and technology requirements for increases for UAM operations
- Conduct AAM human-in-the-loop simulations for key project site 2 in the U.S., leveraging use cases refined through modeling, simulation, and tabletop exercises

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

This Program will identify requirements for enabling and managing UAS operations in airspace that are conducted below 400 feet above ground level for predominantly smaller UAS. This will be accomplished through the development of a separate, but complementary, traffic management system to coincide with the FAA's Air Traffic Management System. With the Flight Information Management System, the FAA will have the ability to provide real-time constraints to UAS operators who will be responsible for managing their own operations safely within these constraints without receiving active air traffic control services from the FAA.

Efforts undertaken by the CVRD Program will enable future integrated UAS operations. Issues involved with UAS integration include the inability to comply with traditional see and avoid requirements, unique communications needs, lost link procedures, and other challenges that dictate that concept engineering activities address all aspects of how UAS operations fit with other NAS operations.

Potential Economic or Societal Impacts:

The UAS Programs play a critical role in enabling UAS operations in the NAS without disrupting manned aircraft operations, without creating disruptions or delays, and ensuring NAS operations will continue to be safe. This program will also identify the necessary infrastructure, requirements, and internal and external stakeholder coordination to support the integration of UAS operations in the NAS. A major part of providing for UAS operations is direct engagement with industry to build a public-private partnership exploiting industry's research and innovative technologies. Leveraging the partnership to provide improvements to NAS capabilities and operations through this integrated framework provides a cost-effective approach to addressing needs and solutions.

The goal extends beyond technical integration; it aims to unlock substantial economic potential by fostering new markets in drone services and AAM, creating jobs, and enhancing efficiency across various sectors. While promising societal benefits like improved emergency response and access, successfully managing inherent challenges related to safety, security, privacy, and public acceptance is crucial for realizing this advanced aerial future and providing improvements to NAS capabilities.

Potential Progress Toward Achieving Modal Strategic Goals:

The UAS Programs will advance the Department of Transportation's strategic goal of "Innovation" by streamlining the integration of UAS and Urban Air Mobility (UAM) into the NAS. The Programs reduce regulatory burdens through initiatives like the UAS Flight Information Management System, which allows UAS operators to manage their flights autonomously within real-time constraints, minimizing the need for active air traffic control and thereby easing regulatory requirements. The Programs also foster the development and adoption of transportation technology by focusing on Beyond Visual Line of Sight operations, enhancing airspace access, and refining surveillance and navigation infrastructure. These efforts are crucial in enabling seamless UAS operations without impeding manned aircraft activities, ensuring safety and efficiency. The Programs' holistic approach to innovation not only address the immediate challenges of airspace integration but also lay the groundwork for a sustainable and advanced aerial future.

Collaboration Partners:

Additional public stakeholder input is obtained through RTCA and the Drone Advisory Committee (DAC). RTCA provides recommendations on technical and operational standards to achieve the necessary improvements in the safety and efficiency of the air transportation system. Input has deepened the FAA's understanding of technical maturity and resulted in changes to definitions and timing for operational concepts. DAC is comprised of the FAA and key decision-makers supporting the safe introduction of UAS into the NAS. The Committee seeks to identify and propose actions for the FAA on how best to facilitate the resolution of issues affecting the efficiency and safety of integrating UAS into the NAS. Additional partners include:

- **FAA Lines of Business and Program Management Organization:** Collaborate with multiple internal lines of business such as air traffic, program management office, and aviation safety for policy development, concept maturation, and technical acceptance of investment capabilities.
- **FAA/NASA UTM Research Transition Team Stakeholder (RTT) Group:** Oversees the RTT activities, including efforts by all working groups to develop the necessary requirements, concepts, and infrastructure for low-altitude operations for UAS. UTM RTT Stakeholder support will ensure proper recording and coordination of RTT progress and actions.

United States Department of Transportation FY 2026 Annual Modal Research Plans

System Planning and Resource Management Requested: (\$3,894,000)

Program Description:

The System Planning and Resource Management (SPRM) Program leads the planning, coordination, development, presentation, and review of the FAA's Research and Development (R&D) portfolio. Its key programmatic outputs include the National Aviation Research Plan (NARP) and its companion document, the R&D Annual Review (AR), both of which are annual statutory deliverables to Congress. The NARP provides an overview of the FAA's research and development plans over the next five years, highlighting near-, mid-, and far-term research. The AR highlights the accomplishments of the research completed during the prior fiscal year, including a description of research results disseminated to the private sector and new technologies developed by the agency. The SPRM Program also conducts the administration of the congressionally mandated Research, Engineering, and Development Advisory Committee (REDAC) and resultant recommendations and reports. SPRM also provides program advocacy and outreach and maintains alignment with departmental R&D program planning and performance reporting guidance. SPRM manages the portfolio planning, formulation, presentation, and review activities to ensure the FAA meets the President's criteria for R&D, increases program efficiency, sustains and maintains management of the program within operating cost targets, and enables effective program review by the REDAC and the Department of Transportation Office of Research and Technology (OST).

SPRM also develops program guidance and conducts compliance reviews to ensure that departmental R&D program planning and performance reporting requirements are met. It also coordinates the establishment and administration of the Air Transportation Centers of Excellence (COE) Program and ensures compliance with related financial assistance and grants management departmental policy guidance.

The SPRM Program advances the Department's mission by providing an inclusive and innovative culture to effectively serve communities and responsibly steward the public's applied research dollars. SPRM ensures the American public's resources are invested in such a manner as to deliver substantive research that provides safety and efficiencies while delivering results to the flying public.

Major Program Objectives:

The SPRM Program manages the RE&D portfolio and submits the mandatory R&D planning documents to Congress each year. Through the REDAC's findings, this program facilitates an independent, expert review of the FAA's R&D portfolio that provides meaningful recommendations for the FAA to refine and improve its portfolio. This results in a more effective research program that will benefit the public by making aviation safer and smarter and enhancing U.S. global leadership in aviation.

Anticipated Program Activities:

- Annual statutory deliverables to Congress
- Departmental (OST) R&D program planning and performance reporting requirements
- Development and submission of the FAA's R&D investment portfolio

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

Ensure that legislatively required R&D program planning and performance reporting requirements are satisfied.

Potential Economic or Societal Impacts:

The SPRM Program helps prevent duplication of R&D work and ensures reporting requirements are met by one organization. These reports and committees provide senior management with the information needed to make informed decisions on future R&D programs.

Potential Progress Toward Achieving Modal Strategic Goals:

By providing support for the FAA to formulate its annual RE&D portfolio and submitting the yearly Congressional planning documents, the SPRM program provides complete transparency on the R&D work that is performed. Its efforts help prevent duplicative work by collaborating with other federal agencies, academia, and private industry to better serve the aviation industry. By highlighting the excellent work performed and collaboration, the SPRM program presents DOT with opportunities to be an employer of choice.

Collaboration Partners:

The development and submission of all SPRM products (AR, NARP, Annual Modal Research Plan, President's Budget Request Budget Narratives, Technology Transfer (Congressional Report), REDAC, and Research Executive Board (REB)) involve the same stakeholders.

FAA research planning and reporting stakeholders include:

- Office of the William J. Hughes Technical Center for Advanced Aerospace Director – Manages the entire FAA Research portfolio, oversees research funding allocations and disbursements, research management and efficiency and serves as the Chair of the REB.
- Office of the Associate Administrator for Aviation Safety – Manages portfolio of Aviation Safety Research Programs, voting member of both the REDAC and the REB.
- Office of the Associate Administrator for Airports – Manages portfolio of Airport Technology and Cooperative Research Programs, voting member of both the REDAC and the REB.
- Office of the Associate Administrator for Commercial Space Transportation – Manages portfolio of Commercial Space Research Programs, voting member of both the REDAC and the REB.
- Office of the Assistant Administrator for Policy, International Affairs and Environment - voting member of both the REDAC and the REB.
- Office of the Assistant Administrator for Finance and Management – Provides all financials associated with the planning and reporting products, serves as financial point of contact to OST, serves as advisory member of the REB.
- Air Traffic Organization – advisory member of the REB.

United States Department of Transportation FY 2026 Annual Modal Research Plans

William J. Hughes Technical Center Laboratory Facilities Requested: (\$6,597,000)

Program Description:

The Laboratory Facilities Program sustains research facilities located at the William J. Hughes Technical Center to support Research and Development (R&D) program goals. These programs require specialized facilities to emulate and evaluate field conditions. The R&D laboratories are comprised of the Cockpit Simulation Facility, Target Generation Facility, Research Development and Human Factors Laboratory (RDHFL) and the Research & Development Operational Environment (RDOE) network and the FAA laboratory space located within the National Aerospace Research and Technology Park (NARTP). The associated R&D programs require specialized facilities which provide flexible, high-fidelity environments to conduct research and perform human-in-the-loop simulations that evaluate advanced air traffic concepts. Researchers measure baseline human performance using existing air traffic controller configurations and determine changes in performance when new systems or procedures are introduced to identify and evaluate human factors issues. These laboratories include integrated cockpits, air traffic controller workstation capabilities (simulated and real), and specialized biometric data collection systems to evaluate the system and human components that can only be addressed in a full mission end-to-end simulation environment. The R&D laboratories are fully integrated with other Center capabilities allowing for an extremely high-fidelity environment supporting R&D research. This research encompasses the capabilities of the current systems, NextGen, and the transition between these systems (e.g., mixed equipage, adjacent site deployment). The funding provides for existing infrastructure support, project support, engineering support, R&D facility modifications and improvements, equipment and software/hardware licenses, and support tools.

Major Program Objectives:

The main goal of the Center is to provide a laboratory environment that is fully integrated, extremely high fidelity, and that encompasses capabilities of current day systems, future systems, and the transition between the two. The goals of these simulation facilities include developing capabilities to enable research of complex problems, such as weather and emerging operations, in a controlled laboratory environment. The fully integrated facilities will enable research from the ground and airborne elements for a complete simulation capability. Objectives include:

- Concepts and Systems Integration - RDHFL goals include conducting proactive human factors research on proposed changes to the National Airspace System (NAS) that identify human performance issues early in the concept development phase.
- Network Infrastructure – RDOE network goals are to maximize shared resources, relieve the need to establish separate connections, and minimize duplication of efforts and the resources to manage these extra connections. The RDOE network provides a common network approach that affords distributed access to R&D laboratories, and a distributed set of capabilities.

The laboratory network operations center provides an environment to maintain, monitor status and cyber events, and operate the RDOE and customer networks. The Laboratory Facilities Program provides researchers with the specialized laboratories and infrastructure required to achieve R&D program goals and objectives. Having an efficient and flexible platform to evaluate current and future air transportation system concepts and technologies enhances the safety and efficiency of air travel for the American public. Performing research in simulation rather than with live aircraft generates cost savings, is intrinsically safer, and allows the study of the extremes that would not be possible in live flight conditions. The implementation of new technologies, such as intelligent agent-based capabilities, allow for a reduction in the number of test subject participants needed for a given study; again, maximizing cost savings and efficiencies. Modernization of the FAA R&D network infrastructure and further

extensibility into the Mike Monroney Aeronautical Center laboratories will directly support exploration of NAS modernization. Finally, human factors-related issues resolved prior to implementation result in cost savings and ensure that the FAA's safety standards for air traffic control operations are met.

Anticipated Program Activities:

- Support the integration of emerging operations within the NAS
- Provide a flexible, robust and secure network environment that enables research through the utilization of the R&D operational environment
- Explore human factors-related issues surrounding NAS automation systems and integration
- Facilitate the safe development of requirements related to Remote Tower operations at the FAA laboratory space at NARTP

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

R&D laboratories will facilitate safety enhancements and minimize operational costs. Early R&D activities help enhance NAS safety by reducing operational errors in the systems and enhancing human performance as new technologies are adopted.

Potential Economic or Societal Impacts:

Use of laboratory facilities provides an opportunity for early detection of issues during the concept development of lifecycles. This will reduce costs down the road as the new systems is developed and operationalized.

Potential Progress Toward Achieving Modal Strategic Goals:

Use of WJHTC laboratories enables new and innovative technology research, development, and testing for the R&D portfolio, supporting the Department of Transportation's goal of "Innovation."

Collaboration Partners:

This program has the following partners:

- Academia: Arizona State University, Drexel University, George Mason University, Georgia Tech, Embry Riddle Aeronautical University, Ohio State University, Rowan University, National Aviation Research & Technology Park.
- Federally Funded Research and Development Centers (FFRDCs): MITRE, MIT Lincoln
- Government: Department of Defense, NASA, Volpe.
- Industry: AvMet, ComSAT, Concepts Beyond, DocuSign, General Dynamics, Harris, Liberty IT Solutions, Saab Sensis, SAIC, Boeing.
- Other Government: EUROControl.

These partnerships are beneficial because they enable the achievement of efficient solutions by eliminating duplicative efforts, filling capability gaps, and sharing technical knowledge.

United States Department of Transportation FY 2026 Annual Modal Research Plans

William J. Hughes Technical Center Laboratory Sustainment

Requested: (\$19,900,000)

Program Description:

The Laboratory Sustainment Program sustains the William J. Hughes Technical Center laboratories. This centralized set of laboratories supports the Acquisition Management System lifecycle from concepts and requirements definition to in-service decision. These laboratories are the only location where it is possible to realistically simulate the National Airspace System (NAS), and it is necessary to maintain the laboratory systems with capabilities that match field sites that currently exist or are planned. These test beds can be altered to replicate desired field configurations and traffic scenarios, providing stakeholders with an understanding of how upgraded systems will perform prior to operational deployment. These labs also provide a flexible high-fidelity environment to conduct research and perform human-in-the-loop simulations that evaluate advanced air traffic concepts and are fully integrated with the other Center capabilities.

Major Program Objectives:

The goal of this program is to modernize the equipment and infrastructure necessary for the FAA's centralized NAS laboratory facilities so that facilities and equipment programs can deliver products that result in a safe, reliable, and efficient NAS. The Center centralized labs eliminate the need for each acquisition program to establish and sustain separate laboratory facilities to support their individual programs and fielded systems. Capabilities developed in these laboratories reduce the overall cost of NAS development while increasing traveler safety and decreasing travel times by reducing airspace congestion. This program is necessary to sustain the Center laboratory test facility, which provides direct field support for operational NAS systems. Problems identified at various field locations are quickly transmitted to the appropriate laboratory where solutions are developed and tested. The test beds are used by acquisition programs and partner agencies for development, test, evaluation, integration, transition testing, and first and second level support to the field. This program is necessary to maintain these laboratory systems in configurations and capabilities that match field sites that currently exist or are planned.

Anticipated Program Activities:

- Support laboratory space and infrastructure improvements
- Support laboratory requirements of programs and customers
- Support laboratory equipment technology refresh
- Support NAS equipment modernization

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

Research and development (R&D) laboratories will facilitate enhancements to safety as well as minimizing operational costs. Early R&D activities help enhance NAS safety by reducing operational errors in the systems and enhancing human performance as new technologies are adopted.

Potential Economic or Societal Impacts:

Use of laboratory facilities provides an opportunity for early detection of issues during the concept development of lifecycles. This will reduce costs down the road as the new systems is developed and operationalized.

Potential Progress Toward Achieving Modal Strategic Goals:

Use of WJHTC laboratories enables new and innovative technology research, development, and testing for the R&D portfolio, supporting the Department of Transportation’s goal of “Innovation.”

Collaboration Partners:

Not Applicable

United States Department of Transportation FY 2026 Annual Modal Research Plans

William J. Hughes Technical Center Infrastructure Sustainment Requested: (\$23,000,000)

Program Description:

The Infrastructure Sustainment Program at the William J. Hughes Technical Center reduces expenses associated with ongoing operation and maintenance activities as well as reducing the frequency of expenses associated with system replacement. System updates reduce energy consumption, and cost, on a per-square-foot basis, thus supporting current Federal Energy Management requirements for sustainability and energy consumption.

Major Program Objectives:

This program sustains the Center facilities, site utilities, and infrastructure. The Center represents approximately 1.6 million square feet of test and evaluation, research and development, and administrative facilities, plus numerous project test sites on 5,000+ acres of land.

Anticipated Program Activities:

- Support Center facility infrastructure

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

Research and Development (R&D) laboratories will facilitate enhancements to safety as well as minimizing operational costs. Early R&D activities help enhance safety to the National Airspace System by reducing operational errors in the systems and enhancing human performance as new technologies are adopted.

Potential Economic or Societal Impacts:

The WJHTC campus and infrastructure are critical to the operations of the NAS, FAA laboratories, FAA lines of business, and other Federal agencies residing on Technical Center grounds.

Potential Progress Toward Achieving Modal Strategic Goals:

Use of the WJHTC Infrastructure Sustainment Program support the Department of Transportation's goal of "Innovation." Program activities will address sustainment and replacement of systems and assets that have exceeded their useful lifecycle or are at risk of failure.

Collaboration Partners:

Not Applicable

Chapter 2 – FY 2027 RD&T Programs

“The AMRP FY2027 outlook year chapter in the annual plan is not developed in alignment with the Presidents’ Budget Request of the same year due to the AMRP development schedule per 49 U.S.C. 6501 – Annual Modal Research Plans.”

Airport Infrastructure and Technologies

FY 2027 Program Descriptions

Airports Cooperative Research Program

Program Description:

The Airport Cooperative Research Program (ACRP) is designed to address needs that are not being addressed by other federal research programs, and that cannot be undertaken cost-effectively by individual airports.

The ACRP is an industry-driven research program managed by the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine. It was authorized by section 712 of Vision 100 – Century of Aviation Reauthorization Act. The Secretary of Transportation maintains a memorandum of agreement among the Department of Transportation, FAA, and the National Academy of Sciences to implement the ACRP. The FAA Associate Administrator for Airports, as delegated by the Secretary also appoints the 13 members of the ACRP Oversight Committee.

The ACRP is a national resource for the airport industry, providing valuable information, guidance and practical tools to airport owners and operators (as well as consultants and contractors) by performing industry-driven research identified as critical by airport operators, industry, and users.

ACRP advances safety, economic impact and global competitiveness, workforce development, and emerging technologies and processes by providing applied research products to the airport industry that address these issues. Research continues in the use of emerging technologies, improved governance, transparency, and ensuring data privacy and cybersecurity of airport operations.

Major Program Objectives:

The ACRP's mission is to develop near-term, practical solutions to problems faced by airport operators. The ACRP uses contractors selected in a competitive process to conduct research, which is overseen by industry experts and designated FAA subject matter experts. Research results are published in the form of handbooks and best practices. To date, the vast library of publications includes the areas of safety, airport management, airport financing, airport environmental quality, airport compliance, and airport planning. These publications are available to the public on the ACRP website and for purchase in hard copy.

The ACRP's main goal is to provide resources to support applied research on a wide variety of issues faced by airport practitioners, including all levels of professional staff within the airport community, from CEOs, airport managers, executive directors, to mid-level managers, non-supervisory technical and professional staff, trainees, students, and interns. These professionals represent airports, suppliers, public safety agencies, airlines, airport tenants, local and regional government authorities, industry associations, and many other stakeholders in the airport community. Each of these practitioners has different interests and responsibilities, and each is an integral part of this cooperative research effort. Although the exact projects selected for research are chosen by an industry-led oversight committee, the committee endeavors to address topics that advance the policy objectives of the Department of Transportation. In addition, the National Academies of Science ensure that research conducted is done in a way that addresses the Department's goals and ensures that research is conducted in a transparent, objective, and academically sound manner.

Anticipated Program Activities:

- The ACRP Oversight Committee will meet in July of 2025 to determine FY 2027 research funding, projects, and priorities.

FY 2027 Program Descriptions

Airports Technology Research Program

Program Description:

The Airports Technology Research (ATR) Program supports the safe and efficient integration of new technologies into the airport environment by evaluating new technologies and methods to inform policies, standards, and regulatory guidance in response to increasing air traffic and industry demands.

The ATR Program focuses on new technology, testing, evaluation, and analysis to both update existing standards and to provide support services addressing site-specific problems at airports. For example, the ATR Program supports Unmanned Aircraft Systems (UAS) integration at airports; the development of new infrastructure design standards for Advanced Air Mobility (AAM); the integration of new firefighting foams used in Aircraft Rescue Fire Fighting (ARFF) response; and pavement research focusing on extending airport pavement life beyond the current 20-year design life.

Major Program Objectives:

The ATR Program directly supports the development and updates of the FAA's Airports regulatory guidance for airport safety and airport infrastructure, such as engineering briefs and advisory circulars (ACs). ATR Program research results and objectives are ultimately reflected in these ACs, which form the technical guidance used by airports across the nation.

On the infrastructure side, key FY 2027 objectives include searching, testing, and applicability of various recycled pavement materials and new construction methods and techniques that may be integrated into the design and construction of airport pavements. These methods and techniques will extend airport pavement life and improve construction efficiency. Since construction and rehabilitation of airport pavements represents a very large annual capital investment at airports (over \$ 2.5 billion), the use of these non-traditional pavement materials and construction methods will enhance airport safety, efficiency, and increase capacity.

On the airport safety side, in FY 2027, the ATR Program will remain engaged in solar lighting performance testing, continued in-house firefighting agent testing, reducing the risk of wildlife strikes by aircraft, researching infrastructure needs of rapidly emerging AAM vehicles, integrating UAS operations at airports, and developing tools to make better use of incident and accident data to direct research more effectively.

The Program also provides an environment where companies of all sizes can test new ideas and products to meet FAA standards. This encourages companies to be innovative in product development and competitive at the global level.

Anticipated Program Activities:

- Evaluate use of Cold Central Plant Recycling in airport pavements
- Evaluate the use of new materials to extend airport pavement life
- Leverage machine learning solutions to support innovative airport pavement design
- Continue development of airport pavement Life Cycle Assessment framework
- Research to support development of AAM infrastructure airport guidance
- Development of Fluorine Free Foams airport guidance for aircraft rescue firefighting
- Development of UAS airport applications integration guidance
- Safe integration of autonomous ground vehicles at airports
- Solar-powered airfield lighting systems
- Maintenance of safety databases including Foreign Object Debris and Wildlife Strikes

Aircraft Safety Assurance

FY 2027 Program Descriptions

Fire Research and Safety

Program Description:

The Fire Research and Safety Program conducts research to prevent accidents caused by in-flight fire and to improve survivability during a post-crash fire. The Program supports the FAA's Associate Administrator for Aviation Safety, who is responsible for issuing regulations, standards, and guidance material to ensure the highest level of safety in commercial aviation. Research efforts specific to hazardous material transport are completed in coordination with the Department of Transportation's (DOT) Pipelines and Hazardous Materials Safety Administration (PHMSA) and the FAA Office of Hazardous Materials.

The Program benefits the public by evaluating potential fire threats on commercial aircraft through laboratory testing. The aviation industry also benefits from the development, validation, and transfer of cost-effective aircraft fire safety technology. This Program is necessary because of the catastrophic consequences of an uncontrollable aircraft fire, including loss of life and the destruction of the aircraft. An example of this Program's results is demonstrated through participation in the Society of Automotive Engineers' G-27 committee, an international organization focused on efforts to develop a packaging standard for the safe shipment of lithium batteries on aircraft. The International Civil Aviation Organization (ICAO) requested this standard after the ban on the carriage of lithium batteries as passenger aircraft cargo. Following this ban, the Fire Research and Safety Program proposed a test standard and conducted extensive testing to understand the details and develop pass/fail criteria. The PHMSA is also participating in the development of the standard and, if adopted, would have the responsibility to change the hazardous materials shipping regulations to mandate its use.

Major Program Objectives:

The primary goals of this research are the prevention of catastrophic aircraft accidents caused by in-flight fires and increased survivability during a post-crash fire. Other benefits derived from this Program include the introduction of enabling technologies to prevent fire accidents in freighter aircraft and hidden in-flight fires in passenger-carrying airplanes, and the development, validation, and transfer of cost-effective aircraft fire safety technology to the aviation industry.

The FAA's William J. Hughes Technical Center for Advanced Aerospace has unique aircraft fire testing capabilities that do not exist anywhere else in the world. The Commercial Aviation Safety Team Safety Enhancement team recognized this fact, which recommended the FAA Fire Research and Safety Program conduct the research on new or improved fire standards for cargo containers and cargo fire suppression systems. The FAA Associate Administrator for Aviation Safety relies on objective research results to make decisions on required changes to certification methods as aircraft manufacturing incorporates new materials and processes that may have unforeseen consequences with respect to aircraft fire safety. Global aircraft manufacturers have no incentive to conduct research that might limit the safe use of these new materials and processes.

Major Fire Research and Safety Program objectives are consistent with the DOT's strategic research and policy objective to implement measures that mitigate or eliminate incidents among aviation operations and the traveling public. These efforts include testing and evaluation of new and emerging fire and smoke detection technologies; testing new fire-resistant cargo container materials and their efficacy in containing cargo fires, including the hazards associated with the carriage of hazardous materials; and supporting the development of a safe packaging standard for lithium batteries on passenger aircraft.

Anticipated Program Activities:

- Aircraft and Occupant Survivability

- Cargo Safety
- Propulsion and Fuels

FY 2027 Program Descriptions

Propulsion and Fuel Systems

Program Description:

The FAA establishes rules for the certification and operation of aircraft engines, fuels, and fuel management systems that enhance the airworthiness, reliability, and performance of air transport. The Propulsion and Fuel Systems Program conducts research that provides the FAA with the basis for new or revised engine certification and continued airworthiness standards. This research also supports FAA actions in response to National Transportation Safety Board safety recommendations. Moreover, it enables the preparation of advisory circulars that provide the industry with technical information on acceptable means of compliance with regulations. While increasingly rare, engine failure remains a major cause of aviation incidents. As new propulsion concepts emerge, such as open and multi-rotor, potentially powered by new fuels such as sustainable aviation fuel or hydrogen in complex, increasingly electrified architectures, new hazards and failure modes arise that may not be fully addressed by current regulation, standards, or advisories. Such gaps need to be identified, prioritized, and addressed as needed through collaborative research where the FAA plays a key role through its unique capabilities. Benefits accrue in the form of reduced risk of engine failures and fewer accidents, leading to fewer injuries and fatalities.

Major Program Objectives:

The Propulsion and Fuel Systems Program supports the Administration's principles regarding safety and American competitiveness. The Program conducts research on new and legacy aircraft propulsion systems to develop the technical basis for rules, policy, and guidance used for certification and continued airworthiness.

The Program is focused on three key elements: safe electrified propulsion, safe hydrogen propulsion, and multi and open rotor safety. The first two areas support safe implementation of emerging technologies that will play a key role in the aviation of tomorrow, including new business models such as advanced air mobility. The third area enables streamlined, model-based certification for multi-rotor aircraft, currently proposed in a variety of transport and cargo applications, as well as high efficiency open-rotor engines. The Program will develop data, models, and means of compliance methods to reduce and eliminate hazards associated with these areas.

The electrified propulsion effort will focus on the durability, endurance, and reliability of key powertrain components, such as batteries, electric motors, power converters, and high voltage interconnect systems under cycling conditions (altitude/pressure, temperature, humidity, load, and vibration) representative of proposed aircraft operations. Such components are expected to be present across the entire spectrum of electrified configurations, from full electric/batteries or fuel cells to various parallel or series hybrid electric architectures.

The safe hydrogen propulsion effort will address well recognized and emerging safety risks associated with gaseous and liquefied hydrogen storage, distribution, and use in aircraft propulsion systems. Key risks for hydrogen use are fire and explosion, although additional concerns exist with respect to material compatibility (e.g., embrittlement and permeation), crashworthiness, installation, fueling and handling, as well as cryogenic exposure physiological hazards. Hydrogen is much easier to ignite, burns faster, hotter, and remains flammable over a much wider range of concentrations in air than hydrocarbons. Colorless and odorless, hydrogen diffuses faster than other fuels. Once initiated, a hydrogen fire may only be safely extinguished by shutting off the fuel supply. Consequently, it is critical to understand, detect, and control leakage from fuel system components under realistic operating conditions, including hydrogen use as cryogenic coolant in systems exposed to turbine exhaust gases. In addition, risks will be addressed arising from requirements of engine start-up and altitude relight where hydrogen could ignite uncontrollably within the propulsion system. Finally, the crashworthiness of large, liquefied hydrogen tanks will be addressed to ensure survivability in the event of an emergency landing.

Multi and open rotor safety builds on methodologies developed to mitigate the risk of uncontained engine failures, such as the LS-DYNA® software that is used by industry to simulate rotating parts liberation, impact, and

penetration. Open rotor, as well as multi rotor systems (as proposed in advanced air mobility applications) pose concerns with respect to cascading failure of the propulsion system, as well as cabin and fuel tank safety, especially when coupled with use of hydrogen tanks. This Program develops advanced analysis methods and modeling tools to evaluate propulsion containment systems, shielding for critical areas, and vulnerability analysis tools necessary to protect the aircraft and its passengers.

To accomplish these objectives, research will be pursued through government and industry collaboration to ensure that a consistent level of safety is widely adopted by the engine industry.

Anticipated Program Activities:

- Safe Electrified Propulsion
- Safe Hydrogen Propulsion

FY 2027 Program Descriptions

Advanced Materials/Structural Safety

Program Description:

The Advanced Materials and Structural Safety Program conducts research to support FAA safety and regulatory activities in the technical areas of composites and other advanced materials and processes, and their impact on flight safety. The overall goal of this research is to support the development of standardized certification protocols and safe maintenance practices for advanced materials and structural applications. This research program is a proactive approach to preventing accidents rather than the reactive approach to preventing the recurrence of accidents pursued in the past. The Program coordinates its efforts with industry to provide data to support the FAA's oversight role of ensuring new technologies are adopted safely, as well as its mandate not to place an undue burden on industry.

Major Program Objectives:

The Advanced Materials and Structural Safety Program research objectives are to understand and document fundamental behaviors of materials and structures; establish methods of compliance to regulations; document background information on lessons learned and best practices in achieving form, fit, and function for a lifetime of structural application; and develop and maintain an educated workforce. The Program strives to understand the risks associated with introduction of new materials, manufacturing methods, and structures, and develops ways to mitigate them. Major program objectives are to:

- Develop methods to characterize and control new materials and processes to achieve consistent part performance
- Investigate long-term behavior and aging mechanisms of materials and structures to develop appropriate life management practices
- Develop certification methods that ensure safe and efficient introduction of new materials and structures in future aviation products
- Understand smart manufacturing and its regulatory and safety implications

Program objectives are driven by industry advancements in the construction of aircraft structures, systems, and engines presented for certification. The FAA must ensure that the changes maintain an equivalent or improved level of safety for the traveling public compared to that achieved with current operational aircraft. Program objectives align with the Department of Transportation (DOT) strategic research and policy objective of advancing transportation safety by building an evidence basis to support performance-based federal safety standards and regulations for transportation technologies.

The Program supports development of industry handbooks and other standardization activities, and promotes knowledge sharing for advanced materials and structures, including evaluation of emerging supporting technologies, with industry as well as internally within the FAA. This objective helps strengthen the use of informed, data-driven decision-making and use of comprehensive approaches such as safety management systems.

Anticipated Program Activities:

- Stable Service Behaviors of Advanced Materials and Structures
- New Manufacturing Process Controls and Guidelines
- Behavior of Advanced Materials in Large Scale Structures
- Modern Inspection Methods Evaluations

FY 2027 Program Descriptions

Continued Airworthiness

Program Description:

The Continued Airworthiness Program promotes the development of technologies, procedures, technical data, and performance models to prevent accidents and mitigate accident severity related to civil aircraft failures as a function of their continued operation and usage. The Program will prioritize research against persistent and active risks, spanning across the breadth of the FAA's aviation safety portfolio. The Program focuses on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, development of inspection technologies, and the safety of mechanical systems.

The quest for improved fuel, operational efficiency, and lower environmental impact is driving the evolution of aircraft at an unprecedented rate. Advances are being made in every aspect of aircraft design and manufacturing methods including new structural alloys and repair methods, additive manufacturing, and new fastening methods; structural technologies such as structural bonding and welding; and avionics. There is also a high level of interest from the aviation industry in increasing the use of modeling and simulation and advanced inspection methods. The FAA must ensure that these new technologies are safe, not only as they enter the airspace, but also throughout the life of the aircraft. This requires a deep understanding of the effects of aging, environmental exposure, and in-service damage to ensure that they are adequately addressed during the certification process.

The Continued Airworthiness Program works with industry and other U.S. government agencies to perform the research required to develop such a body of knowledge. The data developed and insights gained are used to create and update guidance and policy, inform airworthiness directives, enhance the elements of implementation of existing continued operational safety (COS) programs, and create industry standards. The Program focuses on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, continued safety of aircraft engines, development of advanced inspection technologies, and mechanical systems.

Major Program Objectives:

The Continued Airworthiness Program supports the FAA aviation safety oversight responsibility to ensure that aircraft maintain operational safety as they age. The FAA accomplishes this in two ways: first, by anticipating aging issues during the certification process and ensuring that they are adequately covered in the operations and fleet lifecycle management for specific aviation applications; and second, by monitoring the in-service data as it is accumulating, finding issues at the earliest possible point, and ensuring that they are effectively managed through advisories, directives, regulation, or other guidance.

It is also important to conduct research to understand what makes the current systems safe, so that effective mitigations can be leveraged for other risks. The Program, in partnership with oversight systems, must correlate a comprehensive risk picture with the performance of safety controls.

Since its establishment, the Program has led extensive studies on the in-service behavior of airframe structures and aircraft systems, and more recently added safety-critical turbine engine components to the scope. The knowledge and information produced directly supported a wide range of FAA safety rulemaking, including the Aging Aircraft Safety Rule (2005), the Widespread Fatigue Damage Rule (2010), the Damage Tolerance Data for Repairs and Alterations rule under 14 CFR Part 26 (2007), Order 8110.104, Responsibilities and Requirements for Implementing Part 26 Safety Initiatives (2007), as well as related guidance materials and advisory circulars for aircraft and turbine engine structures and components.

Anticipated Program Activities:

- Reliability of Structural Health Monitoring (SHM)

- Airframe Structure Model and Simulation (M&S) Validation and credibility assurance framework (CAF)
- Advanced Fatigue & Damage Tolerance and Inspection Methods for Engine Life-Limited Parts
- Environmentally Assisted Cracking (EAC) and Stress Corrosion Cracking (SCC) in Critical Aircraft Structure

Digital Systems and Technologies

FY 2027 Program Descriptions

Digital System Safety

Program Description:

The Digital System Safety Program aims to understand and mitigate safety risks in digital airborne systems and equipment and provide a safety assurance framework to enable FAA approval and use in a safe operational environment. Airborne system designs have become increasingly dependent on highly integrated software and hardware architectures that share power, computing, networking, input/output, and other resources to support the needs of multiple aircraft functions. Additionally, the increased use of commercial-off-the-shelf devices and proposals to use new and novel airborne electronic hardware and software implementation techniques such as artificial intelligence (AI) and machine learning (ML) were not envisioned by traditional development assurance methodologies. The main goal of the Digital System Safety Program is to analyze airworthiness and certification aspects of these highly integrated, complex digital aircraft systems, including development assurance processes, and evaluate methods to improve and streamline certification efforts.

The Digital System Safety Program takes a proactive approach by analyzing the safety implications and assurance challenges of emerging technologies such as AI and ML. This forward-thinking analysis allows the Program to develop innovative criteria and concepts to address these challenges before they become roadblocks. Ultimately, the Program's research supports the Department of Transportation's broader safety objective of ensuring automation enhances safety and paves the way for performance-based, rather than prescriptive, regulations.

Major Program Objectives:

Research conducted within the Digital System Safety Program differs from industry research. The Program's focus is considering new technology, materials, and procedures while maintaining or increasing current safety levels. The Program's main sponsor is the regulatory community, which can be hindered by proprietary and intellectual property rights. The programs under this budget line item (BLI) provide the aviation community with publicly available data and insight for consistent aircraft certification safety. The Digital System Safety Program demonstrates a commitment to exploring new technologies and improving safety practices through research and collaboration. This aligns well with the DOT's objective of designing a future-proofed transportation system through purpose-driven innovation.

The research requirements will provide additional insights into the safety vulnerabilities of complex digital systems that are developed, integrated, or verified using unproven processes, techniques, and methodologies that could introduce a safety risk for undetected errors with failure manifested at the aircraft level. Digital Systems Safety research will be used to develop policy, guidance, and training for new technologies and techniques to ensure their safe use in aircraft systems. The Program also seeks to understand, address, and provide an annual measurement indicator of Safety Data Sheets-related ongoing operational safety issues.

Anticipated Program Activities:

- Evaluate Artificial Intelligence/Machine Learning applied to airborne systems and equipment
- Improve Safety Through Digitization and Diverse Specifications
- Use of AI to Improve Safety

FY 2027 Program Descriptions

Aircraft Cybersecurity

Program Description:

The Aircraft Cybersecurity Program is pivoting its aim to address evolving threats associated with the use of standardized signals. The Program's goal is to mitigate safety risks to aircraft operations that derive from cyber vulnerabilities, including the manipulation of signals to the aircraft from unauthorized transmitters.

The second focus area for Aircraft Cybersecurity Program research involves "aircraft supersystems." Drones and other operational concepts are introducing connections to the aircraft from ground control stations or networks that can affect the safety of the aircraft operation. Traditional aircraft cyber strategies that isolate safety-critical aircraft networks are not readily adapted to extending those networks off the aircraft, which can involve the use of commercial off-the-shelf equipment and cloud services.

Major Program Objectives:

Standardized signals are radio frequency signals to and from the aircraft for which the FAA or Federal Communications Commission (FCC) specifies signal characteristics, system functionality, and performance. These include communications, navigation, surveillance signals, which are standardized internationally and for which cybersecurity safety cannot be the sole responsibility of the aircraft designer or operator. Historically, these signals (including the Global Positioning System (GPS)) were viewed as "trusted" and outside the scope of standards bodies considering methods for aircraft systems information security protection. Recent events, both domestically and abroad, have made it readily apparent that signals received by the aircraft cannot in all cases be trusted. Radio altimeter, weather radar, and standardized "command and control" (C2) and "detect and avoid" are also considered standardized signals, whose characteristics are defined by FCC requirements and FAA standards (through technical standard orders). Where cyber safety is managed outside of the signal itself, such as end-to-end proprietary encryption on a C2 link, there may be no relevant cyber safety issue to address, but the signal itself should be considered to ensure coverage of any risks. Program objectives will include:

- Cataloging vulnerabilities of the usage of standardized signals through threat informed risk assessments
- Evaluating through experimentation the operational impacts and potential mitigations (both aircraft and connections)
- Scaling experiments according to the vulnerability or mitigation to be evaluated
- Exploring cybersecurity strategies to strengthen the safety posture of aircraft supersystems which rely on connections to and from the aircraft for operation (considering, at a minimum, the use of commercial-off-the-shelf and the interaction/usage of cloud services)

Anticipated Program Activities:

- Identify cybersecurity threats and vulnerabilities of current and future aircraft systems
- Develop cybersecurity methods for highly connected flight deck systems
- Exploration of means of cybersecurity protection for aircraft systems that rely on connections external to the aircraft.

Weather and Aviation Systems

FY 2027 Program Descriptions

Aircraft Icing

Program Description:

The FAA establishes rules for the certification and operation of aircraft in icing conditions. The agency uses the Aircraft Icing Program research results to generate advisory circulars and other forms of technical information to guide certification and airworthiness specialists and inspectors on acceptable means for meeting requirements. This research and the guidance materials generated from this research help to reduce aircraft accidents and incidents caused by aircraft icing.

Major Program Objectives:

The Aircraft Icing Program will improve existing capabilities and develop new engineering tools to support improved means of compliance and new guidance material for engine and airframe certification and operations in super cooled small and large drops, mixed-phase, and ice crystal icing conditions. The outputs will support improved safety through the issuance of new guidance materials and industry standards.

The main goal in Aircraft Icing Program research is to improve aviation safety related to aircraft icing. This includes developing a better understanding of the effects of environmental icing, data in support of new regulations and guidance materials, support for improvements to engineering tools for certification and operations and improving icing weather information for decision-making in terminal areas and in-flight avoidance of high ice water content ice crystal conditions.

Anticipated Program Activities:

- Safe Operations with De-icing/Anti-icing fluids
- Ice Crystal Icing (ICI) Effects on Engine performance
- Icing Effects on Design of New Aircraft Configurations

FY 2027 Program Descriptions

Weather Program

Program Description:

The Weather Program performs applied research to enhance safety and operational efficiency in adverse weather conditions in the National Airspace System (NAS) which collectively aligns with Department of Transportation (DOT) research priorities. Beginning in FY 2024, the Weather Program consists of two research programs: the Aviation Weather Research Program (AWRP) and the Weather Technology in the Cockpit (WTIC) Program. The Weather Program evaluates the National Transportation Safety Board (NTSB) recommendations and, as applicable, performs research to implement the recommendations while also assessing the potential benefits of using innovative approaches.

The Weather Program facilitates the transition of legacy capabilities to meet requirements, often through collaborative and complementary initiatives with the National Weather Service (NWS), as well as focused initiatives to help mitigate safety and efficiency issues associated with well-documented weather problems. The Program leverages advances in meteorological science to enhance observation methods, improve weather prediction models, and produce increasingly accurate forecasts of convective weather (i.e., thunderstorms), turbulence, icing, and low cloud ceiling and restricted visibility conditions. The National Oceanic and Atmospheric Administration (NOAA)/NWS platforms and forecasters use algorithms developed by the AWRP to provide regulatory forecast products and NAS decision aids. The timely dissemination and presentation of such information provides decision support input to enable traffic flow managers, controllers, pilots, and airline operations personnel to implement tactical and strategic traffic management initiatives to avoid encounters with severe weather, reduce delays, and mitigate safety risks.

Weather Program research also develops, verifies, and validates recommendations for incorporation into government and commercial weather standards, guidance documents, and pilot training to enhance the safety and efficiency of commercial, business, and general aviation operations. The standards and guidance documents focus on the minimum weather information and technology functions, and human-machine interfaces to enable safe and efficient operations relative to adverse weather avoidance. Weather-related standards and guidance are needed for new entrant aircraft including Advanced Air Mobility (AAM) and Unmanned Aircraft Systems (UAS). Other evolving areas needing new weather standards and guidance to enable safe operations include weather applications of artificial intelligence and uses of machine-to-machine weather interfaces.

Major Program Objectives:

The FAA's Weather Program enhances safety by improving observations, diagnoses, and forecasts of weather information to support operational planning and decision making by users including air traffic managers, flight dispatchers, and pilots. It also addresses needs for enhanced cockpit weather technology, information, and human factors principles to improve operational efficiency and safety and reduce flight delays via efficient routing/rerouting in adverse weather.

The main objectives of the AWRP are to mitigate the impact of weather on the NAS; mitigate weather-related NAS safety and traffic flow efficiency issues; support the evolution of legacy weather capabilities into decision-support weather processes; improve the accuracy and relevancy of legacy weather products and services mandated by FAA regulatory guidance and/or international agreements; and support the achievement of the FAA weather vision with minimal or no new prescriptive regulations.

The main objectives of the WTIC Program are to enhance aviation safety by resolving gaps in cockpit weather information and technology that are causal factors in prior accidents/incidents or have the potential to be a causal factor in future accidents/incidents. The gaps needing to be resolved by the WTIC Program have been identified by

WTIC gap analyses, NTSB accident investigations, stakeholder inputs, and research experiments. Another objective is to develop weather training using augmented, virtual, and mixed reality to enhance pilot weather knowledge and pilot experience in making safe adverse weather decisions. An additional Program objective is to increase the quality of cockpit weather automation and information by developing techniques for enabling pilots to easily monitor automation performance and the quality of weather data inputs. It also seeks to enhance the aviation weather infrastructure by using non-traditional sources to gather information that provides utility to pilots in making adverse weather avoidance decisions. Though the quality of these sources has historically been too uncertain for aviation, the WTIC Program is using crowd sourcing algorithms, artificial intelligence (AI), machine learning (ML), and big data to recognize outlier data and to converge on accurate observation data. A high-level objective for WTIC research is to use AI and ML to assist pilot situational awareness of adverse weather to enable strategic planning, enhancing safety and reroute efficiency.

Market surveys conducted by the Weather Program indicated that industry has little experience, expertise, budgets, and incentive to perform applied aviation weather research without government funding. Additionally, the limited budgets of airlines and other aviation users to spend on weather information leads to a low return on investment that is not enough to initiate or sustain an industry effort. In cases where industry develops new products, data, or techniques, the resulting output is usually proprietary, which limits use by the government. Without oversight and the ability to test the output for accuracy and conformity to standards and safety regulations, it is generally not suitable for use by the NWS. Therefore, the only viable option is for the Weather Program to conduct and manage weather research to meet FAA requirements.

Anticipated Program Activities:

- Develop Enhancements to Low-Level Aviation Forecasts
- Improve Inflight Icing Diagnosis and Forecasts to Align with Aircraft Certification Criteria
- Develop Probabilistic Forecasts for Turbulence Severity in support of International Civil Aviation Organization World Area Forecast System Requirements
- Innovate Uses of Emerging Technologies into Cockpits to Enhance Adverse Weather Avoidance

FY 2027 Program Descriptions

Alternative Fuels for General Aviation

Program Description:

Current leaded aviation gasoline (avgas) is the only remaining transportation fuel in the U.S. that contains lead additives. Globally, as transportation sectors have transitioned away from leaded fuels, the need for lead additive has significantly reduced. Currently, there is only one provider of the lead additive. That sole provider supplies the entire volume of lead additive for leaded aviation gasoline. The continued availability of the lead additive is an item of concern for the aviation community as it is not anticipated to be available in perpetuity. Additionally, in October 2023, the Environmental Protection Agency (EPA) announced a final endangerment finding that emissions of lead from aircraft operating on leaded fuel cause or contribute to air pollution which may reasonably be anticipated to endanger public health and welfare under the Clean Air Act. This initiated a parallel timeline between the EPA and FAA for joint rulemaking to address the endangerment findings. Due to these actions and corresponding market forces, the availability of leaded avgas is anticipated to be eliminated in the future. Safe alternative fuels must be in place before leaded gasoline becomes unavailable.

The Alternative Fuels for General Aviation Program is actively engaged in the development of unleaded fuels for safe introduction to the fleet. FAA engagement includes participation in the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative, in which the FAA partners and collaborates with the EPA and the aviation industry on research, testing, and qualification of viable, safe, hi-octane unleaded avgas replacements to eliminate the use of leaded aviation gasoline by 2030. Additionally, the FAA is pursuing fleet authorization for those fuels that meet the technical and safety requirements for a hi-octane unleaded fuel as determined using the FAA Piston Aviation Fuel Initiative (PAFI) test protocols and process.

The current fleet of over 220,000 general aviation aircraft operates on a wide range of engine and fuel system technologies. In collaboration with industry, Program research will develop the required technical data to support fleet authorization of an unleaded fuel, examine engine modifications and aircraft operational changes that may be required for unleaded fuels. Additionally, research efforts will support the deployment of unleaded fuels to gain service experience and support the mitigation of in-service issues that may be observed. This will assist in increasing industry and stakeholder readiness for the future deployment of hi-octane unleaded fuels, while enhancing U.S. competitiveness in the global aviation industry. This research will provide necessary data to support FAA certification for the safe integration of unleaded fuels into current and future aircraft.

Major Program Objectives:

The Alternative Fuels for General Aviation Program will support the EAGLE Initiative as it leverages and builds upon continuing industry collaboration. The Program objectives are to enhance and accelerate research in the areas of unleaded fuels for use in piston-engine aircraft; aircraft and engine modifications to allow safe operation on unleaded fuels; and innovative aircraft technologies.

For more information on the EAGLE Program, please see <https://www.faa.gov/about/initiatives/avgas>.

For more information on FAA/EPA collaboration, please see <https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-lead-emissions-aircraft>.

Anticipated Program Activities:

- Support Diagnosis and Mitigation of In-Service Issues with the Use of Unleaded Fuels

FY 2027 Program Descriptions

Advanced Vehicle Technologies & Operations

Program Description:

Efforts under the Advanced Vehicle Technologies and Operations (AVTO) Program support the FAA's mission to provide the safest, most efficient aerospace system in the world. In addition, AVTO activities reflect the FAA's vision to demonstrate global leadership in the safe integration of new users and technologies into the National Airspace System (NAS). The AVTO Program includes data collection and analysis activities that provide valuable insight into the safety and performance of new civil aviation technologies. This Program also supports related work done by the FAA's Center of Excellence for Alternative Jet Fuels and Environment (ASCENT). Critical research outputs from ASCENT enhance understanding of new vehicle technologies, informing standards and operational procedures development.

Major Program Objectives:

The AVTO Program supports the Continuous Lower Energy, Emissions, and Noise (CLEEN) program. The CLEEN program provides valuable technology testing opportunities that provide data for technology validation and standards development. These activities deliver critical insights into new and emerging technologies, enhancing both aviation safety through a more robust understanding of these technologies and American aviation industry competitiveness through accelerated innovation.

The AVTO Program also enables cross-agency collaboration with relevant FAA offices on optimized aircraft, helicopter, and advanced vehicles operational procedures. This includes, for example, rotorcraft noise abatement procedures. This coordination facilitates agency-wide understanding of how these new technologies perform, enabling safety across our aviation system as these technologies are integrated. AVTO activities ensure that U.S. aviation continues to safely integrate new users and technologies, serving as a global leader.

Anticipated Program Activities:

- CLEEN program
- Safety and Performance Evaluation of New Technologies
- Agency Collaboration on Operational Procedures

FY 2027 Program Descriptions

Aviation Systems Performance Analysis

Program Description:

The Aviation Systems Performance Analysis (ASPA) Program supports the FAA's mission to provide the safest, most efficient aerospace system in the world. Part of the FAA's vision is to demonstrate global leadership in how new users and technologies are safely integrated into the NAS. The ASPA Program supports this vision by advancing the agency's understanding of civil aviation technologies, including conventional aircraft, emerging entrants, and other novel technologies. This Program also supports work done by the FAA's Center of Excellence for Alternative Jet Fuels and Environment (ASCENT), and the Department of Transportation's (DOT) Volpe Center. This critical research provides data to address knowledge gaps, ensuring that tools and standards development are data driven and that new technologies are safely integrated using the best available science.

Major Program Objectives:

The ASPA Program supports the Aviation Environmental Design Tool (AEDT), an integrated aviation modeling tool that can be used to evaluate a wide range of scenarios and technologies, including supersonics. The tool is built upon a scientific understanding of noise aviation and exhaust gases, including how they are generated and propagate beyond the vehicle. AEDT analyses inform decision-making on technology development, operational procedures, regulatory compliance, and international and domestic standards relating to civil aviation. Aviation noise and exhaust gases are regulated at the vehicle level as a part of airworthiness certification. Standards development, domestically through the FAA and internationally through the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP), rely on the availability of sound technical data. Research under this Program provides data to develop more robust analysis tools as well as providing inputs to potential standards development.

Program research also focuses on understanding new technologies through testing and analysis. This includes fuel testing to ensure novel jet fuels are safe for use. Opposition to airspace redesigns often centers around aviation impacts, especially vehicle noise. Similar challenges are anticipated with new entrants such as unmanned aircraft systems (UAS), advanced air mobility (AAM), civil supersonic aircraft, and commercial space vehicles. The Program enables critical data collection to advance our understanding of how these new technologies operate, supporting their safe integration into our aviation system. The ASPA program coordinates across partners to efficiently align federal activities. Efforts across the ASPA program ensure that the U.S. continues to demonstrate global leadership in this space, providing resources to facilitate key technical analyses.

Anticipated Program Activities:

- Development of Tools and Standards
- Evaluation of Emerging Entrants
- Testing of Novel Jet Fuels

Human and Aeromedical Factors

FY 2027 Program Descriptions

Air Traffic Control/Technical Operations Human Factors

Program Description:

The purpose of the Air Traffic Control/Technical Operations (ATC/TO) Human Factors Program is to provide scientific and technical information that the Air Traffic Organization (ATO) technical sponsors will apply in their work to improve the safety and efficiency of complex ATC systems. The Program will produce information supporting the FAA's needs by measuring and enhancing the performance of individual controllers and specialists. It also improves the integration of National Airspace System (NAS) technologies for controllers and technicians, capitalizing on the human contribution to safety in ATC operations, and supporting data-driven decisions related to the workforce, including selection methods, job placement, performance measurement, and training.

The Program strives to provide useful human factors research and development (R&D) results that support the agency's development and implementation of new technologies and procedures in the NAS, in accordance with FAA Order 9550.8 Human Factors Policy, as the agency evolves the NAS for the future. The Program invests in purpose-driven research and innovation to meet the ATO's present human factors challenges by addressing the research topics identified in 49 USC 445. It also addresses the ATO's human factors research needs that are driven by Department of Transportation priorities, evolution of the workforce, and advancing technologies and associated procedures that are expected to be implemented in the NAS over the next several years. Thus, the program supports ATO efforts to achieve the air transportation system of the future so that the NAS can serve the flying public today and in the decades to come. Research addresses workforce challenges that are especially acute in the large terminal radar air traffic control facilities and in several of the busy air route traffic control centers. The FAA must hire, place, and train thousands of new air traffic controllers and technical operations specialists, while continuing to provide safe and efficient air traffic services to NAS users. In addition, the Program provides technical guidance that helps FAA acquisition programs to incorporate human factors requirements and methods that will ensure user acceptance and NAS performance with the increasing reliance on automated capabilities, including those that incorporate artificial intelligence and machine learning (AI/ML) technologies. In addition to addressing the human-machine teaming challenges posed by the introduction of these advanced automation tools and capabilities, the Program is also responsible for proactively identifying the potential for human error, and for recommending mitigations. This program addresses ATO challenges in five human factors R&D focus areas:

1. Improved safety, reduced hazards, and error mitigation in ATC
2. Automation effects and controller performance
3. Improved design and operation of ATC systems
4. Improved air traffic controller selection and training
5. Workforce optimization

Major Program Objectives:

The ATC/TO Human Factors Program responds to R&D requirements defined by offices in ATO and other FAA technical sponsors. The Program addresses human factors and training challenges through targeted research that yields an understanding of human performance, and those factors that contribute to facility-specific impacts, especially for high-impact facilities. In the training domain, the Program conducts research to evaluate the effectiveness of realistic simulation capabilities that provide a medium for training complex task performance where ATC system safety depends on job task performance. Effective use of simulation may reduce the time required for air traffic controllers to reach certification and will increase their readiness to perform in an increasingly automated task context.

In support of system acquisitions managed within the ATO program management office (PMO), this Program focuses on integration of human factors considerations to enhance human-technology interactions. Human

performance research aims to enhance overall system performance, reducing errors, increasing safety, and helping reduce life cycle ownership costs. The Program, through the FAA's PMO coordination, provides human factors R&D results that support the development and implementation of new technologies and procedures in the NAS. The Program ensures that the proper roles and responsibilities are assigned to the ATO workforce so that air traffic controller and technician capabilities are compatible with the advanced technology they use in their jobs, enabling air traffic system performance to achieve operational requirements and fulfill safety and efficiency objectives. In terms of research program execution, the program leverages university partnerships to bring new science in the field of AI/ML into practice by identifying human factors, challenges and guidance for system designers that will help to mitigate them. The program also strengthens internal federal human factors research laboratory capabilities at the FAA William J. Hughes Technical Center for Advanced Aerospace and the Civil Aerospace Medical Institute to address these emerging challenges.

This Program continues to provide human factors subject matter expertise to the Joint Resources Council and coordinates with the PMO human factors office in reviewing how acquisitions have complied with human factors design requirements. The program also continues international collaborative research efforts with Eurocontrol and the Single European Sky Air Traffic Management Research human factors experts.

Anticipated Program Activities:

- Integration of Human Factors in Technology Designs, Evaluations, and Improvements
- Improving ATC/Tech Ops Training, Procedures, and Operations

^[1] <https://www.faa.gov/documentLibrary/media/Order/9550.8.pdf>.

FY 2027 Program Descriptions

Aeromedical Research

Program Description:

The Aeromedical Research Program focuses on advancing aviation safety emergency preparedness, safety management, health safety, and pilot medical fitness through targeted initiatives. The Program supports several key activities, including developing safety standards for next-generation seating and occupant protection, optimizing evacuation strategies through passenger behavior studies, and enhancing health safety in commercial aviation by assessing potential aircraft environmental hazards while developing the evidence base for disease outbreak preparedness initiatives. Additionally, the Program works to modernize pilot medical certification by identifying neurocognitive impairment markers and researching alternative fitness assessment methods. The Aeromedical Research Program also facilitates the development of artificial intelligence (AI)-driven certification models, improves pilot health monitoring through public-private data sharing, and integrates medical and operational data for proactive risk management. The expected outputs from these activities include summary technical reports, datasets, models, simulations, prototypes, and system designs, all contributing to the improvement of aviation passenger safety, system resilience, and operational efficiency. This Program involves multi-year efforts organized around five major activities aimed at strengthening aviation health and safety protocols.

Major Program Objectives:

The Aeromedical Research Program is a multi-year initiative designed to enhance aviation safety, modernize pilot medical certification, and strengthen public health resilience through targeted applied research.

One major objective focuses on advancing aviation crashworthiness by developing performance-based safety standards for next-generation seating and rotorcraft occupant protection. Through modeling, simulation, and biodynamics research, the Program aims to improve survivability during aviation mishaps. This work directly contributes to the RD&T Strategic Plan’s “Zero Fatalities” grand challenge by ensuring future aircraft designs incorporate validated safety features that better protect all passengers, especially those who are most vulnerable.

Another key objective supports emergency preparedness and evacuation. This includes optimizing evacuation strategies by studying passenger behavior, emergency exit use, and ditching equipment performance. The results of this research will inform technical standards and operational guidance, improving emergency outcomes and reducing injury risk. This aligns with the RD&T Plan’s focus on human factors and system performance, providing critical insight into how behavioral dynamics and design features affect safety during high-stress scenarios.

The Program also addresses safety management and health protection by assessing cabin environmental conditions—such as air quality, cabin temperature, and radiation exposure—and refining disease transmission models and ventilation assessments. These efforts enhance the evidence base for managing health risks in flight and improving preparedness for future disease outbreaks. This objective supports RD&T priorities in data-driven system safety and public health resilience by enabling aviation systems to better manage biological and environmental hazards.

Modernizing pilot medical certification is a fourth major objective. This includes identifying neurocognitive impairment markers, expanding the use of alternative testing methods, and exploring the feasibility of remote aviation medical exams. These initiatives aim to ensure that only medically fit pilots are certified while reducing administrative burdens and improving access. The work aligns with the RD&T Plan’s emphasis on human-technology interactions, enhancing both the scientific rigor and fairness of medical fitness assessments.

Finally, the Program supports the development of a data- and AI-driven aerospace medical safety assurance system. This objective integrates medical and operational data, establishes public-private data sharing partnerships, and

builds predictive tools for certification risk assessment. These innovations embody the RD&T Plan's Transformation goal and contribute to the "Future System-of-Systems" grand challenge by enabling proactive, real-time risk management in aviation medical oversight.

Together, these objectives position the Aeromedical Research Program as a vital contributor to national efforts to modernize transportation safety. Its focus on actionable science, integrated systems, and emerging technologies reflects DOT's commitment to building a safer, more resilient, and people-centered transportation future.

Anticipated Program Activities:

- Aircraft Cabin and Occupant Protection
- Emergency Preparedness & Evacuation
- Safety Management and Health Safety
- Pilot Health, Medical Certification & Human Factors
- Data, AI & Safety Assurance Systems

FY 2027 Program Descriptions

Aviation Grant Management

Program Description:

The Aviation Grant Management Program supports grant lifecycle administration and management including pre-award, post-award, closeout, records management, program management, compliance and information technology. The Program is administered under regulatory compliance 2 CFR 200 to support and stimulate a public purpose.

Major Program Objectives:

The Program will aid in building and sustaining an infrastructure that encompasses the entire lifecycle of grant management. Program priorities support the FAA's strategic goals by ensuring a comprehensive approach to award grants to the next generation of aviation professionals, while supporting aviation-related research.

The Program enables collaboration and coordination between government, academia, and industry to advance aviation technologies, expand FAA research capabilities, support professional development of aircraft pilots, and increase interest in aviation maintenance careers.

The Aviation Grant Management Program will provide support to administer grants for eligible projects that educate, develop, and recruit aviation professionals, as directed by Congress in Section 440 of the FAA Reauthorization Act of 2024, amending Section 625 of the 2018 Act. The Aviation Grant Management Program fosters programs that are essential in shaping the future aviation workforce and evolving technology.

Funding will be used for grant recipient awards and program management support to include program management, a grants management system, and associated resources.

Anticipated Program Activities:

- Aviation Research and Workforce Grants

Aerospace Performance and Planning

FY 2027 Program Descriptions

System Safety Management/Terminal Area Safety

Program Description:

The System Safety Management/Terminal Area Safety Program focuses on research that will enhance the safe movement of aircraft through the National Airspace System (NAS), supporting the oversight of aviation product/service providers as well as providing for better tools and techniques for pilots and operators. The research supports the development of analytical tools that aid and support the high safety standard for the NAS. To achieve this result, the System Safety Management/Terminal Area Safety Program funds research to develop more effective helicopter simulators, proactive flight risk detection, monitoring and mitigation tools to better support helicopter and fixed wing aircraft pilots, immersive and higher fidelity simulator models and training capabilities, vision enhancing technologies for flights in low or reduced/degraded visibility, and cost-effective flight data recording/monitoring solutions. Research outcomes aim to reduce the number of fatal accidents and enhance the safety of operations for fixed wing aircraft, helicopters, and vertical flight vehicles (e.g., tiltrotors, VTOL's) that operate in and around the terminal airspace. This research also supports safety by providing tools and techniques for air traffic safety oversight, helping to identify potential hazards and issues before changes are made to the NAS.

Major Program Objectives:

The System Safety Management (SSM) Program is designed to improve safety through developing safety data collection methods, advanced safety data and risk analysis techniques, and prototypes of risk-based decision-making capabilities to identify and analyze emerging safety issues in a cooperative nature with aviation stakeholders. The program provides an ability to analyze trends across the aviation community that is much more effective than monitoring individual certificated entities (e.g., air operators and air traffic facilities).

The Terminal Area Safety (TAS) Program improves the safety of operations at or near an airport. Program research focuses on developing training solutions and identifying effective technologies to mitigate key causes of fatal accidents such as loss of control, low altitude operations, unintended flight into instrument meteorological conditions, runway excursions, and runway overruns. These are the leading causes of fatalities in worldwide commercial transport, general aviation, and rotorcraft operations.

This Program evaluates potential solutions to reduce fatal accidents through extending simulator models to allow for better upset and anomalous flight condition training; exploring alternatives to determine runway slipperiness; developing objective motion criteria to minimize inappropriate simulator training; enabling safe helicopter approaches when using advanced vision systems; exploring consistent operational standards for a stable approach to reduce runway excursions and heliport/vertiport overruns; exploring immersive technologies for future flight training; examining the components of future vertical flight infrastructure; and developing a logical go-around training curriculum that mitigates operational go-around risks. This Program also performs flight tests to re-evaluate wet runway wheel braking coefficient models as well as rotorcraft and vertical flight tests to evaluate flight data monitoring devices, vision systems technologies, vertical flight infrastructure, and countless other project areas. These projects address the principal causes of fatalities in commercial transport.

Anticipated Program Activities:

- Measure effects of wake vortex encounters from operational flight data
- Incorporate additional helicopter operational data to the Aviation Safety Information Analysis and Sharing system
- Enhance SMS-centric oversight

FY 2027 Program Descriptions

Wake Turbulence

Program Description

The Wake Turbulence Program provides air traffic control (ATC) wake-hazard-mitigating, aircraft-to-aircraft separation recommendations for new and currently operating aircraft (both legacy and new entrants). Additionally, the Program provides ATC procedural and technology-based wake hazard mitigating solutions. Wake turbulence data collection sites are operated near the San Francisco International (SFO). The Program uses the site data to develop wake hazard risk assessments as part of the FAA's review of proposed changes to ATC's aircraft-to-aircraft separation procedures and ATC automation systems. Additionally, the data analysis (collected under varying weather conditions) provides insight into the development of dynamic flight capacity, increasing wake-hazard-mitigating ATC procedures and supporting upgrades to ATC automation systems.

Major Program Objectives:

The Wake Turbulence Research Program provides aircraft-generated wake turbulence research that matures wake mitigation operational concepts to the point that they can be implemented by FAA orders and enter the FAA facilities and equipment (F&E) development and implementation process to meet National Airspace System (NAS) enhancement requirements. This Program supports the objective to accommodate increased flight demand during peak demand periods at capacity-constrained airports. It provides increased access to airport runways and airspace through modifications to ATC wake separation standards and procedures while maintaining or enhancing NAS safety.

Anticipated Program Activities:

- Wake Track Data Collections, Modeling and Analyses and Modeling for ATC Wake Hazard Mitigations
- Airport/Airspace Specific ATC Wake Hazard Mitigation Procedural Solutions and Associated Infrastructure Modification Recommendations
- Wake Hazard Safety Assessments of Proposed Changes to ATC Separation Services

FY 2027 Program Descriptions

Commercial Space Transportation Safety

Program Description

The Commercial Space Transportation (CST) Safety Program priorities include: (1) safety of all commercial space operations, including integration into the National Airspace System (NAS) and spaceports and (2) operational excellence/transformation to incorporate systemic safety initiatives. CST research focuses on specific research needs in different industry segments including (1) risk-based decision-making techniques and analytics; (2) certification using new technologies, standards, or processes; (3) artificial intelligence; and (4) human-machine teaming and new technology interfaces. CST research is executed through research contracts addressing near-term needs of the FAA Office of Commercial Space Transportation (AST), and by addressing mid-term research questions of common interest to FAA AST, government partners, and industry.

Major Program Objectives:

Statute directs AST to license commercial space launch and reentry operations only to the extent necessary to ensure compliance with international obligations of the United States, and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States. Statute further directs AST to encourage, facilitate, and promote commercial space launches and reentries performed by the private sector.

AST's research activities will find innovative solutions to increase safety, efficiency, and U.S. global leadership in CST. The Program optimizes AST's mission execution through the development of improved regulations, safety assessment tools, and public safety technologies. Funding supports safety research, addresses lessons learned, and enables the FAA to keep pace with the dynamic CST industry. This research benefits all stakeholders within different CST industry segments.

By focusing research on issues directly related to public safety and the trending needs of the rapidly growing CST industry, AST can refine regulations and maintain public safety without hindering industry innovation. Additionally, these efforts help ensure that the FAA continues to lead the world on commercial space standards and keeps the U.S. space industry at the forefront of this exciting field.

Anticipated Program Activities:

- Commercial Space Safety Analysis Improvements
- Licensing Enhancements
- Commercial Space Safety Infrastructure

FY 2027 Program Descriptions

Unmanned Aircraft Systems Research

Program Description:

The Unmanned Aircraft Systems (UAS) Research Program supports the FAA priority to safely integrate UAS by studying the safety implications of new aircraft operational concepts and technology on the National Airspace System (NAS) and supporting the development of new and modified regulatory standards. UAS are fundamentally shifting the aviation landscape and have the potential to provide a wide range of benefits to society. However, there are technical and regulatory challenges that must be overcome as the FAA works to safely integrate these new technologies into the NAS.

Safe, efficient, and timely integration of UAS into the NAS poses substantial technical challenges to the FAA and the aviation industry. UAS often incorporates new or novel technologies to achieve unique operational capabilities that challenge the expectations of current NAS users. These unique capabilities have demonstrated potential to address commercial applications as well as scientific research needs. Integrating UAS will present a challenge to the entire NAS due to the various sizes of UAS (less than a foot up to the size of a commercial jet), a wide range of maximum take-off weights (less than a pound to the weight of a large jet), large performance disparities compared to existing certificated aircraft, and capabilities of operating in all classes of airspace.

Major Program Objectives:

The UAS Research Program enables the planning and prioritizing of UAS research to address challenges, inform decisions, and collaborate with partners. The FAA is incrementally expanding the operational envelope, allowing for new entrants including UAS with increasing levels of complexity, to operate over people, at night, and Beyond Visual Line of Sight (BVLOS), while fully maintaining critical safeguards for existing NAS users. The FAA is applying many UAS-related research initiatives across different research organizations, such as academia, NASA, UAS test sites, and standards bodies. It is leveraging technological advances from industry, lessons learned from approved operations, and expertise from around the world. It is expected that the demand for UAS and advanced air mobility (AAM) integration will accelerate as technology advances and market opportunities evolve.

Advancing UAS integration requires research to inform FAA's data-driven decision-making. Research is the key to solving integration challenges and unlocking the potential of UAS and AAM societal and economic benefits. Based on industry and public demand, FAA is following an integration cadence based on risk. Low-risk operations are integrated first (e.g., recreational, and commercial visual line of sight operations), followed by increasingly complex and higher-risk operations (e.g., commercial BVLOS and cargo operations). There is increased commercial demand for conducting these higher risk operations for the purposes of infrastructure inspection, maintenance, and surveillance. Results from FAA-sponsored research are being used to shape rulemaking, guide decision-making, and grow the UAS and AAM industry. The UAS Research Program continues to remain agile and adaptive to keep up with the pace of industry innovation and respond to FAA, Department of Transportation (DOT), White House executive priorities, and Congressional mandates.

Anticipated Program Activities:

- Advance understanding of Counter- UAS efficacy and impacts to NAS operations and systems to establish policies and standards for system performance, deployment and operator training/certification
- Develop standards for associated elements

FY 2027 Program Descriptions

Flight Deck/Maintenance/System Integration Human Factors

Program Description:

The Flight Deck/Maintenance/Systems Integration Human Factors Program addresses research, engineering, and development requirements defined by technical sponsors in the FAA's Aviation Safety (AVS) organization. These requirements are driven by the human factors needs of personnel who are responsible for the certification and approval of equipment and continued airworthiness of aircraft, certification of pilots and mechanics, and approval of certain flight operations. This human-centered approach will address issues associated with regulatory aspects of design, training, operations, maintenance, and oversight, including complex systems and human-system integration, and it will provide strategic solutions to improve aviation safety.

Major Program Objectives:

Funding will support human factors research related to the safe integration of technologies and procedures in National Airspace System (NAS) operations, and the documentation of human factors/human performance data that supports a transition towards more proactive safety management. The Program will also provide a research foundation which informs AVS personnel who develop, update, and utilize human factors-related regulations, guidance, procedures, standards, Orders, job aids, data, processes, industry standards, and other aviation safety documentation.

Anticipated Program Activities:

- Human Factors Design Standards for New and Advanced Flight Deck Alerting Systems
- Pilot interactions with advanced technologies in flight operations
- Assess Data that Could Indicate Characteristics of Automated Systems that Enhance Pilot Performance
- Integrating Human Factors into Aircraft Certification and Flight Standards Policies and Processes

FY 2027 Program Descriptions

Advanced Technology Development & Prototyping

Program Description:

The FAA's Advanced Technology Development and Prototyping (ATDP) Program develops and validates technology and systems that support air traffic services. These initiatives support the requirements associated with the evolving air traffic system architecture and improvements in airport safety and capacity. A key element of this Program is to promote safe and efficient airspace, provide the means to recognize and respond to needs, and use a data-driven approach to evaluate the results to integrate systems. This Program lays the foundation for the assessment of new innovations and possibilities that could improve safety and capacity measures around our nation's airports and the National Airspace System (NAS), with integration of resource management support.

Major Program Objectives:

Individual projects under the ATDP Program develop and maintain mathematical and simulation software models of the NAS. These models evaluate system-wide benefits associated with the implementation of various solutions. These models are particularly useful in evaluating mid-term and long-term benefits associated with other enhancements.

Another key component of ATDP is developing and improving FAA systems that meet the regulatory requirement for reporting traffic operations, counts, delays, and safety information. These systems must continue to support the growing demands of the NAS. Work under the ATDP Program improves the efficiency and integration of data collection and processing for accurate, timely, and improved NAS reporting capabilities. This research aids in assessing airline operations performance and provides objective data, promoting connectivity, to support the need for improved traffic flow and efficiency measures within the NAS. Projects under the ATDP Program will ensure that the essential hardware and software components are integrated and operational to accurately collect and report operational and safety data associated with air traffic operations. Program data will allow for continued assessment of NAS innovation performance and ensure that those technologies achieve the transformations as planned.

Additionally, ATDP includes integrated services and analysis functions to provide a wide array of support services for more than 55 implementation programs and over 20 pre-implementation programs. This is accomplished through four key mission areas: Integrated Resource Management; Program Acquisition Support; Program Health Management; and Planning, Analysis, and Integration. All program management office programs such as Safety, Information Security, Human Factors, Integrated Logistics Support, Requirements Management, Configuration Management, and Risk/Issues/Opportunity Management use technical services provided by ATDP. Similarly, the process is used for safe integration of emerging aviation technologies and business models into the NAS.

Anticipated Program Activities:

- Perform analyses and simulation work to complete the safety analysis associated with the Multiple Airport Route Separation concept. The objective is to establish a new procedural separation standard that is less than the standard radar separation to deconflict air traffic flows to and from airports in proximity, such as New York
- Continuing coordination and deployment of Established on Required (EoR) Navigation Performance standard at 9 national screening guidelines (NSG) 1 and NSG 2 airports with parallel runway spacing separated by a minimum of 4,300 ft. and using final approach monitors. EoR is a separation standard that allows for simultaneous aircraft operations at airports with parallel runways once aircraft are established on a segment of a published required navigation performance instrument flight procedure
- Develop an initial proof-of-concept that integrates cooperative surveillance and speech recognition technologies with advanced ground surveillance sensor technology

- Continuing support of NAS modernization through performance metric and reporting tool development, as well as to fulfill performance-reporting commitments under FAA international agreements

FY 2027 Program Descriptions

Separation Management Portfolio

Program Description:

The Separation Management Portfolio conducts activities to reduce risk and support the safe and efficient separation of aircraft and other vehicles in the National Airspace System (NAS). Risk reduction activities may include concepts or technologies validation; demonstration and integration of operational capabilities; and an understanding of the human role through cognitive engineering experiments. This Portfolio evaluates and matures concepts and capabilities that focus on the enhancement of separation assurance using both ground-based automation and aircraft technology enhancements. This Portfolio will identify improvements to runway access using improved aircraft technology, and will update standards, safety analysis, and modifications to air traffic monitoring tools and operating procedures to enable more arrival and departure operations.

Major Program Objectives:

The main goal of the Separation Management Portfolio is to provide recommendations through research and technology development activities to improve the tools, standards, and procedures that air traffic controllers use to separate aircraft. Pre-implementation activities conducted under this Program reduce risk, define requirements, and demonstrate operational feasibility to support these recommendations.

As the demand for flights increases, concepts and capabilities that focus on enhancing separation assurance using ground-based automation and aircraft technology enhancements are critical. The Separation Management Portfolio supports the FAA's mission to provide the safest, most efficient aerospace system in the world by conducting research to enhance aircraft separation assurance by safely reducing separation between aircraft, and as a result improving capacity, efficiency, and safety in the NAS.

Anticipated Program Activities:

Closely Spaced Parallel Operations (CSPO):

- Concept validation of arrival Minimum Radar Separation (MRS)
- Conduct site assessments, develop artifacts in support of safety risk management and document change proposal process, and complete concept validation for departure MRS

Integrated NAS Design and Procedure Planning (INDP):

- Develop Established on Required Navigation Performance (EoR) with instrument landing system safety risk management artifacts to support NAS-wide separation standard change
- Commence EoR WSR (while simultaneous runway operations) and Multiple Airport Route Separation (MARS) Phase II FLY IT operations and concept validation activities at new launch site(s)
- Collect and report metrics for all EoR and MARS launch sites
- Complete and transition MARS Phase I safety and operational artifacts to the air traffic organization
- Determine next performance-based navigation safety analysis priority

FY 2027 Program Descriptions

Traffic Flow Management Portfolio

Program Description:

The Traffic Flow Management (TFM) Portfolio involves National Airspace System (NAS) operators and FAA traffic managers, along with advanced automation, in managing daily flight and flow decision-making, and airspace and airport capability issues (special activity airspace, weather, etc.) to improve the overall efficiency of the NAS. Pre-implementation research conducted under this Portfolio includes technology development activities for departure scheduling at smaller community airports, improved strategic flow services, and capabilities that will capitalize on future data communications capabilities; further integrated traffic flow management and metering operations; advanced trajectory-based operations leveraging the technologies of NASA's Airspace Technology Demonstration 3; and exploring technologies, infrastructure enhancements, and procedural changes for future traffic management needs.

Major Program Objectives:

The TFM Portfolio researches and implements capabilities that are expected to improve both the efficiency of individual flights and optimization of throughput. This work will make travel safer for the traveling public, help reduce passenger delays (leading to a better traveling experience) and contribute to less pollution as the result of improved prediction performance for TFM decision-support systems. These support systems include flexibility to avoid airspace constraints, better predict capacity demands, and ensure efficient utilization of NAS capacity.

The TFM Portfolio supports the average daily airport capacity metric by providing more efficient use of system capacity through maximizing airspace and airport throughput using time-based management. It also provides improved operational predictability through more accurate and efficient end-to-end strategic planning and scheduling. Enhanced flight efficiency is achieved by delivering more efficient flows into and out of major metropolitan areas through integrated operations. Increased operational flexibility is provided through increased user collaboration regarding preferred trajectories and priorities to support business objectives.

Anticipated Program Activities:

Surface Tactical Flow:

- Continue to explore emerging technology for development of applications or services for surface movements and standardized information exchange into FAA flow systems for strategic planning
- Development of concept of operations for services that can benefit from a digital exchange data environment and machine learning/artificial intelligence prediction tools to assist and improve surface tactical flow
- Comprehensive assessment of airport flow management in high density airports that could benefit from surface flow in complex surface operations

Strategic Flow Management Application:

- Concept development to address identified TFM shortfalls in support of future NAS vision
- Develop initial TFM agent capabilities using improved predictive modeling for NAS performance
- Continued concept maturation in the areas of performance-based flow management
- Conduct concept engineering to anticipate time-based flow management (TBFM) and traffic flow management system utilization of newly available data elements downlinked as a result of connected aircraft
- Conduct concept development to align FF-ICE services and processes with TBFM, including negotiation horizon, point of alteration, trial and planning services, etc.

Advanced Methods:

- Conduct engineering development to produce a flight and flow automated user notification prototype capability using advanced technologies
- Develop initial concept for Extended Reality for Traffic Flow Management that would provide recommendations based on the situation
- Develop initial laboratory based prototype of Extended Reality for Traffic Flow Management
- Develop initial concept for smart assistance for flow management to provide predictive analytics supporting further capabilities such as FF-ICE (trial planning or trajectory negotiation services)

FY 2027 Program Descriptions

On Demand NAS Portfolio

Program Description:

The On-Demand NAS Information (ODNI) Program conducts pre-implementation work to reduce risks in supporting the efficient and secure exchange of information within the FAA and between the FAA and other NAS users. The ODNI Portfolio conducts research that examines concepts and develops capabilities through validation activities and demonstrations with stakeholders to enhance information exchange within the NAS.

This Program provides flight planners, Air Navigation Service Providers (ANSP) staff, and flight crews with consistent, complete, and easily processed information on changes in NAS conditions. It also works toward developing international data standards that allow more users to share flight information and coordinate various activities related to flight, supporting collaborative decision-making.

As the NAS evolves, more structured digital information will become available, and technologies such as artificial intelligence (AI) and machine learning (ML) and cloud computing will enable airspace users to make decisions based on current information. The research conducted under this Program will leverage these technological advancements and standardize applications to support flight crew and air traffic control (ATC) decision-making. It will also use innovative technologies to create structured data, enabling the FAA to improve situational awareness and collaboration among various traffic management services through better access to a fully integrated information-sharing environment.

Major Program Objectives:

The main goal of the ODNI Program is to ensure the efficient and secure exchange of information within the FAA and between the FAA and other NAS users for collaborative decision-making. Developing a standard set of flight information will simplify the flight planning process and allow information to cross multiple ATC systems and domains with ease, leading to improvements in ongoing traffic management initiatives and decision-making. NAS efficiency, resiliency and flexibility is maximized through the reallocation of existing resources to address demand and capacity imbalances and create additional NAS agility in support of contingency operations. The incorporation of aircraft performance, flight intent, and improved flight crew situational awareness will result in increased predictability of future aircraft positions, allowing traffic managers to strategically manage the airspace based on anticipated aircraft locations. Adaptable architecture and cloud computing will enhance performance and assure interoperability and scalability. Incorporation of artificial intelligence and machine learning that leverage a network of information will enable enhanced trajectory negotiations while providing optimal traffic management solutions across the NAS.

Anticipated Program Activities:

- *Common Status and Structure Data:*
 - Develop airspace information to support new entrants and continue Aeronautical Information Exchange Model coordination on behalf of new projects
 - Investigate FAA data and data sharing requirements for digital Letter of Agreement (LOA) or digital flight constraint portion of the LOA
 - Expand the flight constraint schema recommendations to include diverse operation procedures
 - Implement LOA origination tool proof of concept into the research and development cloud environment
 - Develop transition plan of aeronautical information to be consistent with the ICAO Dynamic Origin-Destination Information System concept

- *Flight Object:*
 - Complete flight information exchange model release package including logical model to reflect the findings and development from Flight and Flow Information for a Collaborative Environment (FF-ICE) post-departure engineering study and post FPL2012 impact assessment
 - Continuing engineering analysis to identify additional flight object functional requirements for services to support NAS automation modernization and info-centric NAS architecture based on ICAO FF-ICE/Release 2 concept
 - Conduct engineering study to identify flight object data store functional and technology requirements to support flight information needs which resulted from Post FPL2012. Develop proof of concepts to investigate identified requirements
 - Conduct additional engineering study to identify flight object functional and technology requirements to support integration with management of flow information and future tactical flow management services
 - Conduct engineering analysis of flight object data store architecture options within the NAS operating environments (i.e. mission essential, mission critical, research, admin) to allow for optimal access, synchronization, and resiliency of flight information
 - Conduct engineering analysis on the additional services, which support providing flight information post FPL 2012 through application such as flight data in/out, to see if they may require enhancement to higher performance or potentially be substituted with one with higher performance
- *Aeronautical Information Management Modernization Notice to Airmen (NOTAM) Modernization:*
 - Vendor NOTAM solution development and NOTAM service delivery
 - Vendor service provisioning (includes cloud infrastructure and licensing)
 - Systems engineering support for deployment
- *Flight Deck Collaborative Decision Making:*
 - Conduct engineering analysis of integration challenges
 - Develop flight deck automation interoperability standards document
 - Develop final prototype data exchange schema
 - Complete integrated laboratory simulation of integrated architecture
- *Dynamic Airspace:*
 - Explore the voice over internet protocol requirements to enable voice communications for dynamic airspace operations
 - Develop architecture and data flow requirements for resilient network technologies using representative automation technologies that are in use in the NAS
 - Conduct laboratory evaluation or proof of concept activity for a dynamic airspace reconfiguration service with operational subject matter experts

FY 2027 Program Descriptions

NAS Infrastructure Portfolio

Program Description:

The NAS Infrastructure Program enhances and improves data communications, air traffic management, and weather management, which facilitates better decision-making among National Airspace System (NAS) users. It focuses on reducing aviation risks through pre-implementation activities related to weather and engineering, supporting infrastructure transformation and enhancement for both current and future Programs. Key Program capabilities are grouped into categories such as communications, navigation, surveillance, infrastructure, standards, and weather. Overall, the Programs enhance airspace capacity, efficiency, and safety, benefiting the public by optimizing airspace usage, increasing airport operational capabilities, and improving data and navigation management.

Major Program Objectives:

The NAS Infrastructure Program contains key transformational and infrastructure sustainment capabilities that are critical to the success of the current and future NAS. This Program supports the FAA goal of expanding capacity by conducting pre-implementation activities geared toward the development of decision support tools that improve the strategic management of NAS operations. The Program's main goal is to support the improved capacity, efficiency, flexibility, environment, predictability, and safety of the NAS.

Anticipated Program Activities:

New ATM Requirements:

- *Advanced Air Ground Communications (Connected Aircraft):*
 - Complete simulation and test of mature connected aircraft technologies within existing environments
 - Develop validation exercise plan for smart routing
- *Artificial Intelligence for Air Traffic Control:*
 - Explore the type of artificial intelligence (AI)/machine learning (ML) technologies appropriate for the support to tactical traffic flow functions
 - Assess suitability for the enhancement e.g. availability of data for developing/training/testing of ML model, how the technology might be integrated into the decision making and identify performance metric to evaluate model/application outcome
 - Conduct proof of concept to develop the AI/ML technology identified in the analysis and demonstrate the application
- *UAS Operational Intelligence – Qualification of Third-Party Weather Providers (3PWP):*
 - Collaborate with other lines of business and industry to gather and evaluate various weather data using verification and validation methodologies
 - Align and compare weather elements between ASOS and 3PWP datasets, noting any differences
 - Assess 3PWP data against ASTM F3673-23 standards
- *Weather Transition:*
 - Development of improved weather performance requirements that enable enhanced forecasting capabilities in support of FAA operational decision-making
 - Identification and replacement of obsolete weather products with more efficient weather information already available from the meteorological community to ensure capability with existing FAA systems

Weather Forecast Improvements:

- *ATM Weather Integration:*
 - *Weather Services for Extensible Traffic Management (xTM):*
 - Develop concept of operations and operational capability business case for weather services for xTM in accordance with concept and requirements definition
- *Cloud Services for Aviation Weather (CSAW):*
 - Initiate final investment decision (FID) activities for initial CSAW capability (e.g., open platform communications, turbulence weather avoidance polygon)
 - Initiate development of the following products in support of the FID for initial CSAW capability:
 - Final program requirements documentation
 - Enterprise architecture artifacts
 - Business case documentation
 - Implementation strategy and planning document
 - Acquisition program baseline (execution plan)
 - Continue exploration of hosting various matured/translated aviation weather capabilities on the CSAW platform and prioritize capabilities based on stakeholder input. Use input to develop new use cases for follow-on CSAW capabilities
- *International:*
 - Produce report on U.S. differences with Amendment 83 to Annex 3
 - Produce U.S. input to final proposed standards and recommended practices for inclusion in Amendment 84 to Annex 3
 - Produce U.S. input to final proposed standards and recommended practices for the provision of aeronautical meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) format for inclusion in Amendment 84 to Annex 3
 - Produce U.S. input to initial draft ICAO guidance material to support implementation of the standards and recommended practices included in Amendment 84 to Annex 3
 - Develop U.S. input to initial ICAO guidance documents to implement the global provision of aeronautical meteorological information in IWXXM format for Amendment 84 to Annex 3
 - Develop user needs assessments and ConOps for new or improved aeronautical meteorological information capabilities for inclusion in Amendment 85 to Annex 3
- *Weather Community of Interest (Wx-COI):*
 - Delivery of the WX-COI yearly technical letter of project history, problem statement adjudication, and accomplishments for the current fiscal year

Information Management:

- Investigate best practices for identity management of NAS systems
- Analysis of candidate use-case for NAS common services
- Investigate best practices for transmitting high fidelity data in an info centric NAS
- Explore use case of system transformation to allow machine readability
- Enterprise assessment for suitable candidate common services

Navigation Engineering:

- Engineering and analyses on innovative navigation solutions for new entrants – high altitude operations
- Initial framework development to certify commercial navigation services
- Initial policy development to allow for performance-based navigation diverse operations

Applications in Support of Air Traffic Control:

- Develop concept of use requirements and engineering artifacts for prototype applications to support surface operations

FY 2027 Program Descriptions

Laboratories and Support Portfolio

Program Description:

The Laboratories and Support Portfolio provides the NAS environments required to validate the broad framework of future concepts, technologies, and systems and to test the integration, development, and operations functions before they are introduced into the NAS. This Program provides three test platforms: the NextGen Integration and Evaluation Capability, the Florida Test Bed, and the Research & Development Operating Environments Cloud. The Program also includes the Operational Assessment of Performance Program which provides analyses in support of NAS modernization activities by providing a comprehensive evaluation of fielded capabilities. System analyses will focus on quantitative assessments of the operational impacts of fielded NAS modernization components as well as identifying operational shortfalls and improvement opportunities as the NAS continues to evolve.

Major Program Objectives:

The Laboratories and Support Portfolio provides targeted FAA research and development that will lead to new technology development and deployment in the NAS. Data generated by this Program will allow for the assessment of regulatory approaches, foster information sharing, and facilitate coordination and collaboration with industry and other stakeholders. Most importantly, this Program facilitates the testing and adoption of new technologies throughout the NAS. To aid in the testing and adoption of new technologies, the Program incrementally expands the capabilities of the testing platforms. These capabilities will also align with the NAS modernization demonstration projects and stakeholders' needs and vision.

Anticipated Program Activities:

NextGen Integration and Evaluation Capability:

- Provide necessary infrastructure enhancements for engineering development and validation exercises supporting NAS 2040 operations.
- Provide engineering support services for infrastructure and capabilities to support future concept demonstrations.
- Provide necessary licenses, maintenance agreements, and equipment of the testing platform.

Florida Test Bed:

- Provide engineering support services for infrastructure and capabilities to support future concept demonstrations.
- Provide necessary licenses, maintenance agreements, and equipment of the testing platform.
- Provide sustainment for the FTB facility which includes leases, utilities, maintenance, and inspections.

Research and Development of Operating Environment (RD-OE):

- Continue to build and support the RD-OE infrastructure to support engineering development and validation activities in support of NAS 2040 operations.

Operational Assessment of Performance:

- Investigate and evaluate performance for capabilities introduced into the NAS within the previous year, focusing on the variation in daily operations.
- Analyze the potential operational needs/improvements supported by the vision and concept of operations for the NAS 2040 outlook vision?

FY 2027 Program Descriptions

Enterprise, Concept Development, Human Factors & Demonstrations Portfolio

Program Description:

The Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio conducts enterprise-level activities, including developing concepts across the National Airspace System (NAS), human factors analysis of the future operational environment, and demonstrations of proposed system improvements to ensure operational feasibility and viability within the current and future NAS.

Major Program Objectives:

Program concept development efforts will evaluate capabilities that will support the NAS environment required to implement information-centric NAS and performance-based operations during all phases of flight, in various types of airspace, and high-altitude operations. These concepts enhance system capacity and efficiency while ensuring safe aircraft separation and reducing workload for controllers and flight crews. The work identifies future concepts and maturation activities that will contribute to NAS modernization. Human factors activities evaluate concepts for human factors implications and inform the maturation of these concepts into successful capabilities. Stakeholder demonstrations provide practical application and analysis of proposed future system improvements to validate and prove concept feasibility and determine which initiatives might be accelerated through fast-track modeling.

Anticipated Program Activities:

Enterprise Human Factor Development:

- Research into human factors considerations in transition to NAS service-based architecture
- Research into human factors considerations for human-automation teaming for air traffic control and air traffic management
- Research on human factors impacts of increasing data and communications availability in the NAS 2040 Vision
- Research on human factors impacts of increasing data and communications availability in the info-centric NAS
- Identify potential controller skill degradation due to increased task automation. Loss of proficiency in tasks that have been automated has been demonstrated in a wide range of activities
- Develop human factors recommendations for improved traffic management information presentation

Enterprise Concept Development:

- Complete update to smart airports concept of operations for small-sized airports
- Final update to the FAA trajectory-based operations (TBO) concept of operations for alignment with global concepts (e.g., International Civil Aviation Organization (ICAO) TBO, connected aircraft, Zero trust)
- Concept development for transitioning from Aeronautical Message Handling System (AMHS) to System Wide Information Management (SWIM) application due to flight plan 2012 cessation
- Begin research and gap analysis on ubiquitous communication in the NAS
- complete concept maturation for transitioning from AMHS to SWIM application due to flight plan 2012 cessation
- Finalize research and draft a concept of operations for ubiquitous communication in the NAS
- Complete a gap analysis for flight information modernization at small and medium air traffic control towers that leverages the smart airport concept

FY 2027 Program Descriptions

Unmanned Aircraft Systems (UAS) Portfolio

Program Description:

The integration of Unmanned Aircraft Systems (UAS) and Urban Air Mobility (UAM) into the National Airspace System (NAS) involves a coordinated effort across multiple programs to enhance airspace management, safety, and efficiency. The UAS Flight Information Management System (FIMS), developed with NASA, supports UAS traffic management by coordinating operations below 400 feet, enabling operators to manage flights with real-time constraints. UAM explores innovative solutions for urban transportation, integrating crewed and uncrewed aircraft into the NAS with new traffic management techniques tailored for urban environments.

The Concept Validation and Requirements Development (CVRD) Program focuses on creating policies and infrastructure for safe Beyond Visual Line of Sight (BVLOS) operations. Upper airspace operations above flight level 600 is addressed by a program analyzing communication, navigation, and surveillance needs for managing diverse high-altitude operations. The Small UAS (sUAS) Implementation Program improves airspace access through initiatives like the low altitude authorization and notification capability and B4UFLY integration, while supporting broader safety compliance efforts with systems like the UAS Geospatial Information Management System (UGIMS).

These Programs collectively aim to address the unique challenges of integrating both traditional and emerging aviation technologies, ensuring safe, efficient, and seamless operations across all sectors of airspace. Through these efforts, the FAA, in collaboration with NASA and industry partners, is paving the way for the future of aviation, accommodating new vehicle types and operational paradigms.

Major Program Objectives:

FAA products, policies, and procedures must be reviewed and refined, or developed through supporting research, to permit UAS operations in the NAS. The UAS Research Program plays a critical role in enabling UAS operations in the NAS without affecting manned aircraft operations (e.g., creating disruptions or delays) and ensures that NAS operations will be as safe as or safer than today.

Anticipated Program Activities:

UAS - Flight Information Management:

- UAS Flight Information Management Concepts and Analysis:
 - Develop subconcept for UAS traffic management (UTM) highly autonomous operations
- UTM Concept Engineering:
 - Complete final system/subsystem specifications version 5.0 (e.g., UTM contingency management, BVLOS controlled airspace access)
 - Develop risk management plan version 5.0 (e.g., UTM contingency management, BVLOS controlled airspace access)
 - Complete information systems security assessment version 5.0 (e.g., UTM contingency management, BVLOS controlled airspace access)
 - Complete human interface assessment version 5.0 (e.g., UTM contingency management, BVLOS controlled airspace access)
 - Develop product improvement plan version 5.0 (e.g., UTM contingency management, BVLOS controlled airspace access)
 - Complete reference implementation version 5.0 (e.g., UTM Contingency Management, BVLOS Controlled Airspace Access).

UAS - Concept Validation and Requirements Development:

- Evaluate navigation infrastructure and services to support large UAS BVLOS operations
- Define navigation performance requirements
- Update shortfalls and requirements
- Create integrated concept of use for large UAS BVLOS operations

Small UAS Implementation:

- Enhance unmanned aircraft flight rules capability and continue integration into UGIMS environments
- Development of data exchange capabilities to support advanced air mobility (AAM) initiatives
- Continuing integration of enterprise-level UAS services suite of systems into UGIMS environments
- Contribute to the development of the UTM ecosystem and enhancements of contributing services as determined by the FAA Air Traffic Organization UAS services plan
- Enhance Drone Information for Security, Compliance, Verification, and Reporting for additional remote ID and security requirements
- Implementation of requirements for enhanced UTM ecosystem capabilities (e.g. FAA DroneZone, enterprise information management)
- Update the UTM ecosystem/infrastructure to support additional data exchange for small UAS operations in constraint area, demand capacity balancing
- Deployment and onboarding of BVLOS (Part 108) support for UAS service suppliers

UAS Upper Airspace:

- Conduct preliminary analysis on global traffic management approaches to expanded traffic management (ETM) operations
- Research and develop interface requirements for information sharing and reporting between ETM service suppliers and FAA systems to provide seamless integration for vehicles entering and exiting cooperative areas
- Complete report on NAS infrastructure and services changes needed to support ETM
- Update ETM concept of operations

UAS - Urban Air Mobility:

- Develop cybersecurity requirements for UAM (version 2.0)
- Conduct human factors assessment for UAM remotely piloted operations
- Develop final engineering analysis on UAM separation management considering performance requirements and aircraft diversity within cooperative airspace
- Conduct initial engineering analysis for UAM cooperative separation management
- Complete final UAM data exchange requirements and integrated architecture
- Complete final UAM data exchange model with operational performance requirements
- Complete final system/subsystem specifications for integrated UAM operations
- Complete infrastructure and technology requirements analysis for UAM operations
- Conduct AAM human-in-the-loop simulations for key project site 3 in the U.S., leveraging use cases refined through modeling, simulation, and tabletop exercises
- Integrate initial AAM operations at project site 1 through the Fly It process

FY 2027 Program Descriptions

System Planning and Resource Management

Program Description:

The System Planning and Resource Management (SPRM) Program leads the planning, coordination, development, presentation, and review of the FAA's Research and Development (R&D) portfolio. Its key programmatic outputs include the National Aviation Research Plan (NARP) and its companion document, the R&D Annual Review (AR), both of which are annual statutory deliverables to Congress. The NARP provides an overview of the FAA's research and development plans over the next five years, highlighting near-, mid-, and far-term research. The AR highlights the accomplishments of the research completed during the prior fiscal year, including a description of research results disseminated to the private sector and new technologies developed by the agency. The SPRM Program also conducts the administration of the congressionally mandated Research, Engineering, and Development Advisory Committee (REDAC) and resultant recommendations and reports. SPRM also provides program advocacy and outreach and maintains alignment with departmental R&D program planning and performance reporting guidance. SPRM manages the portfolio planning, formulation, presentation, and review activities to ensure the FAA meets the President's criteria for R&D, increases program efficiency, and enables effective program review by the REDAC and the Department of Transportation Office of Research and Technology (OST).

SPRM also develops program guidance and conducts compliance reviews to ensure that departmental R&D program planning and performance reporting requirements are met. It also coordinates the establishment and administration of the Air Transportation Centers of Excellence (COE) Program and ensures compliance with related financial assistance and grants management departmental policy guidance.

The SPRM Program advances the Department's mission by providing an inclusive and innovative culture to effectively serve communities and responsibly steward the public's applied research dollars. SPRM ensures the American public's resources are invested in such a manner as to deliver substantive research that provides safety and efficiencies while delivering results to the flying public.

Major Program Objectives:

The SPRM Program manages the RE&D portfolio and submits the mandatory R&D planning documents to Congress each year. Through the REDAC's findings, this program facilitates an independent, expert review of the FAA's R&D portfolio that provides meaningful recommendations for the FAA to refine and improve its portfolio. This results in a more effective research program that will benefit the public by making aviation safer and smarter and enhancing U.S. global leadership in aviation.

Anticipated Program Activities:

- Annual Statutory Deliverables to Congress
- Departmental (OST) R&D Program Planning and Performance Reporting Requirements
- Development and Submission of the FAA's R&D Investment Portfolio

FY 2027 Program Descriptions

William J. Hughes Technical Center for Advanced Aerospace Laboratory Facilities

Program Description:

The Laboratory Facilities Program sustains research facilities located at the William J. Hughes Technical Center for Advanced Aerospace (the Center) to support Research and Development (R&D) program goals. These programs require specialized facilities to emulate and evaluate field conditions. The R&D laboratories are comprised of the Cockpit Simulation Facility, Target Generation Facility, Research Development and Human Factors Laboratory (RDHFL) and the Research & Development Operational Environment (RDOE) network and the FAA laboratory space located within the National Aerospace Research and Technology Park (NARTP). The associated R&D programs require specialized facilities which provide flexible, high-fidelity environments to conduct research and perform human-in-the-loop simulations that evaluate advanced air traffic concepts. Researchers measure baseline human performance using existing air traffic controller configurations and determine changes in performance when new systems or procedures are introduced to identify and evaluate human factors issues. These laboratories include integrated cockpits, air traffic controller workstation capabilities (simulated and real), and specialized biometric data collection systems to evaluate the system and human components that can only be addressed in a full mission end-to-end simulation environment. The R&D laboratories are fully integrated with other Center capabilities allowing for an extremely high-fidelity environment supporting R&D research. This research encompasses the capabilities of the current systems, NextGen, and the transition between these systems (e.g., mixed equipage, adjacent site deployment). The funding provides for existing infrastructure support, project support, engineering support, R&D facility modifications and improvements, equipment and software/hardware licenses, and support tools.

Major Program Objectives:

The main goal of the Center is to provide a laboratory environment that is fully integrated, extremely high fidelity, and that encompasses capabilities of current day systems, future systems, and the transition between the two. The goals of these simulation facilities include developing capabilities to enable research of complex problems, such as weather and emerging operations, in a controlled laboratory environment. The fully integrated facilities will enable research from the ground and airborne elements for a complete simulation capability. Objectives include:

- Concepts and Systems Integration - RDHFL goals include conducting proactive human factors research on proposed changes to the National Airspace System (NAS) that identify human performance issues early in the concept development phase.
- Network Infrastructure – RDOE network goals are to maximize shared resources, relieve the need to establish separate connections, and minimize duplication of efforts and the resources to manage these extra connections. The RDOE network provides a common network approach that affords distributed access to R&D laboratories, and a distributed set of capabilities.

The laboratory network operations center provides an environment to maintain, monitor status and cyber events, and operate the RDOE and customer networks. The Laboratory Facilities Program provides researchers with the specialized laboratories and infrastructure required to achieve R&D program goals and objectives. Having an efficient and flexible platform to evaluate current and future air transportation system concepts and technologies enhances the safety and efficiency of air travel for the American public. Performing research in simulation rather than with live aircraft generates cost savings, is intrinsically safer, and allows the study of the extremes that would not be possible in live flight conditions.

The implementation of new technologies, such as intelligent agent-based capabilities, allow for a reduction in the number of test subject participants needed for a given study; again, maximizing cost savings and efficiencies. Modernization of the FAA R&D network infrastructure and further extensibility into the Mike Monroney Aeronautical Center laboratories will directly support exploration of NAS modernization. Finally,

human factors-related issues resolved prior to implementation result in cost savings and ensure that the FAA's safety standards for air traffic control operations are met.

Anticipated Program Activities:

- Enhance simulation and data reduction software to capitalize on new advances in biometric data collection (i.e., smart watches and eye tracking).
- Implement further network hardening principles to supplement Zero Trust solutions.
- Identify and evaluate alternative technologies for deployment of enterprise FAA micro- segmentation, macro-segmentation, Software Defined Networking, Intelligent Traffic Monitoring, Trust Scoring, other Zero trust technologies, etc.
- Provide RD-OE Network platform to facilitate integration of FAA and partner networks and facilities to expand collaborative capabilities and position the FAA to meet R&D program goals and objectives
- Provide RD-OE cloud infrastructure, platform and computing services to support R&D needs of the FAA and provide the cloud infrastructure to support multiple R&D projects

FY 2027 Program Descriptions

William J. Hughes Technical Center for Advanced Aerospace Laboratory Sustainment

Program Description:

The Laboratory Sustainment Program sustains the William J. Hughes Technical Center for Advanced Aerospace (the Center) laboratories. This centralized set of laboratories supports the Acquisition Management System lifecycle from concepts and requirements definition to in-service decision. These laboratories are the only location where it is possible to realistically simulate the National Airspace System (NAS), and it is necessary to maintain the laboratory systems with capabilities that match field sites that currently exist or are planned. These test beds can be altered to replicate desired field configurations and traffic scenarios, providing stakeholders with an understanding of how upgraded systems will perform prior to operational deployment. These labs also provide a flexible high-fidelity environment to conduct research and perform human-in-the-loop simulations that evaluate advanced air traffic concepts and are fully integrated with the other Center capabilities.

Major Program Objectives:

The goal of this program is to modernize the equipment and infrastructure necessary for the FAA's centralized NAS laboratory facilities so that facilities and equipment programs can deliver products that result in a safe, reliable, and efficient NAS. The Center centralized labs eliminate the need for each acquisition program to establish and sustain separate laboratory facilities to support their individual programs and fielded systems. Capabilities developed in these laboratories reduce the overall cost of NAS development while increasing traveler safety and decreasing travel times by reducing airspace congestion. This program is necessary to sustain the Center laboratory test facility, which provides direct field support for operational NAS systems. Problems identified at various field locations are quickly transmitted to the appropriate laboratory where solutions are developed and tested. The test beds are used by acquisition programs and partner agencies for development, test, evaluation, integration, transition testing, and first and second level support to the field. This program is necessary to maintain these laboratory systems in configurations and capabilities that match field sites that currently exist or are planned.

Anticipated Program Activities:

- Support laboratory space and infrastructure improvements
- Support laboratory requirements of programs and customers
- Support laboratory equipment technology refresh
- Support NAS equipment modernization

FY 2027 Program Descriptions

William J. Hughes Technical Center for Advanced Aerospace Infrastructure Sustainment

Program Description:

The Infrastructure Sustainment Program at the William J. Hughes Technical Center for Advanced Aerospace (the Center) reduces expenses associated with ongoing operation and maintenance activities as well as reducing the frequency of expenses associated with system replacement. System updates reduce energy consumption, and cost, on a per-square-foot basis, thus supporting current Federal Energy Management requirements for sustainability and energy consumption.

Program Objectives:

This program sustains the Center facilities, site utilities, and infrastructure. The Center represents approximately 1.6 million square feet of test and evaluation, research and development, and administrative facilities, plus numerous project test sites on 5,000+ acres of land.

Anticipated Program Activities:

- Support laboratory space and infrastructure improvements
- Support laboratory requirements of programs and customers
- Support laboratory equipment technology refresh
- Support National Airspace System equipment modernization

Additional information about DOT Research can be found at <https://researchhub.bts.gov/search>