United States Department of Transportation
Annual Modal Research Plans
Fiscal Year 2018

FEDERAL AVIATION ADMINISTRATION

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Executive Summary

The Federal Aviation Administration (FAA) is pleased to provide this annual research plan describing its major research program priorities, funding, activities, and departmental collaboration.

Research and development (R&D) programs in the FAA support various operational mission areas across several lines of business and are funded through different appropriations. FAA's complete R&D portfolio is represented in its annual National Aviation Research Plan (NARP) pursuant to 49 United States (U.S.) Code 44501(c), and submitted to Congress with FAA's annual budget request. This plan, in addition to FAA's forthcoming five-year strategic research plan consistent with the Fixing America's Surface Transportation (FAST) Act, build upon FAA's FY2015 and FY2016 strategic goals to promote safety, efficiency, environmental responsibility, and global leadership. A significant tenet of FAA's R&D programs is to systematically expand and apply learned knowledge to produce useful materials, devices, systems, or methods that improve aviation safety, thereby achieving the lowest possible accident rate.

Occurring in one of the U.S. government's largest enclosed fire test facilities, FAA's Fire Research and Safety Program conducts research to prevent accidents caused by in-flight fires, and improve survivability during post-crash fires. Security and hazardous materials safety organizational goals encompass cargo, passenger in-flight, materials, high-energy power sources, and modelling research, and enable FAA to issue regulations, standards, and guidance material that ensure the highest level of safety in commercial aviation.

Through its Airport Improvement Program (AIP), FAA engages in progressive R&D to improve durability, economy, and environmental sustainability and extend the life of airfield pavements. Infrastructure capital improvements designed and implemented by airport operators under this program maintain and enhance both safety and efficiency, and reduce the environmental impacts on adjacent communities. For example, airport technology research addresses pavement structure, sustainable materials and mixture design and specification, while environment and energy research investigates the complex interdependencies that exist among aircraft noise, fuel burn, and emissions. Collectively, AIP programs leverage research to evaluate airport compliance policy and technological options that mitigate aviation's environmental and energy use impacts. FAAs Human Factors laboratories encompass fatigue research across multiple aviation domains. Personnel serve on a variety fatigue-related interagency working groups, including the Department of Transportation's (DOTs) Human Factors Coordinating Committee (HFCC). Fatigue research supports policy development in response to National Transportation Safety Board (NTSB) recommendations and FAA Flight Standards organizations, and various code of federal regulations (CFR) and notice updates. Additionally, FAA genomics teams evaluate biomarkers associated with the cognitive impairment of sleep deprivation in safety critical roles, and identify impairment in post-mortem civil aviation accident victims.

FY 2018 RD&T Program Funding Details

RD&T Program Name	FY 2018 Pres. Budget ($000)	FY 2018 Basic ($000)	FY 2018 Applied ($000)	FY 2018 Development ($000)	FY 2018 Technology ($000)
Fire Research and Safety	7,044		7,044		
Advanced Materials/ Structural Safety	4,338		4,338		
Aeromedical Research	9,765		9,765		
ATC/Tech Ops Human Factors	5,196		5,196		
Aircraft Catastrophic Failure Prevention	1,570		1,570		
Aircraft Icing /Digital System Safety	9,253		9,253		
Commercial Space Transportation	1,796		1,796		
Continued Airworthiness	10,437		10,437		
Flight deck/Maint. System Integration Human Factors	6,825		6,825		
NextGen Alternative Fuels for GA	5,924		5,924		
Propulsion and Fuel Systems	2,269		2,269		
System Safety Management	4,149		4,149		
Unmanned Aircraft Systems	6,787		6,787		
Weather Program	13,399		13,399		
NextGen Wake Turbulence	6,831		6,831		
NextGen Air Ground Integration Human Factors	6,757		6,757		
NextGen Weather Technology in the Cockpit	3,644		3,644		
NextGen Information Security	1,000		1,000		
Environment and Energy	14,497		14,497		
NextGen Environmental Research Aircraft Technologies and Fuels	23,151		23,151		

RD&T Program Name	FY 2018 Pres. Budget ($000)	FY 2018 Basic ($000)	FY 2018 Applied ($000)	FY 2018 Development ($000)	FY 2018 Technology ($000)
System Planning and Resource Management	2,135		2,135		
WJHTC Laboratory Facility	3,233		3,233		
Advanced Technology Development & Prototyping	26,800			26,800	
NextGen Separation Management Portfolio	13,500			13,500	
NextGen On-Demand NAS Information	12,000			12,000	
NextGen Traffic Flow Management Portfolio	10,800			10,800	
NextGen NAS Infrastructure	17,500			17,500	
NextGen Laboratory Support	12,000			12,000	
Enterprise, Concept Development, Human Factors & Demonstration	9,000			9,000	
NextGen UAS	15,000			15,000	
Center for Advanced Aviation System Development	57,000			57,000	
Airport Technology Research Program	33,210				33,210
Airport Cooperative Research Program	15,000				15,000
Total	**371,810**		**150,000**	**173,600**	**48,210**

FY 2018 RD&T Program Budget Request by Critical Transportation Topic Areas

RD&T Program Name	FY 2018 Pres. Budget ($000)	Promoting Safety ($000)	Improving Infrastructure ($000)	Improving Mobility ($000)	Preserving the Environment ($000)
Fire Research and Safety	7,044	7,044			
Advanced Materials Structural Safety	4,338	4,338			
Aeromedical Research	9,765	9,765			
ATC/Tech Ops Human Factors	5,196	5,196			
Aircraft Catastrophic Failure Prevention	1,570	1,570			
Aircraft Icing/Digital System Safety	9,253	9,253			
Commercial Space Transportation	1,796	1,796			
Continued Airworthiness	10,437	10,437			
Flight deck/Maint. System Integration Human Factors	6,825	6,825			
NextGen Alternative Fuels for GA	5,924				5,924
Propulsion and Fuel Systems	2,269	2,269			
System Safety Management	4,149	4,149			
Unmanned Aircraft Systems	6,787	6,787			
Weather Program	13,399	13,399			
NextGen – Wake Turbulence	6,831			6,831	
NextGen Air Ground Integration Human Factors	6,757			6,757	

RD&T Program Name	FY 2018 Pres. Budget ($000)	Promoting Safety ($000)	Improving Infrastructure ($000)	Improving Mobility ($000)	Preserving the Environment ($000)
NextGen – Weather Technology in the Cockpit	3,644			3,644	
NextGen Information Security	1,000			1,000	
Environment and Energy	14,497				14,497
NextGen Environmental Research Aircraft Technologies and Fuels	23,151				23,151
System Planning and Resource Management	2,135	1,302		278	555
WJHTC Laboratory Facility	3,233	2,683		550	
Advanced Technology Development & Prototyping	26,800			26,800	
NextGen Separation Management Portfolio	13,500			13,500	
NextGen Traffic Flow Management Portfolio	10,800			10,800	
NextGen On-Demand NAS Portfolio	12,000			12,000	
NextGen NAS Infrastructure Portfolio	17,500			17,500	

RD&T Program Name	FY 2018 Pres. Budget ($000)	Promoting Safety ($000)	Improving Infrastructure ($000)	Improving Mobility ($000)	Preserving the Environment ($000)
NextGen Laboratory Support Portfolio	12,000			12,000	
Enterprise, Concept Development, Human Factors & Demonstration	9,000			9,000	
NextGen UAS	15,000			15,000	
Center for Advanced Aviation System Development	57,000	10,260		42,180	4,560
Airport Technology Research Program	33,210	17,250		15,5600	400
Airport Cooperative Research Program	15,000	5,000		5,000	5,000
Total	**371,810**	**119,324**		**198,399**	**54,087**

Fire Research and Safety
FY2018 Funding: $7,044,000

Program Description:

The Fire Research and Safety Program develops technologies, procedures, test methods, and fire performance criteria that can prevent accidents caused by hidden cabin or cargo compartment in-flight fires and fuel tank explosions and improve survivability during a post-crash fire. The program supports the FAA's Associate Administrator for Aviation Safety organization, which 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 transports are completed in coordination with DOT's Pipelines and Hazardous Materials Safety Administration (PHMSA).

Program Objectives:

The purpose of this program is to conduct research to prevent accidents caused by in-flight fire (main emphasis of the current program) and to improve survivability during a post-crash fire. Fire research addresses fundamental issues of (a) combustion toxicity; the impact of flame retardant chemicals, (b) health hazards of cabin materials; the impact of materials flammability on the initiation of in-flight fires, and (c) post-crash survivability.

Anticipated Program Activities:

1. Evaluate detector technology that discriminates between aircraft fire and non-fire smoke/odor sources.

2. Make available a searchable database of fire test results and materials flammability for public, government and industry use.

3. Examine state-of-the-art technology for protection of compressed hydrogen in aircraft fuel cell applications.

Expected Program Outcomes:

The outcome and benefit derived from this program will be the introduction of enabling technologies to prevent accidents caused by fire in freighter aircraft and hidden in-flight fires in passenger-carrying airplanes. New technologies of interest to the aircraft manufacturers and operators will be enabled in a fire-safe manner or prohibited if warranted.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Pipelines and Hazardous Safety Materials Administration (PHMSA)

Program Name	Name of Collaboration Partner(s) (External DOT)
	Boeing Embraer Bombardier Airframe Manufacturers Fire Detection Equipment Manufacturers National Institute of Standards and Technologies (NIST)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the Research Engineering and Development Advisory Committee (REDAC) – a chartered committee consisting of industry and academia that functions in accordance with the Federal Advisory Committee Act (FACA). As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Advanced Materials/Structural Safety
FY2018 Funding: $4,338,000

Program Description:

The Advanced Materials/Structural Safety Program supports the goal of improving aviation safety by investigating a broad spectrum of issues related to the use of composite and advanced materials in aircraft structures. These include fatigue and damage tolerance issues from in-flight hail and ground vehicle collisions, environmental and aging effects, and bonded joints and repairs. The program also develops safety awareness training for advanced composite materials and manufacturing processes. The Structural Safety program conducts research to develop or validate dynamic test methods, procedures, and means of analysis to meet crashworthiness regulations. The program helps ensure that new aircraft structures demonstrate levels of safety equivalent to existing aircraft structures when subjected to survivable crash conditions.

Program Objectives:

The program conducts research to develop or validate dynamic test methods, procedures, and means of analysis to meet crashworthiness regulations. It helps ensure that new aircraft structures demonstrate levels of safety equivalent to existing aircraft structures when subjected to survivable crash conditions.

Anticipated Program Activities:

1. Develop assessment of typical range of ditching and other water landing scenarios to provide recommendations on certifications requirements.

2. Evaluate composites quality control Advisory Circular (AC) 21-26 for necessary updates and provide background data.

Expected Program Outcomes:

The Advanced Materials and Structural Safety program will improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	University of Utah Wichita State University University of Washington National Institute of Aerospace Florida International University

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Aeromedical Research
FY2018 Funding: $9,765,000

Program Description:

The Aeromedical Research Program develops new and innovative ways to support FAA regulatory and advisory missions to improve the safety of humans in civilian aerospace operations. Research personnel at the Civil Aerospace Medical Institute (CAMI) supporting this program discover methods and recommend strategies to enhance the safety, security, health, and performance of the most important aspect of the national airspace system (NAS), the human operator and the public that she/he serves.

Program Objectives:

The Aerospace Medical Research Program is formulated to keep abreast of emerging human safety risk issues such as those brought by the aging pilot population and changes in their health condition, advances in pharmacology, therapeutic tools, and surgical procedures. Improved aircraft materials, equipment, cabin configurations, life support systems, and evacuation assistive devices all may affect survival from an aircraft accident. The program has also been designed to address the complexity of software, technology, and systems integration practices as these continue to evolve.

Anticipated Program Activities:

1. Develop advanced methodologies to analyze human biological samples for emerging drugs, toxins, or factors that may impact pilot performance or assist in determining accident causality.

Expected Program Outcomes:

The Aeromedical research program is expected to improve aviation safety through improved understanding of factors that influence human physiology and performance in aerospace environments and guidance and tools that enhance human safety, protection, and survival during civil aerospace operations.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	Oklahoma State University

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Air Traffic Control/Technical Operations Human Factors

FY2018 Funding: $5,196,000

Program Description:

The Air Traffic Control (ATC)/Technical Operations (TO) Human Factors Program emphasize the concept of Human-System Integration (HSI) and safety aspects of the functions performed by air traffic controllers and technical operations personnel. The HSI concept addresses the interactions between workstation design, training and facility assignment, and human error and human performance.

Program Objectives:

The ATC/TO Human Factors Program provides Air Traffic Organization (ATO) technical sponsors with timely and appropriate R&D products and consultation services that focus on improving the safety and efficiency of complex ATC systems, by measuring and enhancing individual and team performance of air traffic controllers and technical operations specialists. Five focus areas are 1) development and update of human factors standards 2) human factors efforts to optimize the controller and technical operations workforces 3) human factors efforts to reduce error and improve safety 4) human factors efforts to support integration of technology into the NAS and 5) development of recommendations and methods for enhancing human performance.

Anticipated Program Activities:

1. Evaluate use of simulation in ATC and technical operations training and make recommendations for simulator fidelity requirements and a mix of simulation capabilities that will reduce training cost and time to achieve training standards (proficiency levels) at core 30 airports.

Expected Program Outcomes:

The Human Factors research program is expected to improve aviation safety through improved knowledge of the human-system interface and a reduction in accidents and incidents through enhanced aerospace vehicle, air traffic, and technical operations that adapt to, compensate for, and augment the performance of the human.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	APT Metrics MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Human Factors Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Aircraft Catastrophic Failure Prevention Research
FY2018 Funding: $1,570,000

Program Description:

The Aircraft Catastrophic Failure Prevention Research Program develops technologies and methods to assess risk and prevent occurrence of potentially catastrophic defects, failures, and malfunctions in aircraft, aircraft components, and aircraft systems. The program uses historical accident data and NTSB recommendations to examine and investigate turbine-engine uncontainment events and other engine-related impact events.

Program Objectives:

The goal of this research program is to have a public tool with standardized generic models, user guides, training, software quality control process, and validated public material models. This will reduce workload and allow for the timely processing of applications.

Anticipated Program Activities:

1. Develop new tests needed for composite impact and failure.
2. Complete verification study for uniaxial composite impact.

Expected Program Outcomes:

The Aircraft Catastrophic Failure Prevention Research Program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA Ohio State University (OSU) Arizona State University (ASU) George Mason University (GMU) Naval Air Warfare Center China Lake Central Connecticut State University (CCSU) LS-DYNA Aerospace Working Group (AWG)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Aircraft Icing/Digital System Safety
FY2018 Funding: $9,253,000

Program Description:

The Aircraft Icing/Digital System Safety Program develops and tests technologies that detect frozen contamination, predict anti-icing fluid failure, and ensure safe operations in atmospheric icing conditions. The program also develops new guidelines for testing, evaluating, and approving digital flight controls, avionics, and other systems during the certification of aircraft and engines and studies the airworthiness requirements of airborne cyber security.

Program Objectives:

The Aircraft Icing Program will continue to develop and test technologies that detect frozen contamination, predict anti-icing fluid failure, and ensure safe flight operations in atmospheric icing conditions. Reducing aviation's vulnerability to all in-flight icing hazards will remain a major program goal.

The goal of the Digital Systems Safety program remains to approve and maintain aircraft safety by taking a proactive approach to the ever changing technological marketplace and conduct research in the areas of advanced digitally-intensive systems and assess how they can safely be deployed in the onboard airborne systems of systems environment

The Aircraft Systems Information Security Protection (ASISP) cyber initiative will remain focused on exploring where ASISP-related threats and risks can compromise fail-safe mechanisms in the architecture, design, and operation of aircraft systems.

Anticipated Program Activities:

1. Develop data and methods for guidance material for the airworthiness acceptance criteria and test methods for engines in simulated high ice water content environments.

2. Create a validation database of ice shapes and their aerodynamic effects on swept wings for computational fluid dynamics.

3. Explore and recommend an approach to determine worst-case execution time for multi-core processors (MCPs), and develop a preliminary identification of certification challenges for systems incorporating MCPs using hyper-threading and hypervisor virtualization technologies, including possible evidence for objective-based certification guidance.

Expected Program Outcomes:

This program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Homeland Security Texas A&M Engineering Experiment Station (TEES) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Commercial Space Transportation Safety
FY2018 Funding: $1,796,000

Program Description:

The Commercial Space Transportation (CST) Safety Program will continue to regulate commercial space launch and reentry operations, only to the extent necessary to ensure compliance with international obligations of the U.S., and to protect the public health and safety, safety of property, and national security and foreign policy interests of the U.S. Additionally, the Office of Commercial Space Transportation (AST) encourages, facilitates, and promotes commercial space launches and reentries by the private sector. This program conducts research on emerging space concepts, technologies, and operating techniques in order to keep safety at the forefront of these activities.

Program Objectives:

The R&D Program is intended to enable advances in critical areas spanning four thematic areas that address safe and efficient integration of increased commercial space launch and re-entry activity into the NAS, advanced safety assessment methods, advanced vehicle safety technologies and methodologies, and human spaceflight and physiological safety factors. The primary mission of the AST is to ensure the safety of the public, property, and national security and foreign policy interests of the U.S. during commercial launch and reentry operations.

Anticipated Program Activities:

1. Assessment of screening and training requirements for pilots with repeated exposures to sustained high acceleration (supports human spaceflight and physiological safety factors).

2. Identify and assess algorithm improvements for launch collision avoidance, with initial formulation of improved trajectory and uncertainty input data requirements (supports safe and efficient integration of increased commercial space launch and re-entry activity into the NAS).

3. Identify candidate approaches to characterize dynamic population clusters in public safety analysis methods and evaluate potential mitigation measures (supports advanced safety assessment methods).

Expected Program Outcomes:

- Safe and efficient integration of increased commercial space launch and re-entry activity into the NAS.

- Improved vehicle safety and risk management, including knowledge of all safety-critical components and systems of the space vehicles and their operations, to better identify potential hazards and apply and verify hazard controls.

- Guidance and tools that enhance human safety, protection, and survival during space operations.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Stanford University CGH Technologies, Inc. University of Central Florida Air Force Research Laboratory University of Texas Medical Branch University of Colorado at Boulder (CU) Volpe National Transportation Systems Center National Oceanic and Atmospheric Administration (NOAA) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Continued Airworthiness
FY2018 Funding: $10,437,000

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 focuses on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, continued safety of aircraft engines, development of inspection technologies, and the safety of electrical wiring interconnect systems and mechanical systems.

Program Objectives:

Continued Airworthiness research will focus on emerging technologies such as damage tolerance and durability issues of new aluminum-lithium alloys, metal additive manufacturing (AM), new and emerging alloys. These will be studied for inclusion in metallic materials properties development and standardization (MMPDS), and risk management methods to support the aircraft certification services monitor safety/analyze data (MSAD) initiative, which is a data-driven, risk-based continued operational safety decision-making process.

Anticipated Program Activities:

1. Develop technical data to evaluate non-flammable electrolyte lithium batteries and battery systems for aerospace applications.

2. Develop property standards for emerging process intensive materials.

Expected Program Outcomes:

The Continued Airworthiness Program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Alcoa Airbus Boeing DNV GL Honeywell Constellium Bombardier Textron Aviation Origo Corporation Spirit Aero systems Teledyne Technologies Infinity Aircraft Services University of Washington Battelle Memorial Institute Embraer Aerospace Company Polytechnic University of Milan University of Texas at San Antonio (UTSA) University of Dayton Research Institute Kansa Aviation Research and Technology Consortium Embry-Riddle Aeronautical University (in-flight simulation) Wichita State University National Institute for Aviation Research (NIAR) Americans with Disabilities Act-Airports Disability Compliance Program

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Flightdeck/Maintenance/System Integration Human Factors
FY2018 Funding: $6,825,000

Program Description:

The program provides the research foundation for FAA guidelines, handbooks, orders, advisory circulars (ACs), technical standard orders (TSO), and regulations that help ensure the safety and efficiency of aircraft operations. It also develops human performance information that the agency provides to the aviation industry for use in designing and operating aircraft, and training pilots and maintenance personnel. The program focuses on the needs of pilots, inspectors, and aircraft maintainers. The revolution in digital avionics has changed flight deck design and operational practices and enabled new head-up display technologies, surface moving maps, electronic flight bags, advanced controls, communications, navigation, surveillance systems, and tools for aircraft system management. With these advances come important human performance and human factors implications that must be understood and applied in the appropriate guidance material developed for policy, procedures, operations, and training.

Program Objectives:

Research results enable the FAA and industry to improve task performance and training for aircrew, inspectors, and maintenance technicians, improve training for unmanned aircraft system (UAS) control station and crew, develop and apply error management strategies to flight and maintenance operations, and ensure certification of new aircraft and design or modification of equipment considers human factors.

Anticipated Program Activities:

1. Define methods for evaluating both Traditional and Advanced Qualification Program training programs to support updates to guidance for crew resource management.

Expected Program Outcomes:

This program is expected to improve aviation safety through improved knowledge of the human-system interface and a reduction in accidents and incidents through enhanced aerospace vehicle, air traffic, and technical operations that adapt to, compensate for, and augment the performance of the human.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	University of Central Florida (UCF)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Alternate Fuels for General Aviation
FY2018 Funding: $5,924,000

Program Description:

The Next Generation Air Transportation System (NextGen) - Alternative Fuels for General Aviation (GA) Program addresses the use of alternative and renewable fuels for GA to lessen aviation environmental impacts on air and water quality. The program develops data and methodologies to support both certification and fleet-wide authorization of GA aircraft for the use of alternative aviation fuels and alternative propulsion technologies. The Piston Engine Aviation Fuels Initiative (PAFI) was formed in 2013 to support the development and deployment of an unleaded alternative to 100LL. The FAA will continue to work with the EPA and the GA community while evaluating the safety, environmental impacts, and the performance of alternatives to 100LL. Near-term research will evaluate the safety and performance of unleaded aviation gasoline and provide data to support the qualification and certification of candidate unleaded fuels.

Program Objectives:

This research program provides critical knowledge (through screening and testing) to assure the continued operational safety of aircraft using a new unleaded fuel. Successful transition to an unleaded fuel will improve the environment by eliminating airborne lead from aviation sources and help sustain a vibrant segment of the nation's economy.

Anticipated Program Activities:

1. Perform engine and aircraft testing to address remaining areas of concern.

Expected Program Outcomes:

The NextGen Alternative Fuels for General Aviation Program is expected to reduce environmental impact of general aviation operation through the establishment of data and methodologies to support certification of alternative fuels for General Aviation aircraft.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Cape Air Swift Fuels Shell Global Cirrus Aircraft Textron Aviation Hartzell Propeller

	Lycoming Engines Continental Motors Radial Engines Limited McCauley Propeller Systems Robinson Helicopter Company American Petroleum Institute (API) Experimental Aircraft Association (EAA) Aircraft Owners and Pilots Association (AOPA) National Business Aviation Association (NBAA) National Air Transportation Association (NATA) Rotax Aircraft Engines-BRP-Rotax GmbH & Co. KG General Aviation Manufacturers Association (GAMA)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

As part of this effort, the FAA has been collaborating with industry stakeholders, including aviation associations, aircraft and engine manufacturers, and fuel suppliers, to facilitate the development of an unleaded replacement fuel for piston-powered aircraft data. This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Propulsion and Fuel Systems
FY2018 Funding: $2,269,000

Program Description:

The Propulsion and Fuel Systems Program develops technologies, procedures, test methods, and criteria to enhance the airworthiness, reliability, and performance of civil turbine and piston engines, propellers, fuels, and fuel management systems.

Program Objectives:

The Propulsion and Fuel Systems Program conducts research on advanced damage-tolerance and risk assessment methods that provide the FAA's Office of Aviation Safety (AVS) with the basis for new or revised engine certification and continued airworthiness standards. This research also supports preparation of ACs that provides industry with technical information on acceptable means of compliance with regulations. Benefits will accrue in the form of a reduced risk of engine failures and fewer accidents, which in turn will lead to fewer injuries and fatalities.

Anticipated Program Activities:

1. Develop and release new DARWIN® analysis mode to address new AC for attachment slots.

2. Develop advanced stress intensity factor solutions for new geometries, extending the applicability of DARWIN® to new classes of life-limited engine components.

Expected Program Outcomes:

The Propulsion and Fuel Systems program is expected to enhance aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA Southwest Research Institute Department of Defense (DoD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

System Safety Management/Terminal Area Safety
FY2018 Funding: $4,149,000

Program Description:

This budget line item (BLI) funds two programs: System Safety Management and Terminal Area Safety research. The System Safety Management/Terminal Area Safety Program develops risk management methods, prototype tools, technical information, and Safety Management System Procedures and Practices. In addition, the program develops an infrastructure that enables the free sharing of de-identified, aggregate safety information derived from government and industry sources in a protected manner. It also conducts research to leverage new technologies and procedures that enhance pilot, aircraft, and operational safety in terminal and enroute domains. Overall, research projects conducted not only address the principal causes of fatalities in the commercial jet fleet but also fill aviation safety research gaps identified in National Transportation and Safety Board's Safety Recommendations A-01-69, A-04-62, A-07-003, and A-07-64.

Program Objectives:

The System Safety Management 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 the 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 program improves the safety of operations near or at an airport. It provides solutions to reduce fatal accidents in the terminal area through (a) improving flight crew response during upset and recovery with an effective indicator, (b) enabling safe helicopter approaches when using advanced vision systems, and (c) exploring consistent operational standards for a stable approach to reduce runway excursions.

Anticipated Program Activities:

1. Develop an integrated domain safety risk evaluation model of air traffic procedures to support the assessment and approval of air traffic procedure changes related to separation minima.

2. Develop state-of-art analytical capabilities for Aviation Safety Information Analysis and Sharing System to analyze rotorcraft data.

3. Determine the criteria for adoption of Helicopter Advanced Vision Systems for Point-in-Space Instrument Approach procedures.

Expected Program Outcomes:

The System Safety Management/Terminal Area Safety program is expected to improve aviation safety through improved system-wide access and sharing of aviation safety data and analysis tools within the

aviation community, providing safety resources that are integrated with operations of aviation industry stakeholders.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Unmanned Aircraft Systems Research
FY2018 Funding: $6,787,000

Program Description:

The Unmanned Aircraft Systems (UAS) Research Program supports FAA efforts in implementing NextGen by studying safety implications of new aircraft operational concepts and technology to the NAS and supporting the development of new and modified regulatory standards. The program's research activities focus on new technology assessments, methodology development, data collection and generation, laboratory and field validation, and technology transfer.

Program Objectives:

The portfolio of work will be focused on sense (detect) and avoid, control and communications, system safety criteria, modeling and simulation requirements, and research that will support the safe, efficient, and timely integration of UAS in the NAS within the 14 CFR regulatory framework. Additionally, funding will provide for engineering, technical, and management support of overall research activities.

Anticipated Program Activities:

1. Define ground control station human interface requirements, UAS pilot training requirements, and ground observer requirements.

Expected Program Outcomes:

The Unmanned Aircraft Systems Research program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partners) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Weather Program
FY2018 Funding: $13,399,000

Program Description:

The Weather program conducts applied research focused on improving weather information required for integration into decision-support processes to reduce the impact of adverse weather on the NAS. The improved weather information increases safety and efficiency by supporting better operational planning and decision-making by air traffic management (ATM), dispatchers, and pilots. It facilitates the transition of legacy capabilities to meet NextGen requirements, often through collaborative and complementary initiatives with National Weather Service (NWS) as well as focused initiatives to help mitigate safety and/or efficiency issues associated with well-documented weather problems. The National Oceanic and Atmospheric Administration (NOAA)/NWS platforms and forecasters also use algorithms developed by the Weather Program to provide regulatory forecast products and NAS decision aids.

Program Objectives:

This program mitigates weather related NAS safety and/or traffic flow efficiency issues with a line of sight to operational exploitations. The applied research also supports the evolution of legacy weather capabilities that meet the weather information needs of today's NAS users into the capabilities that are being developed and deployed as NextGen decision-support processes. This work is frequently conducted in collaboration with the FAA's designated weather provider, the National Weather Service (NWS).

Anticipated Program Activities:

1. Complete development of High Resolution Ensemble Forecast (HREF) weather forecast model.

2. Transition Continental United States (CONUS) in-flight icing forecast and analysis capability, which includes liquid water content, drop-size distribution, and temperature, for implementation (as part of the NAS Infrastructure Portfolio section of the *NextGen Implementation Plan*).

3. Transition Rapid Refresh model, with expanded domain, longer forecasts and improved accuracy, to NWS for operational implementation as part of the North American rapid refresh ensemble weather forecast model.

Expected Program Outcomes:

The Weather program is expected to improve aviation safety and efficiency through:

- Development of aviation weather nowcast and forecast capabilities to support NextGen weather operational improvements contained in the *NextGen Implementation Plan*.

- Identification of complimentary initiatives that can be collaborated on with the NWS to transition legacy capabilities to meet NextGen requirements.

- Development of aviation weather nowcast and forecast capabilities to help mitigate safety and/or efficiency issues associated with well-documented weather problems.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	National Weather Service (NWS) National Center for Atmospheric Research (NCAR) National Center for Environmental Prediction (NCEP) Massachusetts of Technology Institute Lincoln Laboratory (MIT/LL) National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee and the Subcommittee for Aircraft Safety of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Wake Turbulence
FY2018 Funding: $6,831,000

Program Description:

The NextGen - Wake Turbulence Program conducts research to increase airport runway capacity safely by reducing aircraft wake separation minima under certain conditions and addressing wake turbulence constraints in today's terminal and enroute airspace and in the future NextGen airspace designs.

Program Objectives:

ATC contributes to flight delays and aircraft operating costs. By developing safe reductions to the existing air traffic control wake mitigation separations, this program will contribute to increased NAS capacity, enabling more flights with less cost and delay.

Anticipated Program Activities:

1. Perform high level analysis in support of Safety Risk Management Documentation for Wake Turbulence Mitigation for Single Runway procedure.

2. Develop initial operational concepts for dynamically modifying required wake mitigation separations.

Expected Program Outcomes:

The NextGen - Wake Turbulence research program is expected to improve efficiency through improved aircraft separation processes associated with current generalized and static air navigation service provider wake turbulence mitigation separation standards.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Volpe National Transportation Systems Center

Program Name	Name of Collaboration Partner(s) (External DOT)
	Nextor II CSSI, Inc. Eurocontrol Cavan Solutions RTCA Participants George Mason University NASA Langley Research Center National Institute of Aerospace (NIA) Northwest Research Associates (NWRA) National Research Council Canada (NRCC) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Air Ground Integration Human Factors
FY2018 Funding: $6,757,000

Program Description:

The NextGen – Air Ground Integration Human Factors (HF) Program addresses flight deck and ATC integration for NextGen operational capabilities. It focuses on human factors issues that primarily affect the pilot side of the air-ground integration challenge. It conducts research to ensure pilots receive the right information at the right time for decision-making and collaboration with ATC to operate in the NAS efficiently.

Program Objectives:

The NextGen - Air Ground Integration Human Factors addresses flight deck and air traffic service provider integration for each operational improvement or NextGen application considered, with a focus on those issues that primarily affect the pilot side of the air-ground integration challenge. Through use of simulation, and demonstration, the program assesses interoperability of tools, develops design guidance, determines training requirements, and verifies procedures to support certification, flight standards, and the FAAs ATO service units for ensuring safe, efficient, and effective human system integration in transition of NextGen capabilities.

Anticipated Program Activities:

1. Create a report documenting electronic flight bag (EFB) task management research identifying how pilots manage tasks using EFBs including human factors considerations for using a single device to support multiple functions.

2. Create a report with human factors recommendations and considerations for the design and evaluation of electronic chart software related to NextGen capabilities.

Expected Program Outcomes:

This program is expected to improve human-system integration and an increase in ATC efficiency through enhanced controllers. Pilots coordination in cooperatively managing traffic loads as cockpit technology and air traffic workstations are more closely connected.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Human Factors Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Weather Technology in the Cockpit
FY2018 Funding: $3,644,000

Program Description:

The NextGen – Weather Technology in the Cockpit (WTIC) does research to develop, verify, and validate recommended requirements for incorporation into Minimum Weather Service (MinWxSvc) standards. The MinWxSvc is defined as meteorological (MET) information minimum performance standards (e.g., accuracy) of the MET information, minimum information rendering standards, and enhanced training on cockpit MET information and technology.

Program Objectives:

To develop the MinWxSvc recommendations, WTIC research is performing gap analyses to identify operational shortfalls impacting efficiency attributable to adverse weather conditions and associated gaps of MET information in the cockpit. The MinWxSvc standards will resolve the identified MET information gaps to mitigate the efficiency-related operational shortfalls.

Anticipated Program Activities:

1. Propose standards for improving weather information to the flight deck in oceanic and non-controlled airspace.

Expected Program Outcomes:

This program is expected to improve efficiency through:

- Establishment of requirements and standards for enabling availability and improving the quality and quantity of meteorological information to reduce impacts of adverse weather on rerouting, NAS capacity, and NextGen operational procedures.

- Improved accuracy and accessibility of observed and forecast weather information to improve NAS efficiency (e.g., reduced delays and cancellations, increased capacity in high traffic areas).

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Alaska FAA Weather Cameras Civil Aerospace Medical Institute (CAMI) Partnership to Enhance General Aviation, Safety, Accessibility and Sustainability (PEGASAS)

Program Name	Name of Collaboration Partner(s) (External DOT)
	RTCA Harris Boeing Rockwell Collins Embry Riddle Aeronautical University (ERAU) Aircraft Owners and Pilots Association (AOPA) National Center Atmospheric Research (NCAR) Massachusetts Institute of Technology Lincoln Laboratories (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee and Subcommittee for Aircraft Safety of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Information Security
FY2018 Funding: $1,000,000

Program Description:

The NextGen – Information Security program supports the FAA Cyber-Security Strategic Plan goals and objectives to protect and defend the FAA networks and systems deter and mitigate risks of cyber-attacks.

Program Objectives:

The program will conduct research to help prevent and deter disruptive cyber incidents that affect the ATC mission and improve resiliency in the event an incident does occur. The purpose of this program is to conduct research to help prevent disruptive cyber incidents that affect the ATC mission and improve resiliency in the event an incident does occur. While the current measures in place for the information security for the NAS are robust, the rapidly evolving capabilities of our potential adversaries and sharply decreasing costs of exploits will continue to necessitate some prudent exploration of advanced detection and defense capabilities for the NAS systems.

Anticipated Program Activities:

- This is a new BLI and cannot be started under the congressional Continuing Resolution (CR). No funding is available until CR is over.

Expected Program Outcomes:

The program is expected to improve efficiency through improved cyber resiliency for the NAS system of systems in the case of determined adversaries with persistent attacks that try to undermine the NAS.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Defense (DoD) Department of Homeland Security (DHS) Massachusetts Institute of Technology Lincoln Laboratories (MIT/LL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This is a new start initiative, which will be fully shaped if funded in 2017. No public input has been specifically sought in defining the program at this point. However, the program directly supports the Executive Order (EO) 13636 Improving Critical Infrastructure Cybersecurity and the Presidential Policy Directive (PPD)-21 Critical Infrastructure Security and Resilience, which defines Transportation Systems Sector as one of the 16 critical infrastructure sectors and aviation as an essential sub-sector.

Environment and Energy
FY2018 Funding: $14,497,000

Program Description:

The Environment and Energy (E&E) Program is advancing our understanding of aviation noise and emissions as well as their consequential impacts on the environment. This knowledge is being incorporated into an integrated aviation environmental tool suite that can be used to evaluate the full breadth of environmental mitigation solutions that are being developed. The Program is using these models and knowledge to inform decision-making on technology development, alternative fuels, operational procedures, and policies relating to aviation's energy use and environmental impacts.

Program Objectives:

The E&E program is providing the analytical foundation to support the development of solutions to mitigate the impacts of aviation noise and emissions. At the core of the program is the advancement of scientific knowledge and the development and use of an integrated aviation environmental tool suite. The Program is using these models and knowledge to inform both domestic and international decision-making including that within the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP). The result is the harmonization of aviation noise, emissions and energy standards around the world thus ensuring continued U.S. industry competitiveness. This program also supports efforts to develop international standards for supersonic aircraft, including en-route standards that could enable supersonic flight over land.

Anticipated Program Activities:

1. Advance air quality modeling capabilities to capture global impacts of aviation emissions to inform decision-making and enable solution development.

2. Advance noise propagation methodology for implementation in analytical tools.

3. Release aviation environmental design tool (AEDT) version 3 with improved noise, emissions, and fuel burn estimation methodologies.

4. Provide quantitative analysis to support 2018 U.S. Aviation Green House Gas Emissions Reduction Plan (for submission to ICAO).

5. Analyze mitigation options for reducing environmental impacts including policy measures and standards being developed at the ICAO CAEP.

Expected Program Outcomes:

The E&E Program is helping the FAA to achieve its overarching environmental performance goal of environmental protection that allows for sustained aviation growth. This Program provides the fundamental knowledge and tools that are not only helping the FAA achieve this goal but also to

implement NextGen. The E&E Program funds activities that support the U.S. leadership position on international environmental negotiations for standard setting and policymaking. This Program also funds AEDT development to improve our ability to model noise associated with NextGen deployment such that we can develop better mitigation solutions. It also funds improvements in the ability of AEDT to calculate the fuel burn benefits associated with NextGen implementation. The Program expands our understanding of source level aircraft noise and emissions as well as their impacts, which will in turn inform the development of improved metrics and environmental mitigation solutions.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
Policy, Planning & Environment Technical Center	Aviation Sustainability Center (ASCENT) Volpe National Transportation Systems Center International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP)

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Environment and Energy subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Environmental Research Aircraft Technologies and Fuels
FY2018 Funding: $23,151,000

Program Description:

The NextGen – Environmental Research Aircraft Technologies and Fuels Program develops solutions to mitigate impacts associated with aviation noise and exhaust emissions, and increasing fuel efficiency and availability. In partnership with industry, the Program is accelerating the maturation of engine and airframe technologies to reduce aviation noise, fuel use, and emissions through the Continuous Lower Energy, Emissions, and Noise (CLEEN) Program. The Program also supports the development of alternative jet fuels that could serve as drop-in replacements for today's petroleum-derived turbine engine fuels. Efforts are ongoing to approve new alternative jet fuel pathways within ASTM International and to improve the overall fuel approval process; to support the inclusion of alternative jet fuels within the market-based measure being developed by ICAO CAEP; and to facilitate communication across the alternative jet fuel industry to facilitate deployment. These efforts will lead to the faster realization of the accompanying economic development and environmental improvements that will come with a new alternative jet fuel industry.

Program Objectives:

In partnership with industry, the Program is accelerating the maturation of aircraft and engine technologies that reduce aircraft noise, emissions that degrade air quality, greenhouse gas emissions, and energy use while also advancing alternative jet fuels for aviation use. Since its inception in 2010, the CLEEN Program has been successful in maturating technologies to enter into service sooner than what the industry had anticipated. This Program also provides funding for the alternative jet fuel testing and analysis efforts of the Aviation Sustainability Center (ASCENT), the FAA Center of Excellence (COE) for Alternative Jet Fuels and Environment, (http://ascent.aero). This Program also supports efforts of the Commercial Aviation Alternative Fuels Initiative (CAAFI) to focus the efforts of commercial aviation to engage with the emerging alternative fuels industry (http://caafi.org). The CLEEN Program, ASCENT and CAAFI are all contributing to the Farm to Fly 2.0 efforts, which are coordinated with industry, the U.S. Department of Agriculture, and the U.S. Department of Energy to support the development of jet biofuel production and use by the U.S. aviation enterprise.

Anticipated Program Activities:

1. Demonstrate technologies that can reduce energy use, emissions, and noise in year four of the second phase of the CLEEN Program.

2. Support the approval of additional alternative jet fuel pathways via ASTM International.

3. Evaluate regional alternative jet fuel supply chains to identify and overcome key barriers to the development and deployment of 'drop-in' alternative jet fuels.

4. Develop methods to streamline the American society for testing materials (ASTM) approval process for alternative jet fuels.

Expected Program Outcomes:

The NextGen – Environmental Research – Aircraft Technologies and Fuels Program is helping the FAA to achieve its overarching environmental performance goal of environmental protection that allows for sustained aviation growth. In partnership with industry, the Program is maturing aircraft and engine technologies that can reduce aircraft noise, emissions that degrade air quality, greenhouse gas emissions, and fuel use and advancing alternative jet fuels.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
Policy, Planning & Environment Technical Center	CLEEN Consortium Volpe National Transportation Systems Center Aviation Sustainability Center (ASCENT)

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Environment and Energy Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

System Planning and Resource Management
FY2018 Funding: $2,135,000

Program Description:

This program provides crosscutting research and development portfolio planning, development, management, and coordination. It produces the NARP, an annual strategic plan for FAA R&D. The program also administers the congressionally mandated (P.L. 100-591 Section 6 Advisory Committee) REDAC and provides single point of coordination, advocacy and outreach for the FAA research program.

Program Objectives:

The program maintains liaison with all organizational elements and stakeholders participating in the agency's R&D program and ensures cohesion and alignment of the FAA R&D portfolio with national and departmental strategic priorities. It ensures that alignment is expressed and is traceable in all internal planning, coordination and management deliverables.

Anticipated Program Activities:

This program activity promotes an effective aviation R&D Program by engaging users, sponsors, investigators, industry, and academia to formulate and execute an R&D portfolio that maximizes knowledge, technology and capability transfer.

Expected Program Outcomes:

Timely and effective planning, formulation, coordination and management of FAA's R&D portfolio leading to a more effective research program that will benefit the public by making aviation safer and smarter and enhancing the U.S. global leadership in aviation.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	OST-R

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program produces the NARP, which is a report of the FAA to the U.S. Congress pursuant to Section 44501(c) of Title 49 of the U.S. Code. It also produces and submits to the Office of the Secretary of Transportation the Annual Modal Research Plan (AMRP) as required by the FAST Act - P. L. 114-94 (Sec. 6501(a)(1)). Finally, this program administers the FAA REDAC process in accordance with

statutory requirements set forth in the Aviation Safety Research Act of 1988 (P.L. 100-591) and P.L. 101-the FAA Research, Engineering and Development Authorization Act of 1990 (P.L. 101-508).

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is largely about coordination, facilitation, management, and reporting of FAA R&D program activity. Continuous liaison with internal and external stakeholders is in fact the essence of the program and the means of obtaining input.

William J. Hughes Technical Center Laboratory Facility
FY2018 Funding: $3,233,000

Program Description:

This program sustains research facilities located at the William J. Hughes Technical Center Laboratory (WJHTC) to support R&D program goals. These programs require specialized facilities to emulate and evaluate field conditions. The R&D programs require flexible, high-fidelity laboratories to perform full mission, ground-to-air, and human in the loop (HITL) simulations. The R&D laboratories are comprised of the simulation facilities, the flight program's airborne laboratories, and the HF laboratory.

Program Objectives:

The program provides an integrated laboratory platform for the purpose of demonstrating operational procedures, defining human and system performance requirements, full-mission demonstrations integrating NextGen air and ground capabilities for pilot separation responsibility and controller efficiencies, and analysis, evaluation, and validation of R&D milestones. The funding provides for project support, engineering support, aircraft fuel costs, pilot certification and training, equipment and software hardware licenses for support tools.

Anticipated Program Activities:

The work under this program is largely aimed at sustainment and upgrade activity to maintain readiness to support R&D performing program customers as specified below:

Simulation Facilities

- Provide simulated test environments for ongoing research such as for UAS in the NAS, and commercial space vehicle research.

- Achieve a fully integrated weather and traffic simulation capability on the simulators' window visual systems and on the avionics weather displays – is manifested as turbulence in the simulator motion bases. Traffic will be displayed on all visual systems including Traffic Alert and Collision Avoidance System and traffic information service avionics, and depicted on air traffic situation displays.

Flight Program's Airborne Laboratories

- Provide the appropriate flying laboratory to meet the needs of our flight test customer. The flight program will be provided appropriately with trained flight crew, maintained aircraft, and fueled aircraft; at the location required for testing for the period requested, in addition to any modifications to the test aircraft required by the program.

Concepts and Systems Integration – HF

- Provide the necessary resources, including equipment and personnel, to maintain the HF Laboratory in a state of readiness to conduct HF simulations.

- Enhance the HITL ATC simulation platform to include project specific prototypes and data collection capabilities.

Expected Program Outcomes:

Successful program execution will result in a capable and ready integrated laboratory platform to support R&D project performance in demonstrating operational procedures, defining human and system performance requirements, full-mission demonstrations integrating NextGen air and ground capabilities for pilot separation responsibility and controller efficiencies, and analysis, evaluation, and validation of R&D milestones.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program provides crosscutting laboratory support services to diverse research projects. Stakeholder engagement and input occurs at the project level at the point of planning and requirements development for particular projects.

Advanced Technology Development and Prototyping
FY2018 Funding: $26,800,000

Program Description:

The Advanced Technology Development and Prototyping portfolio includes diverse research projects to develop and validate 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. These programs are described in the NARP and are summarized below:

The Runway Incursion Reduction Program (RIRP) conducts research, development, and operational evaluation of technologies to increase runway safety. Consistent with standing NTSB's recommendations, research emphasis will remain on technologies that provide direct safety indications and alerts to pilots at large airports, as well as, those that can be applied cost effectively at small to medium airports.

The Operations Concept Validation and Infrastructure Program develops and validates NAS level operational concepts that are key to the FAA modernization programs and NextGen. Developing operational concepts is the first step in developing an enterprise Architecture. The program conducts the overall analysis and planning for NAS evolution by determining the required annual updates to the NAS enterprise architecture products, operational improvements, operational sustainment, and operational requirements.

The Major Airspace Redesign Program funds physical changes in facilities necessary to accommodate airspace redesign. Implementation of an airspace redesign frequently results in changes to the number and span of control of operational positions or sectors, including changes to sector, area or facility boundaries.

Program Objectives:

Runway incursions (RI) are a leading safety concern of the FAA and the Runway Incursion Reduction Program helps to identify solutions that can aid in preventing them. The program will pursue a strategy of 'right site, right size' to identify candidate technologies that are best suited to a variety of airports in order to address the specific types of RI causal factors encountered at that site (e.g. converging runways, ground vehicle operations, taxiway/runway hotspots, wildlife, etc.).

Concept development and validation is necessary to investigate specific concept elements, and to drive out operational and technical requirements and implications for human factors, training and procedures. The Operations Concept Validation and Infrastructure Evolution Program assesses the interaction of changing roles and responsibilities of NAS service providers and pilots, airspace changes, procedural changes, and new mechanized systems for distributing weather, traffic, and other flight related information.

The Major Airspace Redesign Program is the FAA initiative that ensures all airspace related efficiency benefits facilitated by the Major Airspace Program, facility changes, and automation improvements are achieved. Major Airspace Redesign serves as one of the FAA's primary efforts to modernize the Nation's airspace. The purpose of this national initiative is to review, redesign, and restructure airspace.

Anticipated Program Activities:

Runway Incursion Reduction Program

- No 2018 activities, as this is an F&E program whose milestones reoccur annually.

Operations Concept Validation and Infrastructure Evolution

- No 2018 activities, as this is an F&E program whose milestones reoccur annually.

Major Airspace Redesign

- No 2018 activities, as this is an F&E program whose milestones reoccur annually.

Expected Program Outcomes:

The Runway Incursion Reduction Program is expected to improve aviation safety by ensuring no fatal accidents on certificated airports because of airport design, runway incursions or excursions, or wildlife strikes. The program will continue its mission to develop safety technologies that can then be applied at not just large airports, but also small-to-medium sized airports with commercial service throughout the NAS that have seen a recent uptick in the rate of runway incursions.

Both the Operations Concept Validation and Major Airspace Redesign Programs are expected to improve efficiency by developing feasible procedures, operational methods, and technologically advanced systems, which can decrease workload and increase efficiency of the NAS**.** The Operational Concept Validation Program will perform the early concept research for advanced operational concepts to ensure they are well understood and are based on valid assumptions. The airspace redesign projects are projected to deliver benefits through the reduction of restrictions, shorter flight distances, more fuel-efficient routes, and reduced delays.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Massachusetts Institute of Technology Lincoln Laboratories (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets statutory requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen Separation Management Portfolio
FY2018 Funding $13,500,000

Program Description:

The Separation Management portfolio conducts pre-implementation activities to reduce risk, and implementation activities supporting the safe and efficient separation of aircraft and other vehicles in the NAS. Risk reduction activities may include validation of concepts or technologies; demonstration and integration of operational capabilities; and an understanding of the role of the human through cognitive engineering experiments. Separation Management evaluates and matures concepts and capabilities that focus on the enhancement of separation assurance using both ground based automation and aircraft technology enhancements. Pre-implementation research conducted under this portfolio includes:

Oceanic Tactical Trajectory Management

The Oceanic Tactical Trajectory Management (OTTM) program addresses current performance gaps in the areas of capacity, productivity, efficiency, safety, and environmental impacts in the oceanic environment. Oceanic Trajectory Management in Four Dimensions (OTM-4D) is the OTTM mid-term concept. The key objective of this concept is to use trajectory-based operations to improve fuel efficiency, system predictability, and performance by enabling airlines and other operators to flight plan and fly closer to their optimal (or preferred) 4D trajectories while in oceanic airspace.

Wake Turbulence - Re-Categorization (RECAT)

The RECAT project develops wake separation standards that provide increased airspace and airport throughput capacity without aircraft equipage costs or runway expansions. This project has been part of a joint EUROCONTROL and FAA program that had reviewed the then required wake mitigation aircraft separations used in both the USA's and Europe's ATC processes and determined that the standards could be safely modified to increase the operational throughput capacity of airports and airspace that will have heavy operational demand in the NextGen era.

UAS Concept Validation and Requirements Development

The UAS Concept Validation and Requirements Development Program conduct the overall analysis and planning for the development, integration, and subsequent implementation of emerging UAS enabling technologies. (Note: A Separate FY2018 Research, Development and Technology (RD&T) Project Description for this initiative is included in the AMRP).

Program Objectives:

Oceanic Tactical Trajectory Management

OTTM will conduct research and development to provide enhanced User Trajectory Planning through coordination capabilities. Trajectory coordination enables interactive flight plan collaboration between airspace users and the FAA in which the airspace user informs the FAA of his intended 4D oceanic trajectory and receives feedback prior to the flights entry into oceanic airspace about the likelihood of achieving that trajectory based on other oceanic flights intended trajectories.

Wake Turbulence Re-Categorization

The program will complete Phase II standards that will provide the runway throughput optimal wake separation standards/procedures for Core airports that have different fleet mixes than the airports that implemented and received benefit from the RECAT Phase I wake separation standards.

UAS Concept Validation and Requirements Development

See separate FY2018 RD&T Project Description.

Anticipated Program Activities:

Oceanic Tactical Trajectory Management

- Note that the OTTM program will be closed in FY 2017 and transfer will be determined in the second quarter of 2017. As a result, most planned milestones have been deleted.

Wake Turbulence Re-Categorization

- Complete high level analyses on feasibility and benefit of using dynamic wake separation standards.

UAS Concept Validation and Requirements Development

- See separate FY 2018 RD&T Project Description.

Expected Program Outcomes:

The OTTM supports efficiency by addressing OTM-4D. Improved methods and/or capabilities that enable safe reduction in separation standards increase in airspace capacity, and/or efficient management of aircraft trajectories.

The Wake Turbulence RECAT supports improved aircraft separation processes associated with current generalized and static air navigation service provider wake turbulence mitigation separation standards.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Volpe National Transportation Systems Center National Air Traffic Controllers Association (NATCA)

Program Name	Name of Collaboration Partner(s) (External DOT)
	Cavan Solutions National Institute of Aerospace (NIA) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen On-Demand NAS Information Portfolio

FY2018 Funding: $12,000,000

Program Description:

The On Demand NAS Information (ODNI) portfolio conducts pre-implementation activities to reduce risk supporting the exchange of information between FAA and other NAS users. The portfolio provides flight planners, air navigation service providers' staff, and flight crews with consistent, complete, and easily processed information on changes of conditions in the NAS affecting safety, security, and efficiency. The ODNI portfolio examines concepts and matures capabilities through validation activities, demonstrations conducted with stakeholders, and human systems engineering to mitigate adverse impacts and to exchange information efficiently and securely between FAA and NAS users. Pre-implementation research conducted under this portfolio includes:

Advanced Methods

Advanced Methods is a pre-implementation engineering analysis and requirements program that addresses shortfall areas identified by ATO programs and provides possible solutions to future ATM system work packages. Specifically, Advanced Methods is focusing on addressing shortfall areas identified in the Traffic Flow Management (TFM) shortfall analysis, which was coordinated with industry partners.

Program Objectives:

The Advanced Methods Program will support improvements to increase airport capacity and sector throughput, and reduce sector delays by providing the NAS users and ATM with a common understanding of the NAS constraints. The program will develop and test prototype improvements and provide operational concepts and requirements for implementation by automation programs and operational organizations.

Anticipated Program Activities:

1. Develop capability concept of operations, capability functional analysis, capability requirements, rough order of magnitude cost estimates analysis, and rough order of quantitative capability benefits analysis for constraints prediction, TFM system performance analysis and operational response development.

2. Develop Advanced Coordination prototype capability requirements and concept development activities for Advanced Coordination Capability for TFM recording and logging

Expected Program Outcomes:

The Advanced Methods project is expected to improve efficiency through feasible procedures, operational methods, and technologically advanced systems that can decrease workload and increase efficiency of the NAS.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – NAS Infrastructure Portfolio

FY2018 Funding: $17,500,000

Program Description:

The NAS Infrastructure portfolio conducts pre-implementation activities to reduce risk for aviation weather-related and crosscutting engineering issues. This portfolio provides the research, development, and analysis of portfolio capabilities such as validation activities, human system engineering, and demonstrations. Work with this portfolio addresses aviation weather-related issues by supporting the improvement of (a) ATM decision-making during adverse weather conditions, (b) weather forecasting in the transformed NAS, and (c) existing weather infrastructure. Surface/tower/terminal systems engineering, NextGen navigation engineering, New ATM requirements, NextGen distance measuring equipment (DME), and information management conduct analysis to develop solutions that can apply across the NAS domain. Pre-implementation research conducted under this portfolio includes:

New Air Traffic Management Requirements

The New ATM Requirements Program identifies new opportunities to improve the efficiency and effectiveness of ATM and expanding capacity by developing decision support tools that improve the strategic management of operations in the NAS.

Weather Observation Improvements

The NextGen Weather Observation Improvements Program manages the evolution of the existing aviation weather observation sensor networks to one that provides the optimal quantity and quality of ground, air, and space-based sensors.

Program Objectives:

New ATM Requirements

The service analysis and operational demonstration activities within New ATM Requirements Program support the development of operational improvements that will increase the number of arrivals and departures at major airports. (See separate FY2018 RD&T Project Description).

NAS Weather Observation Improvements

A consistent and effective aviation weather sensor network is fundamental to NextGen. Of primary focus is the surface weather sensor network in the terminal environment. A comprehensive list of weather observation shortfalls is continuously refined and prioritized based on feedback from key stakeholders and user groups. The program uses this information to explore potential NextGen-enabled concepts and to mitigate the high priority shortfalls.

Anticipated Program Activities:

New ATM Requirements

- *Enterprise information protocol and exchange standards*: This research will identify the shortfalls in moving from direct data sharing to a network environment.

- *Future collision avoidance system*: This activity will conduct research to develop requirements for these new classes of users to ensure future collision avoidance systems are interoperable within the NAS.

- *Weather Transition*: This program identifies research concepts and capabilities that have appropriately matured, and transitions them from R, E&D to F&E funding;

- *Synchronization of air/ground procedures*: This activity will evaluate methods for ground systems to communicate procedures to the aircraft and will reduce the need to load the flight management system with variations of the same procedure for different flight conditions.

- *Advanced air/ground communications*: This project will evaluate advanced communications standards such as the internet protocol suite and next generation satellite-based communication for operational usage in domestic airspace.

- *Command and control in a cloud environment*: This activity will evaluate technical assumptions based on safety, mission criticality, and the ability of current and future cloud architecture to provide command and control services in the future, and

- *Common displays/Commercial off-the-shelf*: As part of this effort, requirements definition for displaying strategic decision data will be completed and development of a transition strategy for the possible use of commercial off-the-shelf displays as common displays in the NAS will be initiated.

Weather Observation Improvements

- Complete the documentation of the physical and environmental conditions that are negatively impacting effective wind observations at the subject airports,

Expected Program Outcomes:

New ATM Requirements

- The program supports the NextGen goal of expanding capacity by developing decision support tools that improve the strategic management of operations in the NAS.

Weather Observation Improvements

- The establishment of requirements and standards for enabling availability and improving the quality and quantity of meteorological information to reduce impacts of adverse weather on rerouting, NAS capacity, and NextGen operational procedures, and

- Improved accuracy and accessibility of observed and forecast weather information to improve NAS efficiency (e.g., reduced delays and cancellations, increased capacity in high traffic areas.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen Laboratory Support Portfolio
FY2018 Funding: $12,000,000

Program Description:

The NextGen – Laboratory Support Portfolio focuses on evaluating future concepts and technologies to support technical transfer to the implementing organizations, promoting industry involvement, and identifying implementation challenges and research areas. This work supports the infrastructure needed to complete those demonstrations and studies, measures performance impacts of NextGen capabilities, reports progress in the performance of implemented capabilities at specific locations, as well as updates to the NAS Segment Implementation Plan (NSIP).

The NextGen Laboratories – NextGen Integration Evaluation Capability (NIEC) and Florida Test Bed (FTB) enable research activities that support pre-implementation and risk reduction activities by providing a platform to conduct validation, modeling, and demonstrations.

Program Objectives:

The laboratory support portfolio is intended to provide a robust platform where early-stage NextGen concepts can be integrated, demonstrated, and evaluated. These laboratories provide the FAA and industry an agile environment for the rapid integration of new and emerging technologies. It also promotes contributions and R&D investment from industry and leverages industry's capabilities, resulting in cost avoidance to the FAA and accelerated NextGen development.

Anticipated Program Activities:

<u>NextGen Integration and Evaluation Capability:</u>

- Perform upgrades to support NextGen demonstration and simulation activities.
- Enhance the air ground data communication capabilities between the Air Traffic Controller positions and the cockpit simulator

Expected Program Outcomes:

The projects described above are expected to improve efficiency by enabling concept engineering and evaluation activities that reduces the risk of successful implementation of ATM concepts and capabilities that improve NAS operational efficiency.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is in and of itself, a pathway to obtaining stakeholder input. Specifically, the NIEC laboratory is used to expose stakeholders in the ATM operational user community to emerging NextGen concepts and capabilities in order to gain their assessment of the potential operational effectiveness and/or suitability of the concept for use in further maturation and development.

Airport Technology Research
FY2018 Funding: $33,210,000

Program Description:

The Airport Technology Research Program (ATRP) executes a broad range of research projects that support FAA safety, capacity, and environmental objectives. Safety initiatives include research aimed at (a) improving airport lighting and marking, (b) reducing wildlife hazards near airport runways, (c) improving airport fire and rescue capability, and (d) reducing the likelihood and severity of surfacing accidents. The ATRP establishes up-to-date exposure-response relationships for community annoyance and sleep disturbance in the U.S. by collecting extensive data, which covers a wide variety of airport types and geographic locations.

Program Objectives:

The ATRP supports increased safety and capacity while reducing the environmental impact of airport operations by exploring, evaluating, and testing new technologies and design standards for potential adoption and implementation via the Airport Improvement Program. Under its capacity objective, ATRP research is aimed at providing better airport planning, designs, and improved runway pavement design, construction, and maintenance. Research project outputs inform the development and issuance of Advisory Circulars that are the primary method of conveying airport improvement design guidance and standards for airport operators.

Anticipated Program Activities:

- Initiate testing of new firefighting agents with reduced or zero PFC's or other harmful chemicals which pose either health or environmental hazards to airports and their surrounding communities.
- Conduct research to support the application of warm mix asphalt technologies at airports.
- Continue integration and support of airport technology research databases (bird strike, FOD detection, airport pavement management systems) into one centralized location, which will improve accessibility, overall functionality, and promote public access and sharing of data.
- Conduct additional research to identify ways airports can reduce noise impacts near airports.
- Conduct aircraft braking studies as identified by the FAA Industry expert's Aircraft Braking Research Working Group.
- Assess actual performance of trapezoidal grooves for airport pavements.
- Pursue development of a new pavement roughness index based on pilot evaluation data and studies at the Mike Monroney Aeronautical Center.
- Pursue development of extended pavement design life and acquire long-term performance data from the field.

- Conduct research to development operational standards for the use of UAS at airports to perform important safety functions like conducting airfield inspections, utilizing UAS as a tool for wildlife hazard management, improving situational awareness at airfield emergencies, and maintaining perimeter security.

Expected Program Outcomes:

- No fatal accidents on certificated airports because of airport design, runway incursions or excursions, or wildlife strikes.
- Availability of existing airport facilities protected and used as efficiently as possible, while making strategic investments in new facilities consistent with evolving aviation needs.
- Potential beneficial use of UAS technology at U.S. airports
- Access to analytical tools and guidance to that support optimization of pavement structural design to achieve desired performance targets.
- Ability to select and design mixtures to achieve required performance characteristics and longer life.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Federal Highway Administration (FHWA)

Program Name	Name of Collaboration Partner(s) (External DOT)
	CSRA Booz Allen Hamilton Iowa State University Smithsonian Institution Greater Binghamton Airport University of Nebraska-Lincoln Rensselaer Polytechnic Institute (RPI) U.S. Department of Agriculture (USDA) Center of Excellence for Airport Technology (CEAT) Department of Defense (DoD) United States Air Force (USAF)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Airports Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with the FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Airport Cooperative Research
FY 2018 Funding: $15,000,000

Program Description:

The Airport Cooperative Research Program (ACRP) is an industry-driven, applied research program that develops near-term, practical solutions to problems faced by airport operators. ACRP is managed by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine and is sponsored by the FAA. The research is conducted by contractors who are selected based on competitive proposals.

Program Objectives:

The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. The ACRP undertakes research and other technical activities in a variety of airport subject areas including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. A fundamental element of the program is to produce results that provide protection of aircraft passengers and airport personnel through improved safety training, airport design, and advanced technology implementation.

Anticipated Program Activities:

The ACRP Oversight Committee will announce their FY 2018 projects in August 2017. The selected research projects will examine different research areas that target near-term solutions to problems facing airport operators and industry stakeholders. The projects will report on the state of the practice in critical areas within the industry.

Expected Program Outcomes:

The ACRP advances state of the knowledge and practice across a broad range of topics of importance to the airport operator community and other industry stakeholders. Specific outcomes will be dependent on the particular research proposals awarded in a given year.

FY 2018 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Transportation Research Board (TRB)

Program Name	Name of Collaboration Partner(s) (External DOT)
	Faith Group, Llc. FTI Consulting Texas A&M Transportation Institute

How Program meets Statutory Requirements:

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act (Public Law 108–176).

Describe how Public and Stakeholder Input have been utilized in the Development of this Research Program:

Research problem statements for ACRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the ACRP Oversight Committee (AOC) to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

FY 2018 RD&T Project Budget Request by Critical Transportation Topic Areas

RD&T Program Name	FY 2018 Pres. Budget ($000)	Promoting Safety	Improving Infrastructure	Improving Mobility	Preserving the Environment
UAS Concept Validation and Requirements Development	9,000			9,000	
New ATM Requirements	9,000			9,000	
Florida Test Bed	6,500			6,500	
Total	**24,500**			**24,500**	

UAS Concept Validation and Requirements Development

FY2018 Funding: $12,000,000

(Start and End Dates: IAW Concept Maturation and Investment Schedule)

Project Description:

The UAS Concept Validation and Requirements Development Program is part of the NextGen Separation Management Portfolio. The program conducts the overall analysis and planning for the development, integration, and subsequent implementation of emerging UAS enabling technologies. The program executes concept development, engineering analysis, and evaluation in support of mission analysis and investment analysis activities. This program also conducts shortfall analyses as part of service analysis and ensures the linkage of proposed solutions back to validated operational needs.

Project Objectives:

UAS operations have increased dramatically in both the public and civil sectors. This proliferation consequently introduces greater operational risk and exposure to the users of the NAS. As such, air traffic products, policies, and procedures must be reviewed and refined or newly developed through supporting concept maturation work to permit safe UAS operations, alongside manned aircraft operations.

Anticipated Project Activities:

Following are anticipated activities for the UAS Concept Validation and requirements Development project:

Program Management activities:

- Conduct investment analysis and business case development
- Finalize spectrum management alternative analysis
- Finalize command and control (C2) ground infrastructure alternative analysis

UAS C2 Solution Space Analysis activities**:**

- Continued analysis of the UAS C2 solution space
- Conduct Systems Engineering Trade Studies to determine most cost effective method for providing industry access to the UAS Command and Control allocated spectrum in the C and L band.
- Identify FAA spectrum needs

UAS Concept Maturation activities:

- Review and refine the UAS NAS Impact Analysis results based on revised projected service demands results from FY 2016 HITL trials simulations, etc.
- Conduct HITL trials and simulations based on the UAS Concept Maturation Plan, identifying new operational requirements and potential concept maturation needs.

- Develop preliminary Computer Human Interface requirements documents.

Expected Project Outcomes:

Mature concepts, capabilities, and business cases for investments to facilitate the safe and timely integration of UAS into the NAS.

FY 2018 Collaboration Partners (Internal & External DOT)

Project Name	Name of Collaboration Partner(s) (Internal DOT)
	National Air Traffic Controllers Association (NATCA)

Project Name	Name of Collaboration Partner(s) (External DOT)
	Cavan Solutions

How will Project be Evaluated?

This program is subjected to review and oversight as part of the NextGen portfolio management process. The resulting investment business case products are reviewed by the system engineering and investment planning and analysis organizations in the FAA.

New ATM Requirements

FY 2018 Funding: $9,000,000

(Start and End Dates: IAW Concept Maturation and Investment Schedule)

Project Description:

The New ATM Requirements Program identifies new opportunities to improve the efficiency and effectiveness of ATM and expanding capacity by developing decision support tools that improve the strategic management of operations in the NAS.

Project Objectives:

The service analysis and operational demonstration activities within New ATM Requirements Program support the development of operational improvements that will increase the number of arrivals and departures at major airports.

Anticipated Project Activities:

- *Enterprise information protocol and exchange standards*: This research will identify the shortfalls in moving from direct data sharing to a network environment.

- *Future collision avoidance system*: This activity will conduct research to develop requirements for these new classes of users to ensure future collision avoidance systems are interoperable within the NAS.

- *Weather Transition*: This program identifies research concepts and capabilities that have appropriately matured, and transitions them from R, E&D to F&E funding;

- *Synchronization of air/ground procedures*: This activity will evaluate methods for ground systems to communicate procedures to the aircraft and will reduce the need to load the flight management system with variations of the same procedure for different flight conditions.

- *Advanced air/ground communications*: This project will evaluate advanced communications standards such as the internet protocol suite and next generation satellite-based communication for operational usage in domestic airspace.

- *Command and control in a cloud environment*: This activity will evaluate technical assumptions based on safety, mission criticality, and the ability of current and future cloud architecture to provide command and control services in the future, and

- *Common displays/Commercial off-the-shelf*: As part of this effort, requirements definition for displaying strategic decision data will be completed and development of a transition strategy for the possible use of commercial off-the-shelf displays as common displays in the NAS will be initiated.

Expected Project Outcomes:

Mature concepts, capabilities, and business cases for investments in new ATM decision support tools, capabilities, and operational improvements to enhance NAS operational efficiency.

FY 2018Collaboration Partners (Internal & External DOT)

Project Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How will Project be Evaluated?

This program is subjected to review and oversight as part of the NextGen portfolio management process. The resulting investment business case products are reviewed by the system engineering and investment planning and analysis organizations in the FAA.

Florida Test Bed

FY2018 Funding: $6,500,000

Start and End Dates: N/A

Project Description:

The FTB is a facility located at the Embry Riddle Aeronautical University in Daytona Beach, Florida. It supports the integration of new and emerging technologies into the NAS through demonstrations and evaluations. These activities cultivate government, academia, and industry partnerships through collaboration.

Project Objectives:

One of the main purposes of the FTB is to provide an open-access location for industry, users, and vendors to demonstrate new capabilities and harness NAS architecture solutions. The FTB will also support integrated demonstrations and large-scale modeling and simulation.

Anticipated Project Activities:

Following are anticipated activities for the FTB. It should be noted, that while the activities listed below are largely to sustain, maintain and implement upgrades to the laboratory's capability, additional substantive R&D activities result from FTB utilization by individual demonstration projects.

- Perform upgrades to support NextGen demonstration activities
- Add airport surface automation system to the tower environment
- Add security and business rules on Noise Exposure Map infrastructure and to DOD/Defense Research Engineering Network for increasing the fidelity of the messaging systems.

- Add automated capability to provide adaptation data and system build updates for keeping the FTB systems synchronized with live flight data.

- Finalize Multifunctional Phased Array Radar performance requirements.

Expected Project Outcomes:

Mature concepts, capabilities, and business cases for investments in new ATM decision support tools, capabilities, and operational improvements to enhance NAS operational efficiency.

FY 2018 Collaboration Partners (Internal & External DOT)

Project Name	Name of Collaboration Partner(s) (Internal DOT)
Florida Test Bed	Embry Riddle Aeronautical University

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Defense (DoD)

How will Project be Evaluated?

This program is subjected to review and oversight as part of the NextGen portfolio management process. The resulting test, demonstration, and investment business case products are reviewed by the system engineering and investment planning and analysis organizations in the FAA.

United States Department of Transportation
Annual Modal Research Plans
Fiscal Year 2019 Outlook

Fire Research and Safety
SAFETY

Program Description:

The Fire Research and Safety Program will continue to develop technologies, procedures, test methods, and fire performance criteria that can prevent accidents caused by hidden cabin or cargo compartment in-flight fires and fuel tank explosions and improve survivability during a post-crash fire. The program supports the FAA's Associate Administrator for Aviation Safety organization, which 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 transports are completed in coordination with DOT's Pipelines and Hazardous Materials Safety Administration (PHMSA).

Program Objectives:

Fire research will continue to address fundamental issues of (a) combustion toxicity; the impact of flame retardant chemicals, (b) health hazards of cabin materials; the impact of materials flammability on the initiation of in-flight fires, and (c) post-crash survivability.

Expected Program Outcomes:

The outcome and benefit derived from this program will be the introduction of enabling technologies to prevent accidents caused by fire in freighter aircraft and hidden in-flight fires in passenger-carrying airplanes. New technologies of interest to the aircraft manufacturers and operators will be enabled in a fire-safe manner or prohibited if warranted.

Anticipated Program Activities:

1. Develop necessary training, guidance material, and ACs to support the introduction of new flammability regulations impacting aircraft interiors. The support will involve refinement of new and existing material flammability test methods, and the production of training videos that demonstrate the proper execution of these flammability tests for field personnel responsible for certifying material compliance.

2. Develop hidden fire detection and extinguishment improvements.
3. Determine mechanism of gas phase flame inhibition by halogen and halogen replacement flame retardant.

4. Develop fire protection measures for aircraft fuel cell applications

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Pipelines and Hazardous Safety Materials Administration (PHMSA)

Program Name	Name of Collaboration Partner(s) (External DOT)
	Boeing Embraer Bombardier Airframe Manufacturers Fire Detection Equipment Manufacturers National Institute of Standards and Technologies (NIST)

How Program Meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program will continue to be reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Advanced Materials/Structural Safety
SAFETY

Program Description:

The Advanced Materials/Structural Safety Program will continue to investigate a broad spectrum of issues related to the use of composite and advanced materials in aircraft structures. These include fatigue and damage tolerance issues from in-flight hail and ground vehicle collisions, environmental and aging effects, and bonded joints and repairs. The program will also continue to develop safety awareness training for advanced composite materials and manufacturing processes.

Program Objectives:

The Program will continue to conduct research to develop or validate dynamic test methods, procedures, and means of analysis to meet crashworthiness regulations. It will help ensure that new aircraft structures demonstrate levels of safety equivalent to existing aircraft structures when subjected to survivable crash conditions.

Anticipated Program Activities:

1. Identify key characteristics of metallic aircraft response to crash conditions to establish a baseline for other structural concepts and materials.

2. Develop background information and data for creation of a Part 21 AC on composite structures.

3. Develop background information and data for update of AC 20-107B on composite structures.

4. Develop background information and data for creation of a bonded structure AC.

Expected Program Outcomes:

The Advanced Materials and Structural Safety program will continue to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	University of Utah Wichita State University University of Washington National Institute of Aerospace Florida International University

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with the FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Aeromedical Research
SAFETY

Program Description:

The Aeromedical Research Program will continue to develop new and innovative ways to support FAA regulatory and advisory missions to improve the safety of humans in civilian aerospace operations. Research personnel at CAMI supporting this program will continue discovering methods and recommend strategies to enhance the safety, security, health, and performance of the most important aspect of the NAS, the human operator and the public that she/he serves.

Program Objectives:

The Aerospace Medical Research Program will continue to be formulated to keep abreast of emerging human safety risk issues such as those brought by the aging pilot population and changes in their health condition, advances in pharmacology, therapeutic tools, and surgical procedures. Improved aircraft materials, equipment, cabin configurations, life support systems, and evacuation assistive devices all may affect survival from an aircraft accident. The program has also been designed to address the complexity of software, technology, and systems integration practices as these continue to evolve.

Anticipated Program Activities:

1. Develop and assess safety and emergency equipment standards, procedures, and criteria to ensure the protection and survival of all aircraft occupants from all aircraft incidents and accidents.

Expected Program Outcomes:

The Aeromedical research program is expected to improve aviation safety through improved understanding of factors that influence human physiology and performance in aerospace environments and guidance and tools that enhance human safety, protection, and survival during civil aerospace operations.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	Oklahoma State University

How Program Meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the development of this research program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Air Traffic Control/Technical Operations Human Factors
SAFETY

Program Description:

The ATC/Technical Operations Human Factors Program will continue to emphasize the concept of HSI and safety aspects of the functions performed by air traffic controllers and technical operations personnel. The HSI concept will continue to address the interactions between workstation design, training and facility assignment, and human error and human performance.

Program Objectives:

The program will emphasize R&D activities that:

- Improve training methods to reduce time and cost of training while increasing performance of ATC Specialists and technical operations personnel.
- Identify job tasks, skills, knowledge, and other personal characteristics that ATCS and Technical Operations personnel will need to successfully perform their jobs in the NextGen environment.
- Improve safety in ATO risk analysis processes by addressing human factors aspects in taxonomies and analyses that support event reviews.
- Support NAS technology integration and acquisition program efforts to design ATC systems, providing human factors engineering expertise, human factors standards, prototypes, and human-in-the-loop simulations.

Anticipated Program Activities:

1. Assess the usability and effectiveness of current and planned ATC user interfaces and functions to identify aspects of risks and benefits of integrating the large volume of information required by recent changes to the NAS (for example, because of new programs, implementation of ICAO requirements, and changes in procedures)

Expected Program Outcomes:

The Human Factors research program is expected to improve aviation safety through improved knowledge of the human-system interface and a reduction in accidents and incidents through enhanced aerospace vehicle, air traffic, and technical operations that adapt to, compensate for, and augment the performance of the human.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	APT Metrics MITRE Center for Advanced Aviation System Development (CAASD)

How Program Meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Human Factors Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Aircraft Catastrophic Failure Prevention Research
SAFETY

Program Description:

The Aircraft Catastrophic Failure Prevention Research Program will continue to develop technologies and methods to assess risk and prevent occurrence of potentially catastrophic defects, failures, and malfunctions in aircraft, aircraft components, and aircraft systems. The program will continue to use historical NTSB recommendations to examine and investigate turbine-engine uncontainment events and other engine-related impact events.

Program Objectives:

The goal of this research will continue to be to have a public tool with standardized generic models, user guides, training, software quality control process, and validated public material models. This will reduce workload and allow for the timely processing of applications.

Anticipated Program Activities:

1. Update certification by analysis guidance for metals

Expected Program Outcomes:

The Aircraft Catastrophic Failure Prevention Research Program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA Ohio State University (OSU) Arizona State University (ASU) George Mason University (GMU) Naval Air Warfare Center China Lake Central Connecticut State University (CCSU) LS-DYNA Aerospace Working Group (AWG)

How Program Meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Aircraft Icing/Digital System Safety/Aircraft Cyber
SAFETY

Program Description:

The Aircraft Icing/Digital System Safety/Aircraft Cyber Program will continue to develop and test technologies that detect frozen contamination, predict anti-icing fluid failure, and ensure safe operations in atmospheric icing conditions. The program will also continue to develop new guidelines for testing, evaluating, and approving digital flight controls, avionics, and other systems during the certification of aircraft and engines and studies the airworthiness requirements of airborne cyber security.

Program Objectives:

The Aircraft Icing Program will continue to develop and test technologies that detect frozen contamination, predict anti-icing fluid failure, and ensure safe flight operations in atmospheric icing conditions. Reducing aviation's vulnerability to all in-flight icing hazards will remain a major program goal.

The goal of the Digital Systems Safety Program remains to approve and maintain aircraft safety by taking a proactive approach to the ever changing technological marketplace and conduct research in the areas of advanced digitally-intensive systems and assess how they can safely be deployed in the onboard airborne systems of systems environment

The ASISP cyber initiative, will remained focused on exploring where ASISP-related threats and risks can compromise fail-safe mechanisms in the architecture, design, and operation of aircraft systems.

Anticipated Program Activities:

1. Report on use of computational fluid dynamics analysis and of test methods and scaling for iced swept wings.

Expected Program Outcomes:

This program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Homeland Security Texas A&M Engineering Experiment Station (TEES) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with the FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Commercial Space Transportation Safety
SAFETY

Program Description:

The primary mission of the AST is to ensure the safety of the public, property, and national security and foreign policy interests of the U.S. during commercial launch and reentry operations. This program will continue to conduct research on emerging space concepts, technologies, and operating techniques in order to keep safety at the forefront of these activities.

Program Objectives:

This program will continue to enable advances in critical areas spanning four thematic areas that address safe and efficient integration of increased commercial space launch and re-entry activity into the NAS, advanced safety assessment methods, advanced vehicle safety technologies and methodologies, and human spaceflight and physiological safety factors.

Anticipated Program Activities:

1. Identify draft recommended practices for crew human factors for suborbital winged commercial spaceflight vehicles (supports human spaceflight and physiological safety factors).

2. Identify improved methods for assessing a proposed launch or reentry site location for its impact on the public, to include airspace and airport operations, other transportation modes, population centers, and critical national assets (supports safe and efficient integration of increased commercial space launch and re-entry activity into the NAS).

Expected Program Outcomes:

This program is expected to improve aviation safety through:

- Guidance and tools that enhance human safety, protection, and survival during space operations.

- Improved vehicle safety and risk management, including knowledge of all safety-critical components and systems of the space vehicles and their operations, to better identify potential hazards and apply and verify hazard controls.

- Safe and efficient integration of increased commercial space launch and re-entry activity into the NAS.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Homeland Security Texas A&M Engineering Experiment Station (TEES) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Continued Airworthiness
SAFETY

Program Description:

The Continued Airworthiness Program will continue to promote 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 continue to focus on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, continued safety of aircraft engines, development of inspection technologies and the safety of electrical wiring interconnect and mechanical systems.

Program Objectives:

Continued Airworthiness research will continue to focus on emerging technologies such as damage tolerance and durability issues of new aluminum-lithium alloys, metal AM, new and emerging alloys. These will be studied for inclusion in MMPDS, and risk management methods to support the MSAD initiative, which is a data-driven, risk-based continued operational safety decision-making process.

Anticipated Program Activities:

1. Develop test methods and provide data to assess bird strike avoidance and damage to rotorcraft.
2. Develop technical data to assess damage tolerance of aluminum-lithium primary structure and follow on effort to material characterization.
3. Develop technical data to evaluate the feasibility of using fuel cell systems for aerospace application while retaining or improving the current level of safety in commercial transport aircraft.

Expected Program Outcomes:

The Continued Airworthiness Program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Alcoa Airbus

	Boeing DNV GL Honeywell Constellium Bombardier Textron Aviation Origo Corporation Spirit Aero systems Teledyne Technologies Infinity Aircraft Services University of Washington Battelle Memorial Institute Embraer Aerospace Company Polytechnic University of Milan University of Texas at San Antonio (UTSA) University of Dayton Research Institute Kansa Aviation Research and Technology Consortium Embry-Riddle Aeronautical University (in-flight simulation) Wichita State University National Institute for Aviation Research (NIAR) Americans with Disabilities Act (ADA) - Airports Disability Compliance Program

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Flight deck/Maintenance/System Integration Human Factors
SAFETY

Program Description:

The Flight deck/Maintenance/System Integration HF program will continue to provide the research foundation for FAA guidelines, handbooks, orders, AC's, TSOs, and regulations that help ensure the safety and efficiency of aircraft operations. It also develops human performance information that the agency provides to the aviation industry for use in designing and operating aircraft, and training pilots and maintenance personnel. The program focuses on the needs of pilots, inspectors, and aircraft maintainers. The revolution in digital avionics has changed flight deck design and operational practices and enabled new head-up display technologies, surface moving maps, electronic flight bags, advanced controls, communications, navigation, surveillance systems, and tools for aircraft system management. With these advances come important human performance and human factors implications that must be understood and applied in the appropriate guidance material developed for policy, procedures, operations, and training.

Program Objectives:

Research results will continue to enable the FAA and industry to improve task performance and training for aircrew, inspectors, and maintenance technicians, improve training for UAS control station and crew, develop and apply error management strategies to flight and maintenance operations, and ensure certification of new aircraft and design or modification of equipment considers human factors.

Anticipated Program Activities:

1. Address minimum equipment requirements for new operational concepts using advanced vision systems and head-up/head-mounted displays.

Expected Program Outcomes:

This program is expected to improve aviation safety through improved knowledge of the human-system interface and a reduction in accidents and incidents through enhanced aerospace vehicle, air traffic, and technical operations that adapt to, compensate for, and augment the performance of the human.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	University of Central Florida (UCF)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Alternative Fuels for General Aviation
SAFETY

Program Description:

The NextGen - Alternative Fuels for GA Program will continue to address the use of alternative and renewable fuels for GA to lessen aviation environmental impacts on air and water quality. The program will continue developing data and methodologies to support both certification and fleet-wide authorization of GA aircraft for the use of alternative aviation fuels and alternative propulsion technologies. The Piston Engine Aviation Fuels Initiative (PAFI) was formed in 2013 to support the development and deployment of an unleaded alternative to 100LL. The FAA will continue to work with the EPA and the GA community while evaluating the safety, environmental impacts, and the performance of alternatives to 100LL. Near-term research will evaluate the safety and performance of unleaded aviation gasoline and provide data to support the qualification and certification of candidate unleaded fuels.

Program Objectives:

This research program will continue to provide critical knowledge (through screening and testing) to assure the continued operational safety of aircraft using a new unleaded fuel. Successful transition to an unleaded fuel will improve the environment by eliminating airborne lead from aviation sources and help sustain a vibrant segment of the nation's economy.

Anticipated Program Activities:

1. Complete engine and aircraft testing

Expected Program Outcomes:

The NextGen Alternative Fuels for General Aviation Program is expected to reduce environmental impact of aviation operation through the establishment of data and methodologies to support certification of alternative fuels for GA aircraft.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Cape Air Swift Fuels Shell Global Cirrus Aircraft Textron Aviation Hartzell Propeller Lycoming Engines

	Continental Motors Radial Engines Limited McCauley Propeller Systems Robinson Helicopter Company American Petroleum Institute (API) Experimental Aircraft Association (EAA) Aircraft Owners and Pilots Association (AOPA) National Business Aviation Association (NBAA) National Air Transportation Association (NATA) Rotax Aircraft Engines-BRP-Rotax GmbH & Co. KG General Aviation Manufacturers Association (GAMA)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Propulsion and Fuel Systems
SAFETY

Program Description:

The Propulsion and Fuel Systems Program will continue to develop technologies, procedures, test methods, and criteria to enhance the airworthiness, reliability, and performance of civil turbine and piston engines, propellers, fuels, and fuel management systems.

Program Objectives:

The Propulsion and Fuel Systems Program will continue to conduct research on advanced damage-tolerance and risk assessment methods that provide the FAA's Office of AVS with the basis for new or revised engine certification and continued airworthiness standards. This research will also continue to support preparation of ACs that provides industry with technical information on acceptable means of compliance with regulations. Benefits will accrue in the form of a reduced risk of engine failures and fewer accidents, which in turn will lead to fewer injuries and fatalities.

Anticipated Program Activities:

1. Develop and implement practical methods and tools to incorporate new/advanced integrated computational materials engineering manufacturing and design practices into damage tolerance methodologies.

Expected Program Outcomes:

The Propulsion and Fuel Systems program is expected to enhance aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA Southwest Research Institute Department of Defense (DoD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

System Safety Management
SAFETY

Program Description:

The System Safety Management/Terminal Area Safety Program will continue to develop risk management methods, prototype tools, technical information, and Safety Management System Procedures and Practices. In addition, the program will continue to develop an infrastructure that enables the free sharing of de-identified, aggregate safety information derived from government and industry sources in a protected manner. It also will maintain conducting research to leverage new technologies and procedures that enhance pilot, aircraft, and operational safety in terminal and enroute domains. Overall, research projects conducted not only address the principal causes of fatalities in the commercial jet fleet but also fill aviation safety research gaps identified in National Transportation and Safety Board's Safety Recommendations A-01-69, A-04-62, A-07-003, and A-07-64.

Program Objectives:

The System Safety Management Program will continue 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 the aviation stakeholders. The program will continue to provide 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 Program will continue to improve the safety of operations near or at an airport. It provides solutions to reduce fatal accidents in the terminal area through (a) improving flight crew response during upset and recovery with an effective indicator, (b) enabling safe helicopter approaches when using advanced vision systems, and (c) exploring consistent operational standards for a stable approach to reduce runway excursions.

Anticipated Program Activities:

1. Develop and demonstrate Safety Oversight Management System prototype tool and case studies for Air Traffic Safety Oversight Service.
2. Develop integrated domain safety risk evaluation prototype and demonstrate its applications in support of oversight of Air Traffic Organization.
3. Develop methodology to identify and optimize Air Traffic Safety Oversight Service oversight activities, surveillance targets, and data collection parameters based on risk trends and air traffic safety oversight service resources.

Expected Program Outcomes:

The System Safety Management/Terminal Area Safety program is expected to improve aviation safety through improved system-wide access and sharing of aviation safety data and analysis tools within the

aviation community, providing safety resources that are integrated with operations of aviation industry stakeholders.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Unmanned Aircraft Systems Research
SAFETY

Program Description:

The UAS Research Program will continue to support FAA efforts in implementing NextGen by studying safety implications of new aircraft operational concepts and technology to the NAS and supporting the development of new and modified regulatory standards. The program's research activities will keep focusing on new technology assessments, methodology development, data collection and generation, laboratory and field validation, and technology transfer.

Program Objectives:

The portfolio of work will continue to focus on sense (detect) and avoid, control and communications, system safety criteria, modeling and simulation requirements, and research that will support the safe, efficient, and timely integration of UAS in the NAS within the 14 CFR regulatory framework. Additionally, funding will provide for engineering, technical, and management support of overall research activities.

Anticipated Program Activities:

- Determine baseline of UAS Flight Data Management (UFDM); collect and analyze UFDM data, and develop a minimum standard list of FDM parameters ASIAS.

Expected Program Outcomes:

The UAS Research program is expected to improve aviation safety through improved understanding of aerospace vehicle design, structure, and subsystems to reduce the potential for accidents and incidents and support the development of standards and policy and methodologies and tools for certification.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Civil Aerospace Medical Institute (CAMI)

Program Name	Name of Collaboration Partner(s) (External DOT)
	University of Central Florida (UCF)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Aircraft Safety Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Weather Program
SAFETY and EFFICIENCY

Program Description:

The Weather program conducts applied research focused on improving weather information required for integration into decision-support processes to reduce the impact of adverse weather on the NAS. The improved weather information increases safety and efficiency by supporting better operational planning and decision-making by ATM, dispatchers, and pilots. It facilitates the transition of legacy capabilities to meet NextGen requirements, often through collaborative and complementary initiatives with National Weather Service (NWS) as well as focused initiatives to help mitigate safety and/or efficiency issues associated with well-documented weather problems. The National Oceanic and Atmospheric Administration (NOAA)/NWS platforms and forecasters also use algorithms developed by the Weather Program to provide regulatory forecast products and NAS decision aids.

Program Objectives:

This program mitigates weather related NAS safety and/or traffic flow efficiency issues with a line of sight to operational exploitations. The applied research also supports the evolution of legacy weather capabilities that meet the weather information needs of today's NAS users into the capabilities that are being developed and deployed as NextGen decision-support processes. This work is frequently conducted in collaboration with the FAA's designated weather provider, the NWS.

Anticipated Program Activities:

1. Transition zero-36-hour probabilistic forecast of oceanic convection capability for implementation.

Expected Program Outcomes:

The Weather program is expected to improve aviation safety and efficiency through:

- Development of aviation weather nowcast and forecast capabilities to support NextGen weather operational improvements contained in the *NextGen Implementation Plan*.
- Identification of complimentary initiatives that can be collaborated on with the NWS to transition legacy capabilities to meet NextGen requirements.
- Development of aviation weather nowcast and forecast capabilities to help mitigate safety and/or efficiency issues associated with well documented weather problems.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	National Weather Service (NWS) National Center for Atmospheric Research (NCAR) National Center for Environmental Prediction (NCEP) Massachusetts of Technology Institute Lincoln Laboratory (MIT/LL) National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee and the Subcommittee for Aircraft Safety of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Wake Turbulence
ECONOMIC COMPETITIVENESS

Program Description:

The NextGen – Wake Turbulence Program will continue to conduct research to increase airport runway capacity safely by reducing aircraft wake separation minima under certain conditions and addressing wake turbulence constraints in today's terminal and enroute airspace and in the future NextGen airspace designs.

Program Objectives:

The program will continue to develop safe reductions to the existing ATC wake mitigation separations and thereby contribute to increased NAS capacity, enabling more flights with less cost and delay.

Anticipated Program Activities:

1. Complete development of detailed operational concepts for dynamically modifying required wake mitigation separations.

Expected Program Outcomes:

The NextGen – Wake Turbulence research program is expected to improve efficiency through improved aircraft separation processes associated with current generalized and static air navigation service provider wake turbulence mitigation separation standards.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Volpe National Transportation Systems Center

Program Name	Name of Collaboration Partner(s) (External DOT)
	Nextor II CSSI, Inc. Eurocontrol Cavan Solutions RTCA Participants George Mason University NASA Langley Research Center National Institute of Aerospace (NIA) Northwest Research Associates (NWRA) National Research Council Canada (NRCC) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Air Ground Integration Human Factors
ECONOMIC COMPETITIVENESS

Program Description:

The NextGen – Air Ground Integration Human Factors Program will continue to address flight deck and ATC integration for NextGen operational capabilities and focus on human factors issues that primarily affect the pilot side of the air-ground integration challenge. It will continue to conduct research to ensure pilots receive the right information at the right time for decision-making and collaboration with ATC to operate in the NAS efficiently.

Program Objectives:

The NextGen - Air Ground Integration Human Factors will continue to address flight deck and air traffic service provider integration for each operational improvement or NextGen application considered, with a focus on those issues that primarily affect the pilot side of the air-ground integration challenge. Through use of simulation, and demonstration, the program will continue to assess interoperability of tools, develops design guidance, determines training requirements, and verifies procedures to support certification, flight standards, and the FAA's ATOs service units for ensuring safe, efficient, and effective human system integration in transition of NextGen capabilities.

Anticipated Program Activities:

1. Create a report on the need and design options for briefing strips on area navigation/required navigation performance arrival and departure procedures.

Expected Program Outcomes:

This program is expected to improve human-system integration and an increase in ATC efficiency through enhanced controllers-pilots coordination in cooperatively managing traffic loads as cockpit technology and air traffic workstations are more closely connected.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Human Factors Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Information Security
ECONOMIC COMPETITIVENESS

Program Description:

The NextGen – Information Security program will continue to support the FAA Cyber-Security Strategic Plan goals and objectives to protect and defend the FAA networks and systems deter and mitigate risks of cyber-attacks.

Program Objectives:

Upon successful initiation in FY2017, the program will continue to conduct research to help prevent disruptive cyber incidents that affect the ATC mission and improve resiliency in the event an incident does occur. While the current measures in place for the information security for the NAS are robust, the rapidly evolving capabilities of our potential adversaries and sharply decreasing costs of exploits will continue to necessitate some prudent exploration of advanced detection and defense capabilities for the NAS systems.

Anticipated Program Activities:

- No FY 2019 activities

Expected Program Outcomes:

The program is expected to improve economic competitiveness through improved cyber resiliency for the NAS system of systems in the case of determined adversaries with persistent attacks that try to undermine the NAS.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Homeland Security Texas A&M Engineering Experiment Station (TEES) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL)

How Program meets Statutory Requirements:

The program directly supports the EO 13636 ‘Improving Critical Infrastructure Cybersecurity’ and the PPD-21 ‘Critical Infrastructure Security and Resilience’ which defines Transportation Systems Sector as one of the 16 critical infrastructure sectors and aviation as an essential sub-sector.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

No public input has been specifically sought in defining the program at this point. The program is expected to improve efficiency through improved cyber resiliency for the NAS system of systems in the case of determined adversaries with persistent attacks that try to undermine the NAS.

NextGen – Weather Technology in the Cockpit
ECONOMIC COMPETITIVENESS

Program Description:

The NextGen – WTIC will continue to do research to develop, verify, and validate recommended requirements for incorporation into MinWxSvc standards. The MinWxSvc is defined as MET, minimum performance standards (e.g., accuracy) of the MET information, minimum information rendering standards, and enhanced training on cockpit MET information and technology.

Program Objectives:

To develop the MinWxSvc recommendations, WTIC research will continue to perform gap analyses to identify operational shortfalls impacting efficiency attributable to adverse weather conditions and associated gaps of MET information in the cockpit. The MinWxSvc standards will resolve the identified MET information gaps to mitigate the efficiency-related operational shortfalls.

Anticipated Program Activities:

1. Assess potential NAS benefits of uplinking/crosslink of enhanced MET information to the cockpit.

Expected Program Outcomes:

The program is expected to improve efficiency through the establishment of requirements and standards for enabling availability and improving the quality and quantity of meteorological information to reduce impacts of adverse weather on rerouting, NAS capacity, and NextGen operational procedures. It also expected to improve accuracy and accessibility of observed and forecast weather information to improve NAS efficiency (e.g., reduced delays and cancellations, increased capacity in high traffic areas).

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Alaska FAA Weather Cameras Civil Aerospace Medical Institute (CAMI) Partnership to Enhance General Aviation, Safety, Accessibility and Sustainability (PEGASAS)

Program Name	Name of Collaboration Partner(s) (External DOT)
	RTCA Harris Boeing Rockwell Collins Embry Riddle Aeronautical University (ERAU) Aircraft Owners and Pilots Association (AOPA) National Center Atmospheric Research (NCAR) Massachusetts Institute of Technology Lincoln Laboratories (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Environment and Energy
ENVIRONMENTAL SUSTAINABILITY

Program Description:

The Environment and Energy Program will continue to advance our understanding of aviation noise and emissions as well as their consequential impacts on the environment. This knowledge is being incorporated into an integrated aviation environmental tool suite that can be used to evaluate the full breadth of environmental mitigation solutions that are being developed. The Program is using these models and knowledge to inform decision-making on technology development, alternative fuels, operational procedures, and policies relating to aviation's energy use and environmental impacts.

Program Objectives:

The Environment and Energy program will provide the analytical foundation to support the development of solutions to mitigate the impacts of aviation noise and emissions. At the core of the program is the advancement of scientific knowledge and the development and use of an integrated aviation environmental tool suite. The Program is using these models and knowledge to inform both domestic and international decision-making including that within the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP). The result is the harmonization of aviation noise, emissions and energy standards around the world thus ensuring continued U.S. industry competitiveness. This program also supports efforts to develop international standards for supersonic aircraft, including en-route standards that could enable supersonic flight over land.

Anticipated Program Activities:

1. Complete analyses to support the development of a new engine exhaust particulate matter standard in ICAO Committee on aviation and environmental protection (CAEP).

2. Explore metrics for community exposure to aircraft noise.

3. Develop improved analytical tools and methodologies for cost-benefit analysis of both domestic and international policy options and scenarios.

4. Complete analyses to inform the development of a global market based measure for international aviation.

Expected Program Outcomes:

The E&E Program is helping the FAA to achieve its overarching environmental performance goal of environmental protection that allows for sustained aviation growth. This program provides the fundamental knowledge and tools that are not only helping the FAA achieve this goal but also to implement NextGen. The E&E Program funds activities that support the U.S. leadership position on international environmental negotiations for standard setting and policymaking. This program also funds AEDT development to improve our ability to model noise associated with NextGen deployment such that we can develop better mitigation solutions. It also funds improvements in the ability of AEDT to calculate the fuel burn benefits associated with NextGen implementation. The Program expands our understanding

of source level aircraft noise and emissions as well as their impacts, which will in turn inform the development of improved metrics and environmental mitigation solutions.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
Policy, Planning & Environment Technical Center	Aviation Sustainability Center (ASCENT) Volpe National Transportation Systems Center International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP)

Program Name	Name of Collaboration Partner(s) (External DOT)
	NASA

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Environmental and Energy Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Environmental Research Aircraft Technologies and Fuels
ENVIRONMENTAL SUSTAINABILITY

Program Description:

The NextGen – Environmental Research Aircraft Technologies and Fuels Program will continue to develop solutions to mitigate impacts associated with aviation noise and exhaust emissions, and increasing fuel efficiency and availability. In partnership with industry, the Program is accelerating the maturation of engine and airframe technologies to reduce aviation noise, fuel use, and emissions through the Continuous Lower Energy, Emissions, and Noise (CLEEN) Program. The Program also supports the development of alternative jet fuels that could serve as drop-in replacements for today's petroleum-derived turbine engine fuels. Efforts are ongoing to approve new alternative jet fuel pathways within ASTM International and to improve the overall fuel approval process; to support the inclusion of alternative jet fuels within the market-based measure being developed by ICAO CAEP; and to facilitate communication across the alternative jet fuel industry to facilitate deployment. These efforts will lead to the faster realization of the accompanying economic development and environmental improvements that will come with a new alternative jet fuel industry.

Program Objectives:

In partnership with industry, the program is continuing to accelerate the maturation of aircraft and engine technologies that reduce aircraft noise, emissions that degrade air quality, greenhouse gas emissions, and energy use while also advancing alternative jet fuels for aviation use. Since its inception in 2010, the CLEEN Program has been successful in maturating technologies to enter into service sooner than what the industry had anticipated. This Program will also continue to provide funding for the alternative jet fuel testing and analysis efforts of the Aviation Sustainability Center (ASCENT), the FAA Center of Excellence (COE) for Alternative Jet Fuels and Environment, (http://ascent.aero). This Program will also continue to support efforts of the Commercial Aviation Alternative Fuels Initiative (CAAFI) to focus the efforts of commercial aviation to engage with the emerging alternative fuels industry (http://caafi.org). The CLEEN Program, ASCENT and CAAFI are all contributing to the Farm to Fly 2.0 efforts, which are coordinated with industry, the U.S. Department of Agriculture, and the U.S. Department of Energy to support the development of jet biofuel production and use by the U.S. aviation enterprise.

Anticipated Program Activities:

1. Advance the understanding of alternative jet fuel composition to enable fuels with lower emissions.

2. Demonstrate technologies that can reduce energy use, emissions, and noise in year five of the second phase of the CLEEN Program.

3. Develop lifecycle greenhouse gas emissions values for alternative jet fuels for use by ICAO CAEP.

Expected Program Outcomes:

The NextGen – Environmental Research – Aircraft Technologies and Fuels Program is helping the FAA to achieve its overarching environmental performance goal of environmental protection that allows for sustained aviation growth. In partnership with industry, the Program is maturing aircraft and engine technologies that can reduce aircraft noise, emissions that degrade air quality, greenhouse gas emissions, and fuel use and advancing alternative jet fuels.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
Policy, Planning & Environment Technical Center	CLEEN Consortium Aviation Sustainability Center (ASCENT) Volpe National Transportation Systems Center

Program Name	Name of Collaboration Partner(s) (External DOT)
	Department of Defense (DoD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Environment and Energy Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

System Planning and Resource Management
ECONOMIC COMPETITIVENESS

Program Description:

This program will continue to provide crosscutting research and development portfolio planning, development, management, and coordination. It produces the NARP, an annual strategic plan for FAA R&D. The program also administers the congressionally mandated (P.L. 100-591 Section 6 Advisory Committee) REDAC and provides single point of coordination, advocacy and outreach for the FAA research program.

Program Objectives:

The program maintains liaison with all organizational elements and stakeholders participating in the agency's R&D program and ensures cohesion and alignment of the FAA R&D portfolio with national and departmental strategic priorities. It ensures that alignment is expressed and is traceable in all internal planning, coordination and management deliverables.

Anticipated Program Activities:

1. Conduct the 2018 International Conference on research in air transportation
2. Conduct planning for the 2019 International ATM R&D Seminar
3. Research Collaboration
4. Manage FAA's R, E&D portfolio to meet efficiency goals
5. Deliver the 2019 NARP to Congress with the President's FY 2020 budget request
6. Process REDAC recommendations on planned R&D investments for FY 2021
7. Prepare the FY 2021 R, E&D budget submission

Expected Program Outcomes:

Timely and effective planning, formulation, coordination and management of FAA's R&D portfolio leading to a more effective research program that will benefit the public by making aviation safer and smarter and enhancing the U.S. global leadership in aviation.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
R&D Planning	OST-R

Program Name	Name of Collaboration Partner(s) (External DOT)

How Program meets Statutory Requirements:

This program produces the NARP, which is a report of the FAA to the U.S. Congress pursuant to Section 44501(c) of Title 49 of the U.S. Code. It also produces and submits to the Office of the Secretary of Transportation the AMRP as required by the FAST Act - P. L. 114-94 (Sec. 6501(a) (1)). Finally, this program administers the FAA REDAC process in accordance with statutory requirements set forth in the Aviation Safety Research Act of 1988 (P.L. 100-591) and P.L. 101-the FAA Research, Engineering and Development Authorization Act of 1990 (P.L. 101-508).

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is largely about coordination, facilitation, management, and reporting of FAA R&D program activity. Continuous liaison with internal and external stakeholders is in fact the essence of the program and the means of obtaining input.

Advanced Technology Development and Prototype (F&E Portfolio)
SAFETY, ECONOMIC COMPETIVENESS

Program Description:

The Advanced Technology Development and Prototyping portfolio includes diverse research projects to develop and validate technology and systems that support air traffic services. These initiatives will continue to support the requirements associated with the evolving air traffic system architecture and improvements in airport safety and capacity. These programs are described in the NARP and are summarized below:

The Runway Incursion Reduction Program (RIRP) will continue to conduct research, development, and operational evaluation of technologies to increase runway safety. Consistent with standing NTSB recommendations, research emphasis will remain on technologies that provide direct safety indications and alerts to pilots at large airports, as well as, those that can be applied cost effectively at small to medium airports.

The Operations Concept Validation and Infrastructure program will continue to develop and validates NAS level operational concepts that are key to the FAA modernization programs and NextGen. Developing operational concepts is the first step in developing an Enterprise Architecture. The program will conduct the overall analysis and planning for NAS evolution by determining the required annual updates to the NAS Enterprise Architecture products; Operational Improvements, Operational Sustainment, and Operational Requirements.

The Major Airspace Redesign Program will continue to fund physical changes in facilities necessary to accommodate airspace redesign. Implementation of an airspace redesign frequently results in changes to the number and span of control of operational positions or sectors, including changes to sector, area or facility boundaries.

Program Objectives:

The Runway Incursion Reduction Program will continue to pursue a strategy of 'right site, right size' to identify candidate technologies that are best suited to a variety of airports in order to address the specific types of RI causal factors encountered at that site (e.g. converging runways, ground vehicle operations, taxiway/runway hotspots, wildlife, etc.).

The Operations Concept Validation and Infrastructure Evolution Program will continue to assess the interaction of changing roles and responsibilities of NAS service providers and pilots, airspace changes, procedural changes, and new mechanized systems for distributing weather, traffic and other flight related information.

The Major Airspace Redesign Program will continue to ensure all airspace related efficiency benefits facilitated by the Major Airspace Program, facility changes, and automation improvements are achieved. The program will continue to pursue review, redesign, and restructure airspace.

Anticipated Program Activities:

It is anticipated that the program will continue the activities identified in the FY2018 work plan for each of the projects described above.

Expected Program Outcomes:

The Runway Incursion Reduction Program is expected to improve aviation safety by ensuring no fatal accidents on certificated airports because of airport design, runway incursions or excursions, or wildlife strikes. The program will continue its mission to develop safety technologies that can then be applied at not just large airports, but also small-to-medium sized airports with commercial service throughout the NAS that have seen a recent uptick in the rate of runway incursions.

Both the Operations Concept Validation and Major Airspace Redesign programs are expected to improve efficiency by developing feasible procedures, operational methods, and technologically advanced systems that can decrease workload and increase efficiency of the NAS. The Operational Concept Validation program will perform the early concept research for advanced operational concepts to ensure they are well understood and are based on valid assumptions. The airspace redesign projects are projected to deliver benefits through the reduction of restrictions, shorter flight distances, more fuel-efficient routes, and reduced delays.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Massachusetts Institute of Technology Lincoln Laboratories (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Separation Management Portfolio
ECONOMIC COMPETITIVENESS

Program Description:

The Separation Management portfolio will continue to conduct pre-implementation activities to reduce risk, and implementation activities supporting the safe and efficient separation of aircraft and other vehicles in the NAS. Risk reduction activities may include validation of concepts or technologies; demonstration and integration of operational capabilities; and an understanding of the role of the human through cognitive engineering experiments. Separation Management evaluates and matures concepts and capabilities that focus on the enhancement of separation assurance using both ground based automation and aircraft technology enhancements. Pre-implementation research conducted under this portfolio includes:

Oceanic Tactical Trajectory Management

The OTTM Program will continue to address current performance gaps in the areas of capacity, productivity, efficiency, safety, and environmental impacts in the oceanic environment. OTM-4D is the OTTM mid-term concept. This requires new decision support capabilities and integration with TFM. With increased system precision and enhanced automation, aircraft can more closely fly routes to realize the airlines' goals for fuel efficiency and schedule reliability. Shared state and intent data will lead to fewer predicted conflicts, and as a result, fewer diversions from the preferred routing.

Wake Turbulence - Re-Categorization

The RECAT project will continue to develop wake separation standards that provide increased airspace and airport throughput capacity without aircraft equipage costs or runway expansions. This project has been part of a joint EUROCONTROL and FAA program that had reviewed the then required wake mitigation aircraft separations used in both the USA's and Europe's ATC processes and determined that the standards could be safely modified to increase the operational throughput capacity of airports and airspace that will have heavy operational demand in the NextGen era.

UAS Concept Validation and Requirements Development

The UAS Concept Validation and Requirements Development Program conduct the overall analysis and planning for the development, integration, and subsequent implementation of emerging UAS enabling technologies. (Note: A Separate FY2017 RD&T Project Plan for this initiative is included in the AMRP).

Program Objectives:

Oceanic Tactical Trajectory Management

The key objective of this concept will continue to be to use trajectory-based operations to improve fuel efficiency, system predictability, and performance by enabling airlines and other operators to flight plan and fly closer to their optimal, or preferred four-dimensional trajectories while in oceanic airspace. Better information will result in more efficient use of capacity within flow-constrained airspace, allowing more aircraft to fly through those areas, rather than being re-routed or delayed to avoid them.

Wake Turbulence Re-Categorization

Implementation of the RECAT Phase II wake separation standards, will continue to allow optimization for individual major core airport's fleet mix, and is projected to provide a four to seven percent increase in runway throughput capacity at those airports that would have received a smaller benefit from implementing the RECAT Phase I/I.5 wake separation standards. RECAT Phase III will provide further benefit by enabling dynamic wake separation standards. The RECAT Phase III alternatives will include time based separations which allow for the reduction of wake separation distances in high headwind conditions by using wake decay over time to determine the wake separation requirement.

UAS Concept Validation and Requirements Development

See separate FY2018 RDT Project Description

Anticipated Program Activities:

Note that the Oceanic Tactical Trajectory Management Program will be closed in FY 2017 and transfer will be determined in the second quarter of 2017. As a result, most planned milestones have been deleted.

Wake Turbulence Re-categorization

1. Develop detailed descriptions of air navigation service provider processes and procedures for use of dynamic wake separation standards.

Expected Program Outcomes:

Oceanic Tactical Trajectory Management

The program will continue to improve economic competitiveness through improved methods and/or capabilities that enable safe reduction in separation standards, increase in airspace capacity, and/or efficient management of aircraft trajectories.

Wake Turbulence Re-categorization

RECAT will continue to improve aircraft separation processes associated with current generalized and static air navigation service provider wake turbulence mitigation separation standards.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	Cavan Solutions National Institute of Aerospace (NIA) Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) MITRE Center for Advanced Aviation System Development (CAASD)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – Improved Surface Portfolio
ECONOMIC COMPETITIVENESS

Program Description:

The Improved Surface portfolio will continue to conduct pre-implementation activities to reduce risk and implementation activities supporting the TFDM System. The work will continue to focus on the development of efficient TFM and collaborative decision-making on the surface by providing a key ground infrastructure program for NextGen mid-term operations. Pre-implementation research conducted under this portfolio includes:

Surface Tactical Flow

The STF Program will continue to develop trajectory-based surface operations in support of NextGen. It leverages the development efforts of the NASA surface management system and provides guidelines for the development of a collaborative surface traffic management system.

Program Objectives:

The Surface Tactical Flow program will conduct research activities to develop and mature STBO capabilities to leverage and extend mid-term STBO capabilities of information sharing, planning, and scheduling, and taxi route management.

Anticipated Program Activities:

1. Complete and deliver a report on integrated scheduling in an operationally relevant environment.

Expected Program Outcomes:

The STF Program is expected to continue to improve economic competitiveness through improved methods, technologies, and capabilities that enable increased surface traffic movement efficiency. The STF Program seeks to enable effective use of collaborative decision making by demonstrating efficiency gains through enhanced two-way sharing of prediction and scheduling information.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen On-Demand NAS Information Portfolio
ECONOMIC COMPETITIVENESS

Program Description:

The ODNI portfolio conducts pre-implementation activities to reduce risk supporting the exchange of information between FAA and other NAS users. The portfolio provides flight planners, air navigation service providers' staff, and flight crews with consistent, complete, and easily processed information on changes of conditions in the NAS affecting safety, security, and efficiency. The ODNI portfolio examines concepts and matures capabilities through validation activities, demonstrations conducted with stakeholders, and human systems engineering to mitigate adverse impacts and to exchange information efficiently and securely between FAA and NAS users. Pre-implementation research conducted under this portfolio includes:

Advanced Methods

Advanced Methods is a pre-implementation engineering analysis and requirements program that addresses shortfall areas identified by ATO programs and provides possible solutions to future ATM system work packages. Specifically, Advanced Methods is focusing on addressing shortfall areas identified in the TFM shortfall analysis coordinated with industry partners.

Program Objectives:

The Advanced Methods program will continue to support improvements to increase airport capacity and sector throughput, and reduce sector delays by providing the NAS users and ATM with a common understanding of the NAS constraints. The program will continue to develop and test prototype improvements and provide operational concepts and requirements for implementation by automation programs and operational organizations.

Anticipated Program Activities:

1. Develop and complete a concept of operations for voice recognition for TFM recording and logging.

2. Complete a preliminary shortfall analysis report of trajectory sync against metered airport schedules.

Expected Program Outcomes:

The Advanced Methods project is expected to improve economic competitiveness through feasible procedures, operational methods, and technologically advanced systems that can decrease workload and increase efficiency of the NAS.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen – NAS Infrastructure Portfolio
ECONOMIC COMPETITIVENESS

Program Description:

The NAS Infrastructure portfolio will continue to conduct pre-implementation activities to reduce risk for aviation weather-related and crosscutting engineering issues. This portfolio will continue to provide the research, development, and analysis of portfolio capabilities such as validation activities, human system engineering, and demonstrations. Work with this portfolio addresses aviation weather-related issues by supporting the improvement of (a) ATM decision-making during adverse weather conditions, (b) weather forecasting in the transformed NAS, and (c) existing weather infrastructure. Surface/tower/terminal systems engineering, NextGen navigation engineering, New ATM requirements, NextGen DME, and information management, conduct analysis to develop solutions that can apply across the NAS domain. Pre-implementation research conducted under this portfolio includes:

New Air Traffic Management Requirements

The New ATM Requirements Program will continue to identify new opportunities to improve the efficiency and effectiveness of ATM and expanding capacity by developing decision support tools that improve the strategic management of operations in the NAS. (Note: A Separate FY2017 RDT Project Description for this initiative is included in the AMRP).

Weather Observation Improvements

The NextGen Weather Observation Improvements Program will continue to manage the evolution of the existing aviation weather observation sensor networks to one that provides the optimal quantity and quality of ground, air, and space-based sensors.

Program Objectives:

New ATM Requirements

The service analysis and operational demonstration activities within New ATM Requirements Program will continue to support the development of operational improvements that will increase the number of arrivals and departures at major airports. (See separate FY2018 RDT Project Description).

NAS Weather Observation Improvements

A consistent and effective aviation weather sensor network is fundamental to NextGen. Of primary focus is the surface weather sensor network in the terminal environment. A comprehensive list of weather observation shortfalls is continuously refined and prioritized based on feedback from key stakeholders and user groups. The program will continue to use this information to explore potential NextGen-enabled concepts and to mitigate the high priority shortfalls. (See separate FY2018 RDT Project Description).

Anticipated Program Activities:

The program will continue to perform a broad range of concept engineering and exploratory development activity to support future investment and implementation of improved NAS weather observation capabilities.

Expected Program Outcomes:

The New ATM Requirements Program will continue to support the NextGen goal of expanding capacity by developing decision support tools that improve the strategic management of operations in the NAS.

The Weather Observation Improvements project is expected to improve economic competitiveness by establishing requirements and standards for enabling availability, and improving the quality and quantity of MET information to reduce impacts of adverse weather on rerouting, NAS capacity, and NextGen operational procedures. It is also expected to continue to improve accuracy and accessibility of observed and forecast weather information to improve NAS efficiency (e.g., reduced delays and cancellations, increased capacity in high traffic areas.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the NAS Operations Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

NextGen Laboratory Support Portfolio
ECONOMIC COMPETITIVENESS

Program Description:

The NextGen – Laboratory Support Portfolio will continue to focus on evaluating future concepts and technologies to support technical transfer to the implementing organizations, promoting industry involvement, and identifying implementation challenges and research areas. This work supports the infrastructure needed to complete those demonstrations and studies, measures performance impacts of NextGen capabilities, reports progress in the performance of implemented capabilities at specific locations, as well as updates the NSIP.

The NextGen Laboratories - NIEC and FTB enable research activities that support pre-implementation and risk reduction activities by providing a platform to conduct validation, modeling, and demonstrations.

Program Objectives:

The laboratory support portfolio is intended to provide a robust platform where early-stage NextGen concepts can be integrated, demonstrated, and evaluated. These laboratories will continue to provide the FAA and industry an agile environment for the rapid integration of new and emerging technologies. It also promotes contributions and R&D investment from industry and leverages industry's capabilities, resulting in cost avoidance to the FAA and accelerated NextGen development.

Anticipated Program Activities:

It is anticipated that the program will pursue varied upgrades to maintain, sustain, and enhance the capabilities of the NIEC and FTB as warranted by planned demonstrations and user activity.

Expected Program Outcomes:

The projects described above are expected to improve economic competitiveness by enabling concept engineering and evaluation activities that reduces the risk of successful implementation of ATM concepts and capabilities that improve NAS operational efficiency.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	None

Program Name	Name of Collaboration Partner(s) (External DOT)
	None

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is in and of itself a pathway to obtaining stakeholder input. Specifically, the NIEC laboratory is used to expose stakeholders in the ATM operational user community to emerging NextGen concepts and capabilities in order to gain their assessment of the potential operational effectiveness and/or suitability of the concept for use in further maturation and development. The FTB is used to engage industry stakeholders in the prototyping and demonstration of emerging concepts and thereby promote mutual (FAA and industry) understanding of concept maturity, technology readiness and areas needing further development.

Airport Technology Research Program
SAFETY, ECONOMIC COMPETIVENESS, ENVIRONMENTAL SUSTAINABILITY

Program Description:

The ATRP will continue to execute a broad range of research projects that support FAA safety, capacity, and environmental objectives. Safety initiatives include research aimed at (a) improving airport lighting and marking, (b) reducing wildlife hazards near airport runways, (c) improving airport fire and rescue capability, and (d) reducing the likelihood and severity of surfacing accidents. The ATRP establishes up-to-date exposure-response relationships for community annoyance and sleep disturbance in the U.S. by collecting extensive data, which covers a wide variety of airport types and geographic locations.

Program Objectives:

The ATRP will continue to support increased safety and capacity while reducing the environmental impact of airport operations by exploring, evaluating, and testing new technologies and design standards for potential adoption and implementation via the AIP. Under its capacity objective, ATRP research is aimed at providing better airport planning, designs, and improved runway pavement design, construction, and maintenance. Research project outputs inform the development and issuance of ACs that are the primary method of conveying airport improvement design guidance and standards for airport operators.

Anticipated Program Activities:

- Research new pavement materials as they get introduced to the airport pavement market;
- Research performance of existing airport pavements in the field;
- Research non-destructive pavement analysis tools for pavement design, pavement construction acceptance, and pavement roughness;

- Conduct analysis of airport safety related data and explore innovative ways of improving airport geometry and airport layout to reduce the number of incidents and accidents that occur at airports;

- Research enhanced methods and techniques for habitat management at airports;
- Research new firefighting agents that are PFC free;
- Research more effective runway friction level classification and identify corresponding maintenance requirements for airport runways;

- Study behavior of anti-skid brake systems on low friction pavement surfaces;
- Conduct additional airport noise research to collect data on issues such as interior sound mitigation techniques, the significance of the NEPA definition of noise, sleep disturbance, and noise mitigation, and

- Implement research studies identified under a 10-year framework for future environmental and planning research and development.

Expected Program Outcomes:

- No fatal accidents on certificated airports because of airport design, runway incursions or excursions, or wildlife strikes.
- Availability of existing airport facilities protected and used as efficiently as possible, while making strategic investments in new facilities consistent with evolving aviation needs.
- Enhance and optimize mixture design, testing, and specifications that support pavement performance for mixtures using both virgin and recycled/reclaimed materials and industrial byproducts.
- Explore the use of new and innovative materials and practices that minimize environmental impacts, including the use of nanoparticles for these improvements

FY 2019 Collaboration Partners (Internal DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Federal Highway Administration (FHWA)

Program Name	Name of Collaboration Partner(s) (External DOT)
	CSRA Booz Allen Hamilton Iowa State University Smithsonian Institution Greater Binghamton Airport University of Nebraska-Lincoln Rensselaer Polytechnic Institute (RPI) U.S. Department of Agriculture (USDA) Center of Excellence for Airport Technology (CEAT) Department of Defense (DoD) United States Air Force (USAF)

How Program meets Statutory Requirements:

This program is not driven by particular statutory requirements.

Describe how Public and Stakeholder Input have been, or will be utilized in the Development of this Research Program:

This program is reviewed twice yearly by the Airports Subcommittee of the REDAC – a chartered committee consisting of industry and academia that functions in accordance with FACA. As appropriate, particular findings and recommendations are reported independently by the committee to the FAA Administrator and the agency responds formally to all such recommendations.

Airports Cooperative Research
SAFETY, ECONOMIC SUSTAINABILITY, ENVIRONMENTAL SUSTAINABILITY

Program Description

The ACRP will continue to be an industry-driven, applied research program that develops near-term, practical solutions to problems faced by airport operators. ACRP is managed by the TRB of the National Academies of Sciences, Engineering, and Medicine and is sponsored by the FAA. The research is conducted by contractors who are selected on the basis of competitive proposals.

Program Objectives:

ACRP will continue to carry out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. The ACRP undertakes research and other technical activities in a variety of airport subject areas including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration.

Anticipated Program Activities:

The ACRP Oversight Committee will announce their FY 2018 project topics during the fall of 2017. While the selected research projects remain to be determined, it is anticipated that they will continue examine different research areas that target near-term solutions to problems facing airport operators and industry stakeholders. The selected projects will continue to report on the state of the practice in critical areas within the industry.

Expected Program Outcomes:

The ACRP advances state of the knowledge and practice across a broad range of topics of import to the airport operator community and other industry stakeholders. Specific outcomes will be dependent on the particular research proposals awarded in a given year.

FY 2019 Collaboration Partners (Internal & External DOT)

Program Name	Name of Collaboration Partner(s) (Internal DOT)
	Transportation Research Board

Program Name	Name of Collaboration Partner(s) (External DOT)
	Faith Group, Llc. FTI Consulting Texas A&M Transportation Institute

How Program meets Statutory Requirements:

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act (Public Law 108–176).

Describe how Public and Stakeholder Input have been, or will be, utilized in the Development of this Research Program:

Research problem statements for ACRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.