U.S. Department of Transportation

BUDGET ESTIMATES

FISCAL YEAR 2019

FEDERAL AVIATION ADMINISTRATION

SUBMITTED FOR USE OF
THE COMMITTEE ON APPROPRIATIONS

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SECTION 1. OVERVIEW

OVERVIEW

Since 1958, the Federal Aviation Administration (FAA) has overseen all aspects of civil aviation in the United States, operating the largest, safest and most complex aerospace system in the world. A safe aviation system is the lifeblood of our nation's economy. Every day, the dedicated men and women of the FAA safely and efficiently guide thousands of aircraft to and from their destinations, collectively carrying millions of passengers and tons of cargo.

Innovation has been an enduring theme throughout American history, and nowhere has this been more abundantly evident than in aviation. The founders of modern aviation developed innovative technology and inspired imaginations around the world. This proud tradition of innovation continues today at the FAA. Across the board, we are now unleashing a host of technologies that will profoundly change what aviation looks like for decades to come.

As we work to modernize the National Airspace System (NAS), we are ushering in this great new age of American aviation. Emerging technologies have led to new airspace users, such as unmanned aircraft systems (UAS) and commercial space transportation. These new industries are developing at an astonishing pace. These changes in the aviation industry represent transformational opportunities and challenges for aviation infrastructure that the FAA will continue to address.

The President's Budget request includes a total of $73 million for the safe integration of UAS, commonly referred to as drones, into the National Airspace System. This includes $50.8 million in Operations to set policies, procedures, and standards; $18 million in Facilities & Equipment to develop technologies that will automate authorization requests and eventually bring UAS under air traffic control; $3.3 million in Research, Engineering & Development to study the safety implications of new operational concepts and technology as well as support the development of new regulatory standards; and $1.2 million in Grants-in-Aid for Airports to safely integrate UAS into airport operations. Innovations in UAS technology have fueled a dramatic growth, with FAA's UAS registry recently logging 1 million users. FAA is taking an incremental approach to UAS integration, seeking to balance public safety and security concerns with the flexibility for innovation.

To simplify and streamline the authorization of UAS operations, FAA is implementing new systems including UAS Facility Maps and a Low-Altitude Authorization and Notification Capability (LAANC). LAANC is the first UAS tool that delivers drone information to air traffic control and is the first step in developing an Unmanned Aircraft Systems Traffic Management System (UTM). LAANC is a prototype that will ultimately provide near real-time processing of airspace authorization requests for UAS operators nationwide. The system automatically approves most requests to operate in specific areas of airspace below designated altitudes.

The FAA is also working with National Aeronautics and Space Administration and industry to research an UTM system to manage UAS traffic. The focus of this research is small UAS operations, primarily below 400 feet, in airspace that contains low-density manned aircraft operations. Future phases of UAS work will facilitate UAS operations over people, beyond the operator's visual range, as well as the transportation of people and property.

The President's Fiscal Year (FY) 2019 Budget also requests $31 million to allow us to keep pace with the increasing diversity, complexity and volume of commercial space activities. Included within the Operations budget is a $2 million increase to help us keep pace with industry demands for products and services, and advance regulatory streamlining efforts. The Facilities & Equipment budget includes $7 million to automate launch and reentry operations that are currently manual in nature, time consuming, and require that vast sections of commercial airspace be closed off. This initiative, known as Space Data Integrator, will enable FAA to safely reduce the amount of airspace that must be closed during launch and reentry operations.

Ten years ago, we embarked on an ambitious transformation program while supporting an already aging legacy infrastructure. The FAA has made solid progress implementing innovative NextGen technologies and delivering more than $2.72 billion in benefits to our users, with $13 billion in benefits expected by 2020. However, because of budget uncertainty, the FAA has had to make hard choices. Working in partnership with industry, we have achieved some near-term NextGen benefits but have had to delay others and defer maintenance on existing infrastructure.

While we have made progress, the time has come to embrace a bolder vision of what our Nation's air traffic control system can be and how best to move forward to achieve it. The FAA is funded almost entirely by the users of the National Airspace System. This makes the President's vision of a self-sustaining, non-governmental, not-for-profit air traffic control entity achievable now. The President's budget request for the FAA continues the current financial and organizational structures during a time when it proposes to begin the transition of shifting the air traffic control function of the FAA to an independent entity, making the system more efficient and innovative while maintaining safety. As plans for this transition continue, the FY 2019 budget will enable FAA to provide for the continued safety and efficiency of our air traffic control system, while laying the groundwork so that key FAA elements could easily be seamlessly separated out to achieve the President's vision.

For FY 2019, a total funding level of $16.1 billion will enable the FAA to meet its mission, continue progress on NextGen, and provide for the safe integration of new projects like UAS. This budget furthers our goals while lowering operational costs by 1.8 percent from the FY 2017 level. This is realized through new efficiencies that optimize our provided services at a lower cost to the traveling public. We are also streamlining some services we provide, while considering new ways to be more responsive and adaptable to the demands of a rapidly evolving industry. These efficiencies are sensible and rational. They support our Administration's goal of increased accountability while providing for the FAA's proud and continuing tradition of honorable service to the American people.

Operations

The FY 2019 request of $9.9 billion for Operations reflects an effort to streamline the services we provide, addressing the FAA's funding needs while accommodating today's real budgetary constraints. The request includes $95.5 million in cost saving initiatives by reducing the FAA's workforce through attrition, as well as additional operating and cost saving measures. The budget provides $67 million of uncontrollable increases for the annualization of the FY 2018 pay raise, one additional compensable day, and cost adjustments for GSA rent and the Department of Transportation's Working Capital Fund for critical capabilities and tools that identify, prioritize and mitigate cybersecurity risks. The request also includes one programmatic increase for the Office of Commercial Space Transportation. In addition, there is a base transfer of flight programs in order to better align our resources with organizational functions.

The FAA has identified several ways to achieve significant cost savings throughout its Operations budget, including workforce reductions through attrition, improved efficiency of how the FAA delivers flight services, and the transition from contract weather observers to controller-provided weather services.

In FY 2019, the FAA expects to continue targeted hiring and gradually reduce the size of our workforce through retirement and resignations. Hiring will be restricted for the non-exempt workforces identified under the initial hiring policies developed in FY 2017. This exempts safety personnel, which includes air traffic controller and technician staffs within the Air Traffic Organization and safety inspectors within the Aviation Safety organization. The workforce reduction results in projected savings of $42 million (changes to the Administration's initial policy or to the FAA's exemptions may affect the actual savings and workforce levels).

The FAA will encourage users of its flight services throughout the continental United States to take advantage of automated, internet-provided services. These automated services will allow the FAA to modify the scope of its Flight Service Stations program without affecting current levels of safety. The reduced dependency on direct person-to-person interaction will result in $37 million in cost efficiencies in FY 2019.

After conducting safety analyses and providing the necessary training, FAA air traffic controllers can provide certain weather services that allow the FAA to reduce its reliance on contract weather observers. This change will yield $16 million in new program cost savings. This will be limited to multiple airports currently serviced by Contract Weather Observers that have similar traffic, weather and operational complexity profiles to 392 other airports currently serviced by Limited Aviation Weather Reporting Station controllers.

The budget boosts funding for Commercial Space Transportation (AST) by $2.0 million for the AST divisions that conduct licensing, permitting, safety inspections, technical analyses, and regulations development. This funding will help us keep pace with industry demands for products and services, and advance regulatory

streamlining efforts. This request will ensure the FAA can keep pace with the licensing and permitting needs of this growing and increasingly complex industry.

The Operations budget includes nearly $51 million to develop the policies, procedures, and standards for safe UAS operations in the National Airspace System. Funds will also be used to work with law enforcement agencies, airports, and other government agencies (federal, state and local) to ensure public safety and security; to coordinate with stakeholder groups, advisory groups and other government agencies (federal, state and local) to identify UAS priorities and educate on UAS rules and guidance; and to review applications for specific UAS operations to ensure their safety.

Facilities & Equipment (F&E)

The FY 2019 budget request of $2.77 billion supports the challenge of both maintaining the capacity and safety of the current National Airspace System while continuing its modernization and transformation. This budget will advance near-term priorities identified by the NextGen Advisory Committee, which is comprised of FAA and industry representatives who identify near term priorities that will deliver immediate benefits.

Approximately $1.9 billion of this request is devoted to sustaining the existing NAS infrastructure and systems, including its aging physical infrastructure, power systems, information technology, navigational aids, communications and surveillance equipment, and weather systems. This also includes $524 million to help bring FAA facilities into a state of good repair. This funding will help the FAA keep a maintenance backlog from growing. Continued progress to reduce the maintenance backlog will require ongoing investment for several years and must be accompanied by divestiture and decommissioning of infrastructure to reduce the ground-based footprint of the NAS wherever feasible. The request also supports the ongoing sustainment and technology refresh of systems, ranging from radars to weather sensors/systems to navigation aids and satellite leases. The FAA is aggressively pursuing satellite-based technology as part of its NextGen effort. The current infrastructure must remain in place until the full transition to that technology occurs.

The F&E NextGen portfolio for FY 2019 is $832.6 million and fully supports programs such as Automatic Dependent Surveillance-Broadcast (ADS-B), En Route Automation Modernization Technology Refresh, Data Communications (Data Comm), the second segment of System Wide Information Management (SWIM) and the NAS Voice System, which will replace legacy voice switches by 2025. NextGen capabilities continue to bring benefits to the aviation industry and the traveling public across the national airspace.

The Data Comm request of $114 million will continue the modernization of communications between air traffic controllers and pilots by replacing some traditional voice communications with digital information exchanges. This results in faster taxi out times and reduced delays while improving controller and pilot efficiency, reducing radio congestion, and reducing the likelihood of communication errors that can occur from voice exchange. Data Comm has already resulted in substantial taxi out time savings at major airports across the country. FY 2019 funding allows us to complete deployment of Tower Services and to begin implementing Initial En Route Services in the facilities that manage high altitude traffic.

The System Wide Information Management (SWIM) request is for $59 million to continue implementation. This information-sharing platform allows members of the aviation community to access the specific information they need, in the way that they need it, to facilitate an innovative and efficiently run NAS. Industry has made significant advancements in sharing data using SWIM. Delta Airlines and American Airlines are providing 11 surface data elements to improve surface efficiency, and other airlines are in the testing and development phase.

The FAA is upgrading the technology used at airports to alert tower controllers of a significant risk of collision on a runway. The new technology adds Automatic Dependent Surveillance – Broadcast (ADS-B) and multilateration surveillance sources to the existing surface radar. The FY 2019 budget includes $37 million in the Facilities & Equipment account for ADS-B to begin initial operational use of the new technology, known as Airport Surface Surveillance Capability (ASSC), at Portland, New Orleans, Pittsburgh, and Anchorage. In addition, the FAA is testing software modifications to its existing airport surface surveillance system, called the Airport Surface Detection Equipment Model X (ASDE-X). While traditionally used to prevent surface runway collisions, this modification is intended to alert controllers in the tower when a pilot is lined up to land on a taxiway instead of a runway.

The request provides for NextGen programs such as en route and terminal automation platforms, which are foundational requirements to deliver advanced flight capabilities and decision support tools. It also provides $140 million for programs that give the air traffic controllers the tools they need to optimize traffic flow across the national airspace. Of this total, $119 million is for Terminal Flight Data Manager (TFDM), which shares real-time data among controllers, aircraft operators, and airports so they can better stage arrivals and departures for greater efficiency. TFDM is a key ground infrastructure program for NextGen operations in the areas of flight planning; push back, taxi and departure; descent and approach; and landing, taxi and arrival. $21.2 million is requested for Time Based Flow Management (TBFM), which uses time rather than distance to help controllers sequence air traffic. Compared to the traditional miles-in-trail process to separate aircraft, TBFM provides a more efficient traffic flow that reduces fuel burn, lowers exhaust emissions, and increases traffic capacity.

The integration of UAS into the NAS is included in the F&E budget request. For UAS, $14 million is included to help develop an Unmanned Traffic Management system, a separate but complementary system to the Air Traffic Management system. This includes the Low Altitude Authorization and Notification Capability (LAANC) for drone operators, already deployed at several air traffic facilities. LAANC is the first UAS tool that delivers drone information to air traffic control and is the first step in developing Unmanned Aircraft Systems Traffic Management System (UTM).

The integration of commercial space into the NAS is also reflected in the F&E budget request. For Commercial Space, $7.0 million is requested to automate the current manual process used to determine and communicate the portion of airspace that is closed during rocket launches. This initiative, known as Space Data Integrator, will enable FAA to safely reduce the amount of airspace that must be closed during launch operations.

Research, Engineering & Development

The FAA's RE&D budget proposal aligns to the Administration's commitment to maximize the impact of taxpayer dollars and improve the efficiency of federal research programs for the benefit for the American public. The FAA's existing RE&D programs will continue to progress in tandem with the private sector's research and development initiatives essential to maintaining the highest levels of safety for the U.S. aviation system.

The budget request includes a total of $43.9 million for research in essential safety areas, including $4.9 million focused on research activities to increase aircraft fire safety such as fire tests for interior materials, fire detection and suppression systems, fire-fighting procedures and guidance material, and safeguards to protect against fires involving lithium batteries, fuel cells, and hazardous materials. Other safety-related research areas include advanced materials, aircraft icing, and continued airworthiness. The budget request also includes $2.5 million to continue to investigate improvements for the safe integration of commercial space operations into the NAS.

The request provides $19.5 million for NextGen research, including programs on the safe integration of UAS into the NAS, information security, wake turbulence, weather technology, and a new item, Flight Deck Data exchange. The Environmental program is funded at $19.2 million and supports the Continuous Lower Energy Emissions and Noise program and noise research.

Grants-in-Aid for Airports

The FY 2019 budget request of $3.4 billion provides the funding needed to ensure safety, capacity, and efficiency at our nation's airports through federal grants when combined with revenue generated from Passenger Facility Charges. This request supports our continued focus on safety-related development projects, including projects to help reduce runway incursions as well as increased capacity, efficiency, noise mitigation and improving infrastructure conditions.

The FY 2019 request provides $113 million for Personnel & Related Expenses to allow the Office of Airports to fulfill its mission of leadership in planning and developing a safe and efficient national airport system. It provides additional funding for: safety inspector positions; to develop upgrades to airports' national data systems; and to establish a permanent field office in Puerto Rico to provide Planning, Environmental,

Engineering, and Compliance services to support improvements to aging infrastructure at the 11 National Plan of Integrated Airport Systems airports in Puerto Rico and the U.S. Virgin Islands.

The budget requests $33.2 million for the Airport Technology Research program to support the safe and efficient integration of new technologies into the airport environment. Examples of these programs include airfield pavement testing, new airfield lighting technology, UAS operations, foreign object detection, and airport design standards to accommodate new aircraft. The Airport Cooperative Research program (ACRP) continues at the $15 million level. The FAA co-sponsors and provides expertise for ACRP projects in areas such as evaluating climate resilience, commercial space noise measurements, UAS operation at airports, safe construction practices, and emergency communications models.

Conclusion

Every day, tens of thousands of commercial flights, operating from a vast network of airports spanning 3.8 million square miles in the United States alone, will take off and land safely. The vast majority of flights will leave their gates on time and arrive on time. They will operate throughout their journeys under the watchful eyes of professional air traffic controllers in an air transportation system that is second to none.

In this age of globalization, America has a clear opportunity to lead the way, investing in our future and preparing our world class aviation system to meet increasing demands. America relies on civil aviation. A cornerstone of our nation's economy, it contributes approximately $1.5 trillion annually to the national economy, provides 12 million jobs, and constitutes 5.4 percent of the gross domestic product. The FY 2019 budget will enable us to continue protecting this vital economic engine, while operating the safest and most complex aerospace system in the world.

Since FY 2009, FAA has been funded through 44 appropriation cycles, including continuing resolutions, and 27 authorization cycles, including extensions. There have also been three lapses in authorizations and appropriations, as well as the FY 2013 Sequestration. These frequent challenges to long term capital planning and short term operations put pressure on our operations and are hindering us from transforming the NAS as efficiently and rapidly as our Nation deserves. Further, we can be more accountable to the users of the airspace with a transformation in our governance. The President recognizes our current constraints and our vast potential to help our economy grow, and has proposed a bold transformation that will be good for aviation, our stakeholders, and the citizens of our Nation. The time has come to make that transformation a reality, and we are up to the challenge.

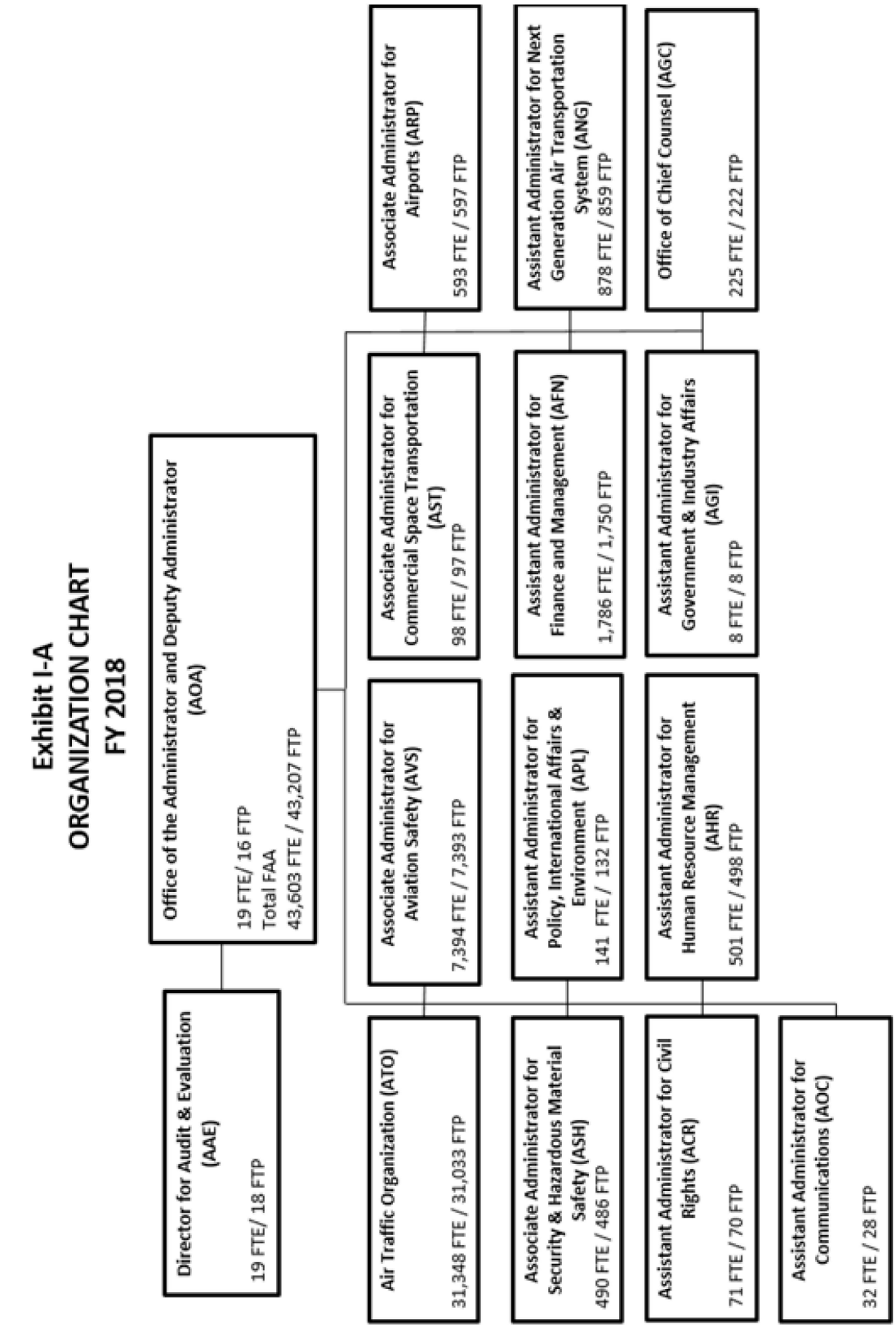
Exhibit I-A
ORGANIZATION CHART
FY 2018
Office of the Administrator and Deputy Administrator (AOA)
19 FTE/ 16 FTP
Total FAA
43,603 FTE / 43,207 FTP
Director for Audit & Evaluation (AAE)
19 FTE/ 18 FTP
Associate Administrator for Airports (ARP)
593 FTE / 597 FTP
Assistant Administrator for Next Generation Air Transportation System (ANG)
878 FTE / 859 FTP
Office of Chief Counsel (AGC)
225 FTE / 222 FTP
Associate Administrator for Commercial Space Transportation (AST)
98 FTE / 97 FTP
Assistant Administrator for Finance and Management (AFN)
1,786 FTE / 1,750 FTP
Assistant Administrator for Government & Industry Affairs (AGI)
8 FTE / 8 FTP
Associate Administrator for Aviation Safety (AVS)
7,394 FTE / 7,393 FTP
Assistant Administrator for Policy, International Affairs & Environment (APL)
141 FTE / 132 FTP
Assistant Administrator for Human Resource Management (AHR)
501 FTE / 498 FTP
Air Traffic Organization (ATO)
31,348 FTE / 31,033 FTP
Associate Administrator for Security & Hazardous Material Safety (ASH)
490 FTE / 486 FTP
Assistant Administrator for Civil Rights (ACR)
71 FTE / 70 FTP
Assistant Administrator for Communications (AOC)
32 FTE / 28 FTP

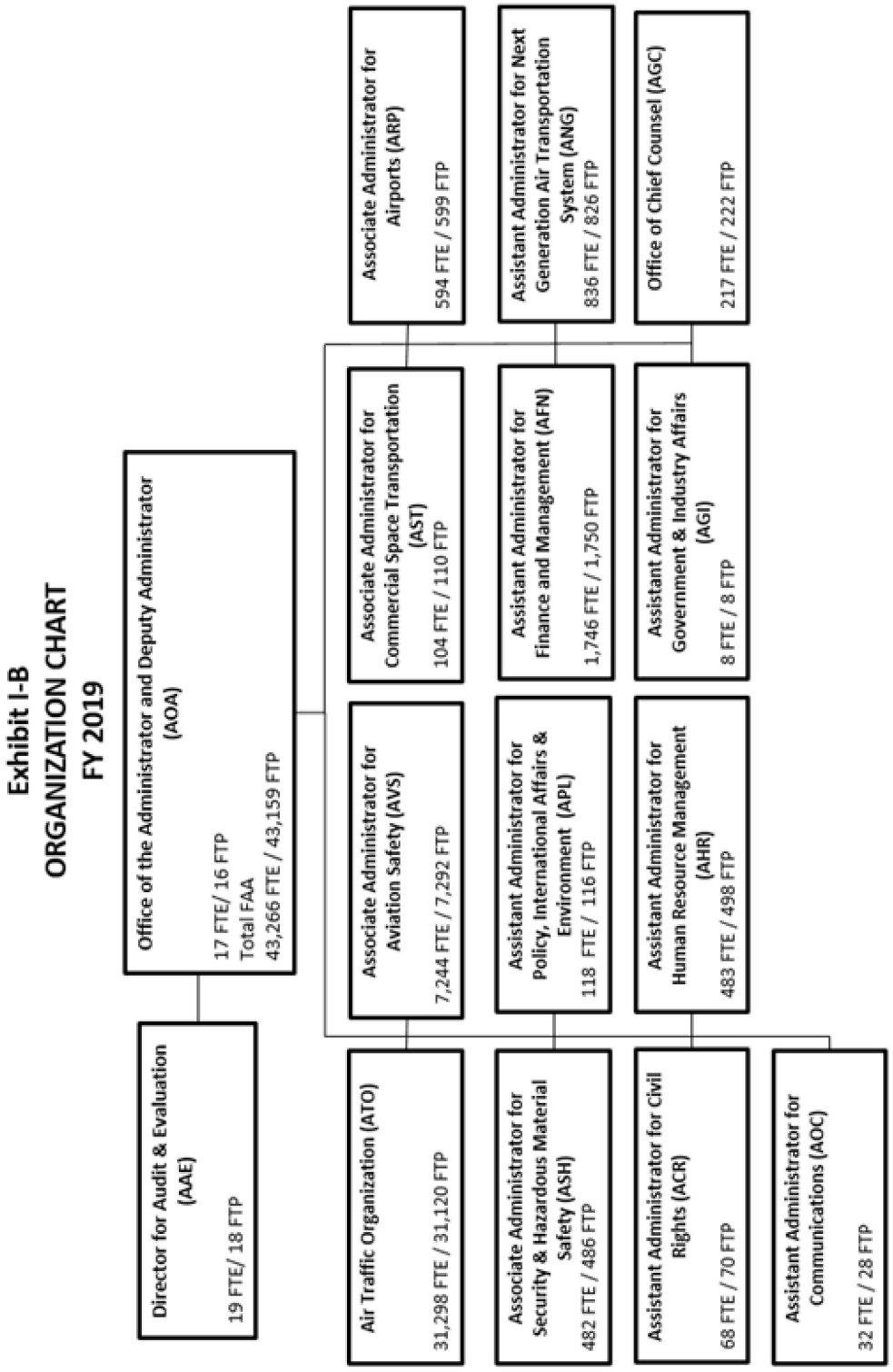
Exhibit I-B
ORGANIZATION CHART
FY 2019
Office of the Administrator and Deputy Administrator (AOA)
17 FTE/ 16 FTP
Total FAA
43,266 FTE / 43,159 FTP
Director for Audit & Evaluation (AAE)
19 FTE/ 18 FTP
Associate Administrator for Airports (ARP)
594 FTE / 599 FTP
Assistant Administrator for Next Generation Air Transportation System (ANG)
836 FTE / 826 FTP
Office of Chief Counsel (AGC)
217 FTE / 222 FTP
Associate Administrator for Commercial Space Transportation (AST)
104 FTE / 110 FTP
Assistant Administrator for Finance and Management (AFN)
1,746 FTE / 1,750 FTP
Assistant Administrator for Government & Industry Affairs (AGI)
8 FTE / 8 FTP
Associate Administrator for Aviation Safety (AVS)
7,244 FTE / 7,292 FTP
Assistant Administrator for Policy, International Affairs & Environment (APL)
118 FTE / 116 FTP
Assistant Administrator for Human Resource Management (AHR)
483 FTE / 498 FTP
Air Traffic Organization (ATO)
31,298 FTE / 31,120 FTP
Associate Administrator for Security & Hazardous Material Safety (ASH)
482 FTE / 486 FTP
Assistant Administrator for Civil Rights (ACR)
68 FTE / 70 FTP
Assistant Administrator for Communications (AOC)
32 FTE / 28 FTP

SECTION 2. BUDGET
SUMMARY TABLES

EXHIBIT II-1

FY 2019 COMPARATIVE STATEMENT OF NEW BUDGET AUTHORITY
FEDERAL AVIATION ADMINISTRATION
($000)

ACCOUNT NAME	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
Operations	$10,025,852	$9,957,766	$9,931,312
Rescission			
Subtotal	**$10,025,852**	**$9,957,766**	**$9,931,312**
Facilities and Equipment	$2,855,000	$2,835,612	$2,766,572
Rescission			
Cancellation			
Subtotal	**$2,855,000**	**$2,835,612**	**$2,766,572**
Research, Engineering and Development	$176,500	$175,301	$74,406
Rescission			
Subtotal	**$176,500**	**$175,301**	**$74,406**
Grants-in-Aid for Airports			
Contract Authority (AATF)	$3,350,000	$3,350,000	$3,350,000
Rescission			
Subtotal	**$3,350,000**	**$3,350,000**	**$3,350,000**
Obligation Limitation [Non-Add]	[3,350,000]	[3,327,250]	[3,350,000]
Overflight Fees	$137,778	$140,257	$140,176
Overflight Fees (Transfer to EAS)	($130,828)	($140,257)	($140,176)
TOTAL	**$16,414,302**	**$16,318,679**	**$16,122,290**
Appropriations	$16,414,302	$16,318,679	$16,122,290
Rescissions	$0	$0	$0
Cancellations	$0	$0	$0

EXHIBIT II-2

FY 2019 TOTAL BUDGETARY RESOURCES BY APPROPRIATION ACCOUNT
FEDERAL AVIATION ADMINISTRATION
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
Operations	**10,025,852**	**9,957,766**	**9,931,312**
Air Traffic Organization (ATO)	7,559,785	7,508,447	7,495,690
Aviation Safety (AVS)	1,298,482	1,289,664	1,276,255
Commercial Space Transportation (AST)	19,826	19,691	21,578
Finance & Management (AFN)	771,342	766,104	771,010
NextGen (ANG)	60,155	59,746	58,536
Security and Hazardous Materials Safety (ASH)	107,161	106,433	105,558
Staff Offices	209,101	207,681	202,685
Facilities & Equipment	**2,855,000**	**2,835,612**	**2,766,572**
Engineering, Development, Test and Evaluation	156,960	151,100	166,889
Air Traffic Control Facilities and Equipment	1,791,710	1,783,312	1,681,193
Non-Air Traffic Control Facilities and Equipment	182,930	192,000	201,899
Facilities and Equipment Mission Support	237,400	226,500	227,019
Personnel and Related Expenses	486,000	482,700	489,572
Research, Engineering & Development	**176,500**	**175,301**	**74,406**
Improve Aviation Safety	105,370	104,718	43,935
Improve Efficiency	22,243	22,067	8,647
Reduce Environmental Impacts	43,187	42,834	19,166
Mission Support	5,700	5,682	2,658
Grants-in-Aid for Airports	**3,350,000**	**3,327,250**	**3,350,000**
Grants-in-Aid for Airports	3,185,934	3,164,298	3,189,206
Personnel & Related Expenses	107,691	106,960	112,600
Airport Technology Research	31,375	31,162	33,194
Airport Cooperative Research Program	15,000	14,898	15,000
Small Community Air Service	10,000	9,932	0
TOTAL:	**16,407,352**	**16,295,929**	**16,122,290**

EXHIBIT II-3

FY2019 BUDGET REQUEST BY DOT STRATEGIC AND ORGANIZATIONAL GOALS
FEDERAL AVIATION ADMINISTRATION
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

	Safety	Infrastructure	Innovation	Accountabilit	Total
Operations	**5,708,768**	**2,714,147**	**49,821**	**1,458,576**	**9,931,312**
Air Traffic Organization (ATO)	4,376,244	2,655,611	31,476	432,358	**7,495,690**
Aviation Safety (AVS)	1,205,387	-	18,345	52,523	**1,276,255**
Commercial Space Transportation (AST)	21,578	-	-	-	**21,578**
Finance & Management (AFN)	-	-	-	771,010	**771,010**
NextGen (ANG)	-	58,536	-	-	**58,536**
Security and Hazardous Materials Safety (ASH)	105,558	-	-	-	**105,558**
Staff Offices	-	-	-	202,685	**202,685**
Facilities & Equipment	**164,970**	**1,633,968**	**858,031**	**109,603**	**2,766,572**
Engineering, Development, Test and Evaluation	-	12,000	154,889	-	**166,889**
Air Traffic Control Facilities and Equipment	46,600	1,042,388	550,305	41,900	**1,681,193**
Non-Air Traffic Control Facilities and Equipment	89,177	64,414	-	48,308	**201,899**
Facilities and Equipment Mission Support	-	226,019	1,000	-	**227,019**
Personnel and Related Expenses	29,193	289,147	151,837	19,395	**489,572**
Research, Engineering & Development	**43,935**	**19,166**	**8,647**	**2,658**	**74,406**
Improve Aviation Safety	43,935	-	-	1,891	**45,826**
Improve Efficiency	-	-	8,647	372	**9,019**
Reduce Environmental Impacts	-	19,166	-	395	**19,561**
Mission Support	-	-	-	-	**-**
Grants-in-Aid for Airports	**1,467,736**	**1,441,221**	**440,416**	**627**	**3,350,000**
Grants-in-Aid for Airports	1,387,304	1,377,738	424,164	-	**3,189,206**
Personnel & Related Expenses	56,917	43,804	11,252	627	**112,600**
Airport Technology Research	18,515	14,679	-	-	**33,194**
Small Community Air Service	-	-	-	-	**-**
Airport Cooperative Research Program	5,000	5,000	5,000	-	**15,000**
TOTAL:	**7,385,409**	**5,808,502**	**1,356,915**	**1,571,464**	**16,122,290**

EXHIBIT II-4

FY 2019 BUDGET AUTHORITY
FEDERAL AVIATION ADMINISTRATION
($000)

ACCOUNT NAME	Mandatory/ Discretionary	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
Operations	**D**	**$10,025,852**	**$9,957,766**	**$9,931,312**
General		$852,852	$847,060	$1,298,591
AATF		$9,173,000	$9,110,706	$8,632,721
Facilities & Equipment (AATF)	**D**	**$2,855,000**	**$2,835,612**	**$2,766,572**
AATF	**D**			
Research, Engineering & Development (AAT	**D**	**$176,500**	**$175,301**	**$74,406**
Grants in Aid for Airports (AATF)	**M**	**$3,350,000**	**$3,350,000**	**$3,350,000**
Contract Authority (AATF)	**M**	$3,350,000	$3,350,000	$3,350,000
Pop Up Contract Authority (49 USC 48112)	**D/M**			
Rescission	**D/M**			
Cancellation - CHIMPS	**D/M**			
Aviation User Fees	**M**	**$137,778**	**$140,257**	**$140,176**
Aviation User Fees (transfer to EAS)	**M**	**($130,828)**	**($140,257)**	**($140,176)**
TOTAL:		**$16,414,302**	**$16,318,679**	**$16,122,290**
[Mandatory]		$3,356,950	$3,350,000	$3,350,000
[Discretionary]		$13,057,352	$12,968,679	$12,772,290
[General]		$852,852	$847,060	$1,298,591
[AATF]		$15,554,500	$15,471,619	$14,823,699

Note: Totals may not add due to rounding.

EXHIBIT II-5

FY 2019 OUTLAYS
FEDERAL AVIATION ADMINISTRATION
($000)

ACCOUNT NAME	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
Operations	**$9,988,146**	**$10,200,600**	**$10,169,560**
General	$1,093,146	$811,600	$1,536,560
AATF	$8,895,000	$9,389,000	$8,633,000
Facilities & Equipment	**$2,531,000**	**$2,927,178**	**$2,924,178**
AATF			
- Discretionary	$2,546,360		
- Mandatory	($15,360)		
Aviation Insurance Revolving Account (M)	**($56,301)**	**($38,000)**	**($56,000)**
Research, Engineering & Development	**$161,080**	**$194,160**	**$151,120**
Grants-in-Aid for Airports	**$3,282,679**	**$3,444,164**	**$3,471,314**
Aviation User Fees (Overflight) (M)	**$1,003**	**$3,395**	**$0**
Franchise Fund	**($40,538)**	**$30,000**	**($17,000)**
TOTAL:	**$15,867,069**	**$16,761,497**	**$16,643,172**
[Mandatory]	($70,658)	($34,605)	($56,000)
[Discretionary]	$15,937,727	$16,796,102	$16,699,172

EXHIBIT II-6
SUMMARY OF REQUESTED FUNDING CHANGES FROM BASE
Federal Aviation Administration
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

			Baseline Changes									
Operations	**FY 2017 Actual**	**FY 2018 Annualized CR**	**Annualization of 2018 Pay Raises**	**Annualization of 2018 FTE**	**2019 Pay Raises**	**Extra Compensable Day (261 days)**	**GSA Rent**	**WCF Increase/ Decrease**	**Inflation/ Deflation**	**FY 2019 Baseline Estimate**	**Program Increases/ Decreases**	**FY 2019 Request**
PERSONNEL RESOURCES (FTE)												
Direct FTE	40,117	40,117								40,117	-226	39,891
FINANCIAL RESOURCES												
ADMINISTRATIVE EXPENSES												
Salaries and Benefits	$7,054,228	$7,142,822	$33,675		$0	$26,232				$7,202,729	($39,385)	$7,163,344
Travel	$161,433	$150,447								$150,447	$0	$150,447
Transportation	$23,524	$23,524								$23,524	$0	$23,524
GSA Rent	$112,339	$114,549					$6,600			$121,149	$0	$121,149
Rental Payments to Other	$53,564	$53,564								$53,564	$0	$53,564
Communications, & Utilities	$318,544	$320,144								$320,144	$0	$320,144
Printing	$6,818	$6,818								$6,818	$0	$6,818
Other Services	$2,099,448	$1,953,453						$538		$1,953,991	($54,114)	$1,899,877
Supplies	$140,034	$136,465								$136,465	$0	$136,465
Equipment	$51,249	$51,309								$51,309	$0	$51,309
Land and Strructure	$462	$462								$462	$0	$462
Grants, Claims and Subsidies	$2,640	$2,640								$2,640	$0	$2,640
Insurance Claims and Indemnities	$1,569	$1,569								$1,569	$0	$1,569
Admin Subtotal	**$10,025,852**	**$9,957,766**	**$33,675**	**$0**	**$0**	**$26,232**	**$6,600**	**$538**	**$0**	**$10,024,811**	**($93,499)**	**$9,931,312**
PROGRAMS												
Air Traffic Organization (ATO)	$7,559,785	$7,508,447	$25,920			$19,985		($189)		$7,554,163	($58,473)	$7,495,690
Aviation Safety (AVS)	$1,298,482	$1,289,664	$5,171			$4,155		($428)		$1,298,562	($22,307)	$1,276,255
Commercial Space Transportation (AST)	$19,826	$19,691	$76			$65				$19,832	$1,746	$21,578
Finance and Management (AFN)	$771,342	$766,104	$1,251			$1,023	$6,600	$2,065		$777,043	($6,033)	$771,010
NextGen (ANG)	$60,155	$59,746	$138			$111		$53		$60,048	($1,512)	$58,536
Security and Hazardous Materials Safety (AS	$107,161	$106,433	$353			$297		($323)		$106,760	($1,202)	$105,558
Staff Offices	$209,101	$207,681	$766			$596		($640)		$208,403	($5,718)	$202,685
Programs Subtotal	**$10,025,852**	**$9,957,766**	**$33,675**	**$0**	**$0**	**$26,232**	**$6,600**	**$538**	**$0**	**$10,024,811**	**($93,499)**	**$9,931,312**
TOTAL	**$10,025,852**	**$9,957,766**	**$33,675**	**$0**	**$0**	**$26,232**	**$6,600**	**$538**	**$0**	**$10,024,811**	**($93,499)**	**$9,931,312**

EXHIBIT II-6
SUMMARY OF REQUESTED FUNDING CHANGES FROM BASE
Federal Aviation Administration
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

Facilities & Equipment	FY 2017 Actual	FY 2018 Annualized CR	Baseline Changes: Annualization of 2018 Pay Raises	Annualization of 2018 FTE	2019 Pay Raises	One More Compensable Day (261 days)	GSA Rent	WCF Increase / Decrease	Inflation / Deflation	FY 2019 Baseline Estimate	Program Increases / Decreases	FY 2019 Request
PERSONNEL RESOURCES (FTE)												
Direct FTE	2,687	2,664								2,664	-15	2,649
FINANCIAL RESOURCES												
ADMINISTRATIVE EXPENSES												
Salaries and Benefits	423,732	$429,388	$2,010	$0	$0	$1,606				$433,004	($1,744)	$431,260
Travel	44,218	$39,160								$39,160	$5,000	$44,160
Transportation	2,440	$2,288								$2,288	$23	$2,311
GSA Rent										$0	$0	
Rental Payments to Others	36,000	$43,249								$43,249	$941	$44,190
Communications, & Utilities	45,000	$46,915								$46,915	$479	$47,394
Printing	30	$30								$30	$0	$30
Other Services:	1,989,325	1,946,647								$1,946,647	($107,521)	1,839,126
-WCF	48	$49						$1		$50	$0	$50
Supplies	21,519	$26,704								$26,704	$272	$26,976
Equipment	183,185	$188,185								$188,185	$12,719	$200,904
Lands and Struc tures	105,000	$110,000								$110,000	$17,143	$127,143
Grants, Claims, Subsidies and Interest	4,503	$2,997								$2,997	$31	$3,028
Admin Subtotal	**$2,855,000**	**$2,835,612**	**$2,010**	**$0**	**$0**	**$1,606**	**$0**	**$1**	**$0**	**$2,839,229**	**($72,657)**	**$2,766,572**
PROGRAMS												
Engineering, Development, Test and Evaluatior	156,960	151,100								151,100	15,789	166,889
Air Traffic Control Facilities and Equipment	1,791,710	1,783,312								1,783,312	(102,119)	1,681,193
Non-Air Traffic Control Facilities and Equipment	182,930	192,000								192,000	9,899	201,899
Facilities and Equipment Mission Support	237,400	226,500								226,500	519	227,019
Personnel & Related Expenses	486,000	482,700	2,010		-	1,606		1		486,317	3,255	489,572
Programs Subtotal	**2,855,000**	**2,835,612**	**$2,010**	**$0**	**$0**	**$1,606**	**$0**	**$1**	**-**	**2,839,229**	**(72,657)**	**2,766,572**
TOTAL	**2,855,000**	**2,835,612**	**$2,010**	**$0**	**$0**	**$1,606**	**$0**	**$1**	**-**	**2,839,229**	**(72,657)**	**2,766,572**

EXHIBIT II-6
SUMMARY OF REQUESTED FUNDING CHANGES FROM BASE
Federal Aviation Administration
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

Research, Engineering and Development	FY 2017 Actual	FY 2018 Annualized CR	Baseline Changes: Annualization of 2018 Pay Raises	Annualization of 2018 FTE	2019 Pay Raises	One more Compensable Days (261 days)	GSA Rent	WCF Increase/ Decrease	Inflation/ Deflation	FY 2019 Baseline Estimate	Program Increases/ Decreases	FY 2019 Request
PERSONNEL RESOURCES (FTE)	230	229								229	-97	132
Direct FTE	230	229								229	-97	132
FINANCIAL RESOURCES												
ADMINISTRATIVE EXPENSES												
Salaries and Benefits	$39,021	$39,021	$185			$150				$39,356	($18,450)	$20,906
Travel	$1,756	$1,756								$1,756	($872)	$884
Transportation	$138	$101								$101		$101
GSA Rent										$0		$0
Communications, & Utilities	$18	$18								$18		$18
Printing	$8	$8								$8		$8
Other Services:	$102,210	$98,618								$98,618	($81,908)	$16,710
-WCF		$0								$0		$0
Supplies	$2,931	$3,268								$3,268		$3,268
Equipment	$1,841	$1,954								$1,954		$1,954
Grants, Claims & Subsidies	$28,577	$30,557								$30,557		$30,557
Admin Subtotal	**$176,500**	**$175,301**	**$185**	**$0**	**$0**	**$150**	**$0**	**$0**	**$0**	**$175,636**	**($101,230)**	**$74,406**
PROGRAMS												
Improve Aviation Safety	$105,370	$104,718	$144			$116				$104,978	($61,043)	$43,935
Improve Efficiency	$22,243	$22,067	$10			$8				$22,085	($13,438)	$8,647
Reduce Environmental Impacts	$43,187	$42,834	$14			$11				$42,859	($23,693)	$19,166
Mission Support	$5,700	$5,682	$17			$15				$5,714	($3,056)	$2,658
Programs Subtotal	**$176,500**	**$175,301**	**$185**	**$0**	**$0**	**$150**	**$0**	**$0**	**$0**	**$175,636**	**($101,230)**	**$74,406**
TOTAL	**$176,500**	**$175,301**	**$185**	**$0**	**$0**	**$150**	**$0**	**$0**	**$0**	**$175,636**	**($101,230)**	**$74,406**

EXHIBIT II-6
SUMMARY OF REQUESTED FUNDING CHANGES FROM BASE
Federal Aviation Administration
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

			Baseline Changes									
Grants-in-Aid for Airports	**FY 2017 Actual**	**FY 2018 Annualized CR**	**Annualization of 2018 Pay Raises**	**Annualization of 2018 FTE**	**2019 Pay Raises**	**One More Compensable Day**	**GSA Rent**	**WCF Increase / Decrease**	**Inflation / Deflation**	**FY 2019 Baseline Estimate**	**Program Increases / Decreases**	**FY 2019 Request**
PERSONNEL RESOURCES (FTE)												
Direct FTE	589	599								593	1	594
FINANCIAL RESOURCES												
ADMINISTRATIVE EXPENSES												
Salaries and Benefits	91,444	91,426	434			352				92,213	150	92,363
Travel	2,982	3,156								3,156		3,156
Transportation	266	124								124		124
GSA Rent	103	104								104		104
Rental Payments to Others	888	789								789	200	989
Communications, Rent & Utilities	501	265								265	15	280
Printing	502	27								27		27
Other Services:										0		0
-WCF	134	133						-5		128		128
-Advisory and Assistance Services	26,737	23,073								23,073	6,480	29,553
-Other	29,070	36,267								36,267		36,267
Supplies	659	1,122								1,122	20	1,142
Equipment	982	1,236								1,236	15	1,251
Lands and Structures	1,013	496								496		496
Grants, Claims & Subsidies	3,184,682	3,159,080								3,159,080	25,020	3,184,100
Insurance Claims and Indemnities	1	1								1		1
Interest and Dividends	36	19								19		19
Financial transfers	10,000	9,932								9,932	-9,932	0
Admin Subtotal	**3,350,000**	**3,327,250**	**434**	**0**	**0**	**352**	**0**	**-5**	**0**	**3,328,032**	**21,968**	**3,350,000**
PROGRAMS												
Grants	3,185,934	3,164,298								3,164,298	24,908	3,189,206
Personnel and Related Expenses	107,691	106,960	416			337		-5		107,708	4,892	112,600
Airport Technology Research	31,375	31,162	17			14				31,194	2,000	33,194
Airport Cooperative Research	15,000	14,898	1			1				14,900	100	15,000
Small Community Air Service	10,000	9,932								9,932	-9,932	0
Programs Subtotal	**3,350,000**	**3,327,250**	**434**	**0**	**0**	**352**	**0**	**-5**	**0**	**3,328,032**	**21,968**	**3,350,000**
TOTAL	**3,350,000**	**3,327,250**	**434**	**0**	**0**	**352**	**0**	**-5**	**0**	**3,328,032**	**21,968**	**3,350,000**

EXHIBIT II-7
WORKING CAPITAL FUND
FEDERAL AVIATION ADMINISTRATION
($000)

	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
DIRECT:			
Facilities & Equipment	48	49	50
Grants-in-Aid for Airports	143	134	128
Operations	52,738	54,572	55,110
TOTAL	**$ 52,929**	**$ 54,755**	**$ 55,288**

Footnote:
F&E and Grants-in-Aid for Airports funding only support E-gov Initiatives

EXHIBIT II-8
FEDERAL AVIATION ADMINISTRATION
PERSONNEL RESOURCE -- SUMMARY
TOTAL FULL-TIME EQUIVALENTS

	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
DIRECT FUNDED BY APPROPRIATION			
Operations	40,117	40,117	39,891
Facilities & Equipment	2,687	2,664	2,649
Research, Engineering & Development	230	229	132
Grants-in-Aid for Airports	589	593	594
SUBTOTAL, DIRECT FUNDED	**43,623**	**43,603**	**43,266**
REIMBURSEMENTS / ALLOCATIONS / OTHER			
Reimbursements and 'Other'			
Operations	240	228	228
Aviation Insurance Revolving Fund	3	3	4
Facilities & Equipment	54	54	55
Grants-in-Aid for Airports	-	2	1
Administrative Services Franchise Fund	1,627	1,627	1,593
Allocations from other Organizations			
SUBTOTAL, REIMBURSE./ALLOC./OTH.	**1,924**	**1,914**	**1,881**
TOTAL FTEs	**45,547**	**45,517**	**45,147**

EXHIBIT II-9
FEDERAL AVIATION ADMINISTRATION
RESOURCE SUMMARY – STAFFING
FULL-TIME PERMANENT POSITIONS

	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
DIRECT FUNDED BY APPROPRIATION			
Operations	39,634	39,675	39,722
Facilities & Equipment	2,717	2,706	2,706
Research, Engineering & Development	223	229	132
Grants-in-Aid for Airports	570	597	599
SUBTOTAL, DIRECT FUNDED	**43,144**	**43,207**	**43,159**
REIMBURSEMENTS/ALLOCATIONS/OTHER			
Reimbursements and 'Other'			
Operations	110	236	236
Aviation Insurance Revolving Fund	3	4	4
Facilities & Equipment	-	4	4
Grants-in-Aid for Airports	-	2	2
Administrative Services Franchise Fund	1,597	1,594	1,560
Allocations from other Organizations			
SUBTOTAL, REIMBURSE./ALLOC./OTH.	**1,710**	**1,840**	**1,806**
TOTAL POSITIONS	**44,854**	**45,047**	**44,965**

EXHIBIT II-10
FEDERAL AVIATION ADMINISTRATION
USER FEES
($000)

	FY 2017 Actual	FY 2018 ESTIMATE	FY 2019 ESTIMATE
USER FEE			
Civil Aviation Registry Fees	1,277	1,300	1,300
Foreign Repair Station/Certification Fees	11,163	10,000	10,000
Aeronautical Charting Fees	354	46	46
Overflight Fees	122,438	131,231	140,177
Unmanned Aircraft Systems Registry Fees	1,706	1,000	1,000
Total User Fees	**136,938**	**143,577**	**152,523**

SECTION 3. BUDGET BY APPROPRIATIONS ACCOUNT

OPERATIONS

(AIRPORT AND AIRWAY TRUST FUND)

For necessary expenses of the Federal Aviation Administration, not otherwise provided for, including operations and research activities related to commercial space transportation, administrative expenses for research and development, establishment of air navigation facilities, the operation (including leasing) and maintenance of aircraft, subsidizing the cost of aeronautical charts and maps sold to the public, lease or purchase of passenger motor vehicles for replacement only, in addition to amounts made available by Public Law 112–95, $9,931,312,000 to remain available until September 30, 2020, of which $8,632,721,000 shall be derived from the Airport and Airway Trust Fund: Provided, That not later than 60 days after the submission of the President's budget request, the Administrator of the Federal Aviation Administration shall transmit to Congress an annual update to the report submitted to Congress in December 2004 pursuant to section 221 of Public Law 108–176: Provided further, That not later than 60 days after the submission of the President's budget request, the Administrator shall transmit to Congress a companion report that describes a comprehensive strategy for staffing, hiring, and training flight standards and aircraft certification staff in a format similar to the one utilized for the controller staffing plan, including stated attrition estimates and numerical hiring goals by fiscal year: Provided further, That funds may be used to enter into a grant agreement with a nonprofit standard-setting organization to assist in the development of aviation safety standards: Provided further, That none of the funds in this Act shall be available for new applicants for the second career training program: Provided further, That there may be credited to this appropriation, as offsetting collections, funds received from States, counties, municipalities, foreign authorities, other public authorities, and private sources for expenses incurred in the provision of agency services, including receipts for the maintenance and operation of air navigation facilities, and for issuance, renewal or modification of certificates, including airman, aircraft, and repair station certificates, or for tests related thereto, or for processing major repair or alteration forms.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

Program and Financing (in millions of dollars)

Identification code: 69-1301-0-1-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Obligations by program activity:			
0001	Air Traffic Organization (ATO)	7,542	7,541	7,497
0002	NextGen	60	60	59
0003	Finance & Management	773	770	773
0004	Regulation & Certification	1,302	1,303	1,286
0005	Commercial Space Transportation	19	21	22
0006	Security & Hazardous Materials Safety	103	110	106
0007	Staff Offices	206	211	203
0100	Direct Program Activities Subtotal	10,005	10,016	9,946
0799	Total Direct Obligations	10,005	10,016	9,946
0801	Operations (Reimbursable)	145	143	145
0900	Total new obligations, unexpired accounts	10,150	10,159	10,091
	Budget resources:			
1000	Unobligated balance brought forward, Oct. 1	52	86	.....
1011	Unobligated balance transferred from other acct [072-1037]	3	.....	.....
1021	Recoveries of prior year unpaid obligations	3	.....	.....
1050	Unobligated balance (total)	58	86	.....
	Budget authority:			
	Appropriations, discretionary:			
1100	Appropriation	853	847	1,299
	Spending authority from offsetting collections, discretionary,			
1700	Collected	8,982	9,504	8,838
1701	Change in uncollected payments, Federal sources	343	-278	.....
1750	Spending auth from offsetting collections, disc (total)	9,325	9,226	8,838
1900	Budget authority (total)	10,178	10,073	10,137
1930	Total budgetary resources available	10,236	10,159	10,137
	Memorandum (non-add) entries:			
1941	Unexpired unobligated balance, end of year	86	.....	46
	Change in obligated balance:			
	Unpaid obligations:			
3000	Unpaid obligations, brought forward, Oct. 1	1,616	1,586	1,430
3010	New Obligations, unexpired accounts	10,150	10,159	10,091
3011	Obligations ("upward adjustments"), expired accounts	37	.....	.....
3020	Outlays (gross)	-10,150	-10,315	-10,374
3040	Recoveries of prior year unpaid obligations, unexpired	-3	.....	.....
3041	Recoveries of prior year unpaid obligations, expired	-64	.....	.....
3050	Unpaid obligations, end of year	1,586	1,430	1,147
	Uncollected payments:			
3060	Uncollected pymts, Fed sources, brought forward, Oct 1	-140	-408	-130
3070	Change in uncollected pymts, Fed sources, unexpired	-343	278	.....
3071	Change in uncollected pymts, Fed sources, expired	75	.....	.....
3090	Uncollected pymts, Fed sources, end of year	-408	-130	-130
	Memorandum (non-add) entries:			
3100	Obligated balance, start of year	1,476	1,178	1,300
3200	Obligated balance, end of year	1,178	1,300	1,017
	Budget authority and outlays, net:			
	Discretionary:			
4000	Budget authority, gross	10,178	10,073	10,137
	Outlays, gross:			
4010	Outlays from new discretionary authority	8,805	8,878	8,945
4011	Outlays from discretionary balances	1,345	1,437	1,429
4020	Outlays, gross (total)	10,150	10,315	10,374
	Offsets against gross budget authority and outlays:			

Identification code: 69-1301-0-1-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Offsetting collections (collected) from:			
4030	Federal sources	-9,026	-9,473	-8,806
4033	Non-Federal sources	-29	-29	-29
4034	Offsetting governmental collections	-2	-2	-3
4040	Offsets against gross budget authority and outlays (total)	-9,057	-9,504	-8,838
	Additional offsets against gross budget authority only:			
4050	Change in uncollected pymts, Federal sources, unexpired	-343	278	.....
4052	Offsetting collections credited to expired accounts	75	.....	.....
4060	Additional offsets against budget authority only (total)	-268	278	.....
4070	Budget authority, net (discretionary)	853	847	1,299
4080	Outlays, net (discretionary)	1,093	811	1,536
4180	Budget authority, net (total)	853	847	1,299
4190	Outlays, net (total)	1,093	811	1,536
	Memorandum (non-add) entries:			
5093	Unavailable balance, SOF: Offsetting collections	1	1	1
5095	Unavailable balance, EOY: Offsetting collections	1	1	1

For 2019, the Budget requests $9,931 million for Federal Aviation Administration (FAA) operations. These funds will be used to continue to promote aviation safety and efficiency. The Budget provides funding for the Air Traffic Organization (ATO) which is responsible for managing the air traffic control system. As a performance-based organization, the ATO is designed to provide cost-effective, efficient, and, above all, safe air traffic services. The Budget also funds the Aviation Safety Organization which ensures the safe operation of the airlines and certifies new aviation products. In addition, the request also funds regulation of the commercial space transportation industry, as well as FAA policy oversight and overall management functions.

Object Classification (in millions of dollars)

Identification code: 69-1301-0-1-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent	4,590	4,631	4,631
11.3	Other than full-time permanent	31	31	32
11.5	Other personnel compensation	425	433	436
11.9	Total personnel compensation	5,046	5,095	5,099
12.1	Civilian personnel benefits	2,006	2,046	2,063
13.0	Benefits for former personnel	2	2	2
21.0	Travel and transportation of persons	161	150	150
22.0	Transportation of things	24	24	24
23.1	Rental payments to GSA	112	115	121
23.2	Rental payments to others	54	54	54
23.3	Communications, utilities, and miscellaneous charges	319	320	320
24.0	Printing and reproduction	9	8	8
25.1	Advisory and assistance services	689	695	685
25.2	Other services from non-Federal sources	1,387	1,315	1,227
26.0	Supplies and materials	140	135	136
31.0	Equipment	51	52	52
41.0	Grants, subsidies, and contributions	3	3	3
42.0	Insurance claims and indemnities	2	2	2
99.0	Direct obligations	10,005	10,016	9,946
99.0	Reimbursable obligations	145	143	145
99.9	Total new obligations	10,150	10,159	10,091

Employment Summary

Identification code: 69-1301-0-1-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
1001	Direct civilian full-time equivalent employment	40,117	40,117	39,891
2001	Reimbursable civilian full-time equivalent employment	240	228	228

EXHIBIT III-1

OPERATIONS
Summary by Program Activity
Appropriations, Obligations Limitations, and Exempt Obligations
($000)

	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
Air Traffic Organization (ATO)	$ 7,559,785	$ 7,508,447	$ 7,495,690
Aviation Safety (AVS)	$ 1,298,482	$ 1,289,664	$ 1,276,255
Commercial Space (AST)	$ 19,826	$ 19,691	$ 21,578
Finance & Management (AFN)	$ 771,342	$ 766,104	$ 771,010
NextGen (ANG)	$ 60,155	$ 59,746	$ 58,536
Security and Hazardous Materials Safety (ASH)	$ 107,161	$ 106,433	$ 105,558
Staff Offices	$ 209,101	$ 207,681	$ 202,685
TOTAL	**$10,025,852**	**$9,957,766**	**$9,931,312**
FTEs			
Direct Funded	40,117	40,117	39,891
Reimbursable, allocated, other	240	228	228

Program and Performance Statement

This account provides funds for the operation, maintenance, communications and logistical support of the air traffic control and air navigation systems. It also covers administrative and managerial costs for the FAA's regulatory, international, medical, engineering and development programs as well as policy oversight and overall management functions. The operations appropriation includes the following major activities:

(1) operation on a 24-hour daily basis of a national air traffic system;
(2) establishment and maintenance of a national system of aids to navigation;
(3) establishment and surveillance of civil air regulations to assure safety in aviation;
(4) development of standards, rules and regulations governing the physical fitness of airmen as well as the administration of an aviation medical research program;
(5) regulation of the commercial space transportation industry;
(6) administration of acquisition programs; and
(7) headquarters, administration and other staff offices.

Operations Summary
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$9,957,766**	**39,675**	**739**	**40,117**
Adjustments to Base	**$67,045**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	33,675	0	0	0
Extra Compensable Day (261)	26,232	0	0	0
GSA Rent	6,600	0	0	0
Working Capital Fund	538	0	0	0
Other Changes	**-$93,499**	**13**	**0**	**-260**
Contract Weather Observers	-16,406	0	0	0
Flight Service Stations	-37,380	0	0	0
Workforce Reduction Through Attrition	-41,672	0	0	-267
Regulatory Reform	1,959	13	0	7
Base Transfers	**$0**	**34**	**0**	**34**
Global Leadesrhip Initiative	0	0	0	0
Flight Programs Operations	0	34	0	34
FY 2019 Request	**$9,931,312**	**39,722**	**739**	**39,891**

Base Transfer Summary
($000)

	LOB/SO	FTE	FTP	Funding	LOB/SO	FTE	FTP	Funding
Global Leadership Initiative	ANG	-1	-1	-$250	APL	1	1	$250
*Flight Program Operations	AVS/ ANG	-34	-34	-$15,221	ATO	68	68	$15,221
Total		**-35**	**-35**	**-$15,471**		**69**	**69**	**$15,471**

*The Flight Program Operations transfer includes 34 FTP/FTE from the Air Traffic Organization (ATO) Franchise Fund account to the ATO Operations account.

Staffing Summary -- FY 2017 - FY 2019					
		Type	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Air Traffic Organization	ATO	FTP	29,058	29,058	29,126
		OTFTP	677	677	677
		FTE	29,438	29,438	29,379
Associate Administrator for Aviation Safety	AVS	FTP	7,225	7,266	7,236
		OTFTP	20	20	20
		FTE	7,266	7,266	7,187
Associate Administrator for Commercial Space Transportation	AST	FTP	97	97	110
		OTFTP	-	-	-
		FTE	98	98	104
Assistant Administrator for Finance and Management	AFN	FTP	1,610	1,610	1,610
		OTFTP	15	15	15
		FTE	1,635	1,635	1,596
Assistant Administrator for Next Generation Air Transportation System	ANG	FTP	183	183	178
		OTFTP	5	5	5
		FTE	191	191	181
Associate Administrator for Security and Hazardous Materials Safety	ASH	FTP	486	486	486
		OTFTP	1	1	1
		FTE	490	490	482
Staff Offices: Assistant Administrator for Human Resource Management	AHR	FTP	498	498	498
		OTFTP	2	2	2
		FTE	501	501	483
Staff Offices: Office of the Administrator and Deputy	AOA	FTP	16	16	16
		OTFTP	3	3	3
		FTE	19	19	17
Staff Offices: Assistant Administrator for Audit and Evaluation	AAE	FTP	18	18	18
		OTFTP	1	1	1
		FTE	19	19	19
Staff Offices: Assistant Administrator for Civil Rights	ACR	FTP	70	70	70
		OTFTP	2	2	2
		FTE	71	71	68
Staff Offices: Asst. Administrator for Government and Industry Affairs	AGI	FTP	8	8	8
		OTFTP	1	1	1
		FTE	8	8	8
Staff Offices: Assistant Administrator for Communications	AOC	FTP	28	28	28
		OTFTP	1	1	1
		FTE	32	32	32
Staff Offices: Office of Chief Counsel	AGC	FTP	222	222	222
		OTFTP	5	5	5
		FTE	225	225	217
Staff Offices: Asst. Administrator for Policy, International Affairs and Environment	APL	FTP	115	115	116
		OTFTP	6	6	6
		FTE	124	124	118
Total		FTP	39,634	39,675	39,722
		OTFTP	739	739	739
		FTE	40,117	40,117	39,891

Resource Summary -- FY 2017 - FY 2019 ($000)

			FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Air Traffic Organization (ATO)		pcb	$ 5,443,242	$ 5,526,514	$ 5,557,535
		o/o	$ 2,116,543	$ 1,981,933	$ 1,938,155
ATO Total			**$ 7,559,785**	**$ 7,508,447**	**$ 7,495,690**
Associate Administrator for Aviation Safety (AVS)		pcb	$ 1,078,460	$ 1,091,116	$ 1,088,332
		o/o	$ 220,022	$ 198,548	$ 187,923
AVS Total			**$ 1,298,482**	**$ 1,289,664**	**$ 1,276,255**
Associate Administrator for Commercial Space Transportation (AST)		pcb	$ 16,276	$ 16,415	$ 18,630
		o/o	$ 3,550	$ 3,276	$ 2,948
AST Total			**$ 19,826**	**$ 19,691**	**$ 21,578**
Assistant Administrator for Finance and Management (AFN)		pcb	$ 254,547	$ 250,727	$ 246,968
		o/o	$ 516,795	$ 515,377	$ 524,042
AFN Total			**$ 771,342**	**$ 766,104**	**$ 771,010**
Assistant Administrator for NextGen Air Transportation System (ANG)		pcb	$ 29,402	$ 29,230	$ 27,967
		o/o	$ 30,753	$ 30,516	$ 30,569
ANG Total			**$ 60,155**	**$ 59,746**	**$ 58,536**
Associate Administrator for Security and Hazardous Materials Safety (ASH)		pcb	$ 74,433	$ 74,670	$ 74,118
		o/o	$ 32,728	$ 31,763	$ 31,440
ASH Total			**$ 107,161**	**$ 106,433**	**$ 105,558**
Staff Offices	Assistant Administrator for Human Resource Management (AHR)	pcb	$ 70,524	$ 68,299	$ 66,017
		o/o	$ 32,069	$ 33,597	$ 33,000
	AHR Total		**$ 102,593**	**$ 101,896**	**$ 99,017**
	Office of the Administrator and Deputy (AOA)	pcb	$ 3,063	$ 2,969	$ 2,723
		o/o	$ 1,007	$ 1,093	$ 1,093
	AOA Total		**$ 4,070**	**$ 4,062**	**$ 3,816**
	Assistant Administrator for Audit and Evaluation (AAE)	pcb	$ 3,172	$ 3,130	$ 3,156
		o/o	$ 110	$ 110	$ 110
	AAE Total		**$ 3,282**	**$ 3,240**	**$ 3,266**
	Assistant Administrator for Civil Rights (ACR)	pcb	$ 9,943	$ 9,555	$ 9,170
		o/o	$ 2,312	$ 2,617	$ 2,617
	ACR Total		**$ 12,255**	**$ 12,172**	**$ 11,787**
	Assistant Administrator for Government and Industry Affairs (AGI)	pcb	$ 1,306	$ 1,253	$ 1,264
		o/o	$ 123	$ 300	$ 300
	AGI Total		**$ 1,429**	**$ 1,553**	**$ 1,564**
	Assistant Administrator for Communications (AOC)	pcb	$ 6,163	$ 5,985	$ 6,039
		o/o	$ 305	$ 305	$ 305
	AOC Total		**$ 6,468**	**$ 6,290**	**$ 6,344**
	Office of the Chief Council (AGC)	pcb	$ 39,089	$ 38,555	$ 37,612
		o/o	$ 6,007	$ 6,235	$ 6,192
	AGC Total		**$ 45,096**	**$ 44,790**	**$ 43,804**
	Assistant Administrator for Policy, International Affairs and Environment (APL)	pcb	$ 24,607	$ 24,403	$ 23,812
		o/o	$ 9,301	$ 9,275	$ 9,275
	APL Total		**$ 33,908**	**$ 33,678**	**$ 33,087**
Grand Total			**$ 10,025,852**	**$ 9,957,766**	**$ 9,931,312**

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AIR TRAFFIC ORGANIZATION (ATO)

Detailed Justification for the Air Traffic Organization (ATO)

FY 2019 - Air Traffic Organization (ATO) Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	5,443,242	5,526,514	5,557,535
Program Costs	2,116,543	1,981,933	1,938,155
Total	**$7,559,785**	**$7,508,447**	**$7,495,690**
FTE	**29,438**	**29,438**	**29,379**

Funding details for ATO's eight service units:

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Air Traffic Services (AJT)	4,034,252	4,046,677	4,057,045
Technical Operations (AJW)	1,601,197	1,612,571	1,615,422
System Operations (AJR)	276,302	248,834	211,698
Safety and Technical Training (AJI)	199,975	195,627	195,020
Mission Support Services (AJV)	293,599	292,252	289,841
Management Services (AJG)	210,723	165,484	165,350
Program Management (AJM)	851,850	849,223	847,977
Flight Programs (AJF)	91,887	97,779	113,337
Total	**$7,559,785**	**$7,508,447**	**$7,495,690**

What is this program and what does this funding level support?

The Air Traffic Organization (ATO) operates the most complex and technically advanced air traffic control system in the world. In FY 2019, ATO is required to sustain and improve effective and efficient air traffic control throughout U.S. airspace. The funding being requested will enable ATO to train our highly-skilled workforce, provide information and updates to the flying public to ensure safe air travel, maintain critical infrastructure necessary to operate the National Airspace System (NAS), review and update navigational information to promote more efficient air transportation, and effectively control air traffic which is a major contributor to our national economy.

While the system is already exceedingly safe, ATO is making it safer by moving to a proactive safety culture in which every individual in ATO is committed to assessing and mitigating risks. While safety is paramount, ATO is also taking steps to enable growth and changes in aviation.

ATO is a Performance-Based Organization providing safe, secure, and cost effective air traffic control services to commercial, private aviation and the military. FAA's ATO is comprised of more than 29,000 professional employees committed to providing safe and efficient air traffic control services. Many of ATO employees, including approximately 14,500 air traffic controllers, 5,000 air traffic supervisors and air traffic managers, 1,800 engineers, and 6,000 maintenance technicians, directly serve our customers. The remaining employees work in a wide variety of professions to sustain the smooth operations of ATO. They research, plan, and build air traffic control equipment and programs; manage payroll and benefits programs; maintain productive relationships with the aviation industry and the general public; and ensure that the environment and ATO employees are protected.

FAA's ATO provides air traffic services for the Nation and is fully committed to the agency's mission. ATO handles 26,775 scheduled passenger flights per day at US airports and help transport over 946 million passengers per year, a vital part of the Nation's economy. In total, the ATO handles 44,000 IFR (Instrument Flight Rules) flights per day, and manages 145,703 operations (including departures, arrivals and over-flights) per day at FAA and contract towers. FAA data shows that civil aviation accounted for over $1.6 trillion in total economic activity, supporting 5.1 percent of U.S. Gross Domestic Product. Approximately 10.6 million people are employed in aviation-related fields, and earn over $446.8 billion a year.

ATO's eight service organizations include:

Air Traffic Services (AJT): Air Traffic Services provides air traffic control operations from en-route, terminals, and combined control facilities in the U.S., Puerto Rico, and Guam. Air Traffic Services also controls more than 59 million square miles of airspace over the continental U.S. and the Atlantic and Pacific Oceans including the South Pacific, to the Northern Polar Routes, the North Atlantic, the Caribbean, and the Gulf of Mexico. Every day we ensure thousands of positively controlled aircraft, en route from one terminal area to another, are directed to the safest, most efficient pathway to their destinations.

The en-route domain provides air traffic controller services at 21 air route traffic control centers (ARTCCs) and two combined control facilities, which interface with more than 18 air navigation service providers (ANSPs). Terminal air traffic control (ATC) services include both airport surface operations and terminal area operations. Airport surface operations are conducted by controllers at 263 federal and 253 contract towers located at the Nation's airports. Terminal area operations are conducted by controllers at 160 TRACON facilities, which routinely handle aircraft within 40 miles of an airport.

Air Traffic Services is divided into three geographical service areas (Eastern, Central, and Western) to better manage the delivery of ATC services. The primary function of each service area is to oversee ATC operations within its geographical area and to ensure quality standards established for Safety, Capacity, and Organizational Excellence are met.

Technical Operations (AJW): The NAS is composed of a mix of hardware and software systems that enable controllers to monitor and communicate with pilots and other ATC facilities. NAS system capabilities include automation, communications, surveillance and navigation. Failure at any point in the system can cause capacity reductions and potentially compromise safety. Reductions in capacity cause delays with costs to users and the flying public. Technical Operations ensures that terminal and en-route controllers have all critical parts of the NAS infrastructure available for the safe and efficient delivery of air traffic services.

The mission of the Technical Operations Service Unit is to:

- Ensure efficient delivery of all NAS services for all stakeholders;
- Increase NAS capacity for all users through changes in technology;
- Maintain optimal NAS services for all users by strategically investing in the current infrastructure and providing operational oversight of leased NAS services;
- Improve situational awareness for pilots, controllers and airfield operators by providing them with real-time information concerning potential conflicts and offering possible resolutions; and
- Provide a safe and healthful workplace for all FAA employees through an active Occupational Safety and Health Administration (OSHA) program.
  Technical Operations supports the delivery of safe and efficient flight services to customers through responsive and cost effective maintenance of NAS facilities, systems, and equipment, and by providing operational oversight of leased services. The work consists of:

  - NAS system design, development, acquisition, installation, maintenance, restoration, modification, certification and oversight of vendor-supplied NAS services and vendor maintenance programs;
  - Facilities maintenance; and
  - Engineering and assignment of aeronautical frequency spectrum.

Our core work is performed by personnel at our System Support Centers and Technical Operations Control Centers. These professionals focus daily on optimizing NAS performance through prioritization of response based on factors, such as, importance of the airport or ATC facility that is directly or indirectly affected by the equipment or service outage.

Technical Operations leads the day-to-day defense and protection of the NAS by providing governance and requirements to enhance cybersecurity; coordinate threat information sharing and inter-agency collaboration; tailor cybersecurity business and acquisition strategies to support the rapid delivery of tools, applications, and other capabilities to defend the critical infrastructure from the evolving threat; and authorize systems to operate within the NAS domain.

System Operations (AJR): The System Operations Service Unit consists of several directorates that perform essential functions in the daily operation of the NAS. These functions affect all aspects of FAA ATC operations and our engagement with other Government agencies, airlines, and foreign ANSPs. These directorates are:

- NAS Operations;
- Security;
- Flight Service;
- International; and
- Performance and Data Analysis.

Safety and Technical Training (AJI): Safety and Technical Training provides the ATO with the Safety, Technical Training, Policy & Performance, and Standardization expertise necessary to help enable air traffic controllers, technicians, engineers and support personnel's daily efforts to keep aircraft safe, separated, and on time.

AJI safety programs are responsible for ensuring the safety of the National Airspace System (NAS) through reporting, mitigating, and monitoring risks. This strategy includes gathering input from front line employees, deploying technology to gather data, improving analysis to identify risk and implementing corrective actions to mitigate identified hazards. AJI ensures that national safety management policies are clearly defined, communicated, and adhered to; conducts audits, operational assessments of NAS changes and new technologies; and provides safety analysis and data management capability. We manage safety policy development, reduce fatigue risks through a comprehensive fatigue risk management system, facilitate an ongoing ATO safety culture transformation that leads to improved safety performance, and are the focal point for reducing the risk of runway collisions and excursions in the NAS.

AJI is the organization within ATO that provides technical training to controllers, technicians, and engineers. We provide a national training program to ensure the technical competency (knowledge and skills) of the workforce, and ensure we certify enough of the right workers to meet operational needs. We develop and deliver technical training programs for a workforce of approximately 14,500 air traffic controllers, 6,000 Airway Transportation Systems Specialist (ATSS), and 1,800 engineers.

The work of ATO Safety and Technical Training benefits the goal of ensuring system-wide safety and will assist in preventing the loss of human life, reduction in transportation-related injuries and fatalities.

Mission Support Services (AJV): The Mission Support Services mission is to provide policy, technical expertise and analyses, critical support services and regulatory guidance across a broad range of activities directly related to the safe and efficient operation of the National Airspace System (NAS). Core work includes:

- Oversight and support for NAS procedures and changes which affect operations and special activities with the NAS.
- Development and dissemination of digital Aeronautical Charts, Instrument Flight Procedures (IFPs), aeronautical data, and related aeronautical navigation products.
- Aeronautical chart and data revisions, and development and maintenance of Radar Video Maps (RVMs) in response to increasing requirements of Unmanned Aircraft Systems (UAS) Integration.
- Inspections, evaluations, safety risk management, accident and incident information gathering and reporting services, and support for National Airspace System (NAS) procedures and changes, which affect operations and special activities with the NAS.
- Standardized administrative support services.
- Financial, material, procurement, and logistical support services.
- Integrated planning, requirements management and program implementation management support services.
- Facilitate the development of enterprise solutions and implement changes necessary to integrate new entrants into the NAS, covering a wide array of technical challenges with a focus on UAS and Commercial Space integration across the ATO.

- Develops, validates, integrates, and prioritizes new Air Traffic Management concepts and requirements across the enterprise, ensuring future changes to the NAS are operationally sound.

Management Services (AJG): The Management Services organization provides leadership and guidance in the areas of financial management, people services, business planning, technical labor relations and employee engagement, and leadership development for the ATO. This shared services model was designed to decrease the administrative burden on our operating service units and improve the overall efficiency and effectiveness of the ATO. Management Services strives to maximize economies of scale by promoting standardization of processes, providing budget formulation and execution, overseeing ATO administrative policy, providing personnel actions and technical labor advice and leading ATO-specific employee development and succession planning efforts on behalf of our customers, who collectively operate and maintain the National Airspace System.

Management Services directly supports the workforce by providing an all-encompassing career progression plan and leadership development program, along with the personnel and organizational policies that meet the needs of our highly skilled workforce. We ensure performance stays on track by providing the framework to integrate ATO's plans, programs, and activities. We serve as a centralized point of contact for other FAA partners to develop strategies for implementing solutions within ATO.

Program Management Organization (AJM): The PMO provides full life-cycle program management capability across all of ATO from initial definition, through design, development, and effective deployment of both NAS sustainment and NextGen modernization systems.

The PMO was created after a comprehensive look at whether the agency was positioned strategically for success as we implement NextGen. The study, known as Foundation for Success, examined how our internal structures and processes could be improved to support NextGen. It was determined that better collaboration across lines of business would help us advance our initiatives more seamlessly and effectively.

Flight Program Operations (AJF): Flight Program Operations is responsible for all aspects of flight program safety, administration, operations, training, and maintenance. The FAA operates and maintains 46 owned/exclusive-use leased aircraft performing four primary missions: aviation safety training (currency and proficiency for AVS pilots); flight inspection of airspace infrastructure; research, development, test and evaluation (RDT&E); and transportation (disaster/emergency and National Transportation Safety Board (NTSB) Go Team response). Flight program consolidation realigns employees, aircraft, and resources from the following legacy flight programs: Flight Inspection Flight Program (AJW-3); Washington Flight Program (AJW-36); William J. Hughes Technical Center (WJHTC) Flight Program (ANG-E17); and AFS Flight Program (AFS-60), into the new Flight Program Operations organization, resulting in a single FAA Flight Program. Flight Program Operations is also the sole provider of flight program services for ATO and Office of Aviation Safety (AVS) participants, as well as internal and external customers, including the NextGen Office (ANG).

What benefits will be provided to the American Public through this request and why is this program necessary?

The ATO is committed to the American public to provide the safest aviation system in the world by preventing collisions between aircraft operating in the National Airspace System (NAS), by providing an organized and expeditious flow of air traffic, and by providing support for National Security and Homeland Defense. The ATO relies on numerous programs to maintain the safety and efficiency of the current system.

The ATO provides strategic and tactical NAS oversight, and regulate real-time air traffic when constraints such as weather, runway closures, equipment outages, security issues or other impacting conditions that affect the NAS. By developing and coordinating FAA operational metrics, system operations develop recommendations for improving NAS capacity and system efficiency to reduce delays at specific airports and in high volume corridors. The flying public benefits directly by minimizing NAS delays and congestion, which delivers an efficient and safe mode of transportation to travelers. It will also lead to efficiencies that will save fuel, reduce emissions and provide a better flying experience to the public.

The ATO's responsibilities also include environmental assessments and polices to manage effective airspace use, and complete regulatory development for Unmanned Aircraft Systems (UAS) operations over urban areas. This will expand the use of unmanned aircraft while deliberation completes on the UAS rulemaking actions.

The ATO creates standardization and provides synergy and efficiencies across the operations missions. The organization supports various programs and projects and contributes to the user benefits of safety and flight efficiency to ensure the existing NAS infrastructure remains within established specifications.

The safety of American aviation is unparalleled. Since 2003, we have coordinated more than 135 million successful flights on commercial aircraft, transporting over 7 billion passengers safely to their destinations. This outstanding record is attributable to our efforts at reducing fatal accident rates, deploying systems and procedures to reduce serious runway incursions, and conducting training programs aimed at reducing operational errors.

Controller Workforce FY 1992 through FY 2019

FY 1992	15,147	FY 2001	15,233	FY 2010	15,696	FY 2019 Req.	14,438
FY 1993	14,970	FY 2002	15,478	FY 2011	15,418		
FY 1994	14,953	FY 2003	15,691	FY 2012	15,211		
FY 1995	14,614	FY 2004	14,934	FY 2013	14,463		
FY 1996	14,360	FY 2005	14,540	FY 2014	14,330		
FY 1997	14,588	FY 2006	14,618	FY 2015	14,143		
FY 1998	14,966	FY 2007	14,874	FY 2016	14,449		
FY 1999	15,061	FY 2008	15,381	FY 2017	14,481		
FY 2000	15,153	FY 2009	15,770	FY 2018 Req.	14,497		

Air Traffic Organization (ATO)
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$7,508,447**	**29,058**	**677**	**29,438**
Adjustments to Base	**$45,716**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	25,920			
Extra Compensable Day (261)	19,985			
Working Capital Fund	-189			
Other Changes	**-$73,694**	**0**	**0**	**-127**
Contract Weather Observers	-16,406			
Flight Service Stations	-37,380			
Workforce Reduction Through Attrition	-19,908			-127
Base Transfers	**$15,221**	**68**	**0**	**68**
Flight Programs Operations	15,221	68		68
FY 2019 Request	**$7,495,690**	**29,126**	**677**	**29,379**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

Working Capital Fund: This cost adjustment is requested to support the Department of Transportation's (DOT) Working Capital Fund (WCF) profile. These adjustments are being made to best align each office's resources within their expected WCF costs.

Contract Weather Observers: Savings will come from an effort to streamline the CWO program to achieve operational cost efficiencies. This will be limited to multiple airports currently serviced by Contract Weather Observers (CWO) that have similar traffic, weather and operational complexity profiles to the 392 other airports currently serviced by Limited Aviation Weather Reporting Station (LAWRS) controllers.

Flight Service Stations: Cost savings will be achieved by encouraging users to utilize more automated, internet provided services, which will not impact current levels of safety. The reduced dependency on direct person to person interaction will result in significant cost efficiencies. We will discontinue some of the services provided by the Flight Service Stations (FSS), reducing the need for pilot-to-specialist interaction from five fixed locations (Prescott, AZ; Fort Worth, TX; Ashburn, VA; Raleigh, NC; and Miami, FL).

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

Flight Program Operations (AVS, ANG to ATO): This request transfers funding $15.2K and 34FTP/34FTE from the Aviation Safety Organization, AVS (30 FTP/FTE) & NextGen and Operations, ANG (4 FTE/FTP) to the Air Traffic Organization, ATO. In addition, 34FTP/34FTE will transfer from the ATO Franchise Fund account into the ATO Operations account.

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AVIATION SAFETY
(AVS)

Detailed Justification for the Aviation Safety Organization (AVS)

FY 2019 - Aviation Safety Organization (AVS) Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	$1,078,460	$1,091,116	$1,088,332
Program Costs	$220,022	$198,548	$187,923
Total	**$1,298,482**	**$1,289,664**	**$1,276,255**
FTE	**7,266**	**7,266**	**7,187**

Funding details for AVS's eight services and offices:

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Flight Standards Service	$876,409	$871,844	$858,112
Aircraft Certification Service	$230,139	$230,437	$230,794
Office of Aerospace Medicine	$62,803	$61,929	$61,914
Office of Rulemaking	$6,504	$6,418	$6,320
Air Traffic Safety Oversight Service	$25,105	$25,055	$24,700
Office of Accident Investigation & Prevention	$26,392	$24,703	$24,802
Office of Unmanned Aircraft Systems Integration	$19,670	$22,769	$22,841
Office of Quality, Integration and Executive Services	$51,460	$46,508	$46,772
Total	**$1,298,482**	**$1,289,664**	**$1,276,255**

What is this program and what does this funding level support?

The request allows Aviation Safety (AVS) to provide core services for certification, production approval, and continued airworthiness of aircraft as well as the certification of pilots, mechanics, and others in safety-related positions; continue Unmanned Aircraft System (UAS) integration into the National Airspace System (NAS); and maintain essential safety data reporting capabilities.

The requested resource level will enable AVS to provide funding and staffing for continued operational safety, certification services and policy development initiatives, while supporting UAS integration

requirements. The AVS Workforce Plan projects the need for additional safety staffing in the future to meet growing demands for certification services and UAS operations, while continuing to expand delegation responsibilities to designees for future NAS growth. FAA/AVS forecast that changes in the demand for non-UAS type certification design approvals required by applicants, production certificates provided to manufacturers, and supplier control audits conducted at manufacturers will exhibit minimal growth from FY 2018 to FY 2019. In order to accommodate short term workload changes in demand, AVS will reallocate existing resources.

The most recent AVS Staffing Tool and Reporting System data indicates that the time to complete certifications for the design of new aviation products and airworthiness directives issued to correct aircraft safety deficiencies remained relatively constant. The number of UAS aviation products requiring certification and approvals services is anticipated to expand within the system and products as well as operational complexity is anticipated to increase as new technologies are introduced. These factors are driving the need in the short-term to reprioritize some of AVS existing resources for certification services and UAS integration into the NAS. Consistent with the most recent AVS Work Force Plan, out-year resource changes will be requested to support forecasted growth in demands for service.

AVS is responsible for setting the safety standards for every product, person, and organizations that manufacture and operate aircraft in the NAS. Through its approximately 7,000 employees, AVS provides the following services:

- Surveillance and oversight of existing certificate holders.
- Development and establishment of safety and certification standards for the civil aviation industry.
- Surveillance and oversight of air carriers, general aviation (GA) operators, repair stations, manufacturers and airman.
- Issuance or denial of certifications.
- Ongoing and wide-ranging transformation of the NAS encompassed by NextGen.

AVS has eight services and offices:

Flight Standards (AFS): Flight Standards Service promotes safety in air transportation by setting the standards for certification and oversight of airmen, air operators, air agencies, and designees as well as safety of flight of civil aircraft in air commerce; sets regulations and standards that consider the air carrier's duty to operate in the public interest at the highest possible degree of safety; sets regulations and standards for other air commerce, air agencies, and airmen at the appropriate level of safety in the public interest; accomplishes certification, inspections, surveillance, investigation, and enforcement activities; and manages the system for registry of civil aircraft and all official airmen records.

Aircraft Certification (AIR): Aircraft Certification Service develops and administers safety standards governing the design, production and airworthiness of civil aeronautical products; oversees design, production, and airworthiness certification programs to ensure compliance with prescribed safety standards; establishes and maintains a Safety Performance Management system for continued operational safety of aircraft; provides oversight of approval holders, designees, and delegated organizations; and works with aviation authorities, manufacturers, and other stakeholders to help them improve safety in the international air transportation system.

Aerospace Medicine (AAM): Office of Aerospace Medicine oversees a broad range of medical programs and services for both the domestic and international aviation communities; performs medical certification of airmen; inspects and oversees aviation industry drug and alcohol testing programs; performs medical clearance of air traffic control specialists; oversees drug and alcohol testing of FAA employees with safety-sensitive jobs and jobs requiring security clearances; performs aerospace medicine and human factors research; manages employee occupational health and health awareness programs; develops and provides airman training in physiological and survival training to GA and commercial aviation airmen through on-site and sponsoring training events at aviation-related events and performs designee oversight of aviation medical examiners.

Rulemaking (ARM): Office of Rulemaking manages FAA's rulemaking program, processes, and timelines; develops proposed and final rules; manages responses to petitions for rulemaking and for exemption from

regulatory requirements; and oversees rulemaking advisory committees that provide advice and recommendations on aviation-related issues.

Accident Investigation & Prevention (AVP): Office of Accident Investigation and Prevention investigates aviation accidents and incidents to detect unsafe conditions and trends and to coordinate the corrective action process; investigates major or significant accidents and incidents to identify safety deficiencies and unsafe conditions and recommend policy; coordinates with the responsible FAA office for evaluation and corrective action; analyzes accident and incident data and other safety data to identify safety issues and trends; addresses National Transportation Safety Board and internal FAA Safety Recommendations; and leads Safety Management System (SMS) implementation efforts for FAA and AVS.

Air Traffic Safety Oversight (AOV): Air Traffic Safety Oversight Service conducts independent safety oversight of the ATO provisioning of air traffic services, using risk-based, data-supported surveillance methods. Surveillance approaches include audits, inspections, investigations, compliance, and approvals, acceptances, and concurrences. AOV staff monitors local air traffic services, processes, and procedures using safety risk standards, SMS principles, and certification/credentialing programs. AOV approves the ATO's SMS, monitors the ATO for compliance with its approved SMS, and reviews and approves the ATO's safety implementation actions and risk management strategies.

Unmanned Aircraft Systems Integration (AUS): Office of Unmanned Aircraft Systems Integration is responsible for facilitating the safe, efficient, and timely integration of UAS into the NAS; managing and coordinating international activities for UAS within FAA, aligning UAS international activities with foreign civil aviation authorities; supporting standards and policy development related to UAS projects, providing strategic planning and support for continued UAS Research and Development.

Quality, Integration, and Executive Services (AQS): Office of Quality, Integration, and Executive Services provides executive oversight and direction of consolidated management support services for all of AVS; manages all phases of planning, financial management, IT liaison services, and administrative activities for the immediate office of the associate administrator; approves, oversees, and facilitates integration initiatives among the AVS services and offices; oversees the AVS Quality Management System; provides budget and labor distribution reporting management; and provides AVS training, planning, and human resource management.

What benefits will be provided to the American Public through this request and why is this program necessary?

AVS will provide the American public safety and economic benefits by maintaining oversight of the NAS through data analysis techniques used for audits, surveillance, and certification of aircraft operators and production manufacturers, pilots, mechanics, and other safety related positions. AVS will provide certification and integration services for newly designed and manufactured aviation products associated with UAS. The engineer and inspector resources will provide manufacturing and operational approvals of UAS technologies while maintaining safety oversight services within the NAS.

Staffing Information

	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Direct Full Time Equivalents (FTEs)	**7,266**	**7,266**	**7,187**
Flight Standards Service	5,192	5,202	5,143
Aircraft Certification Service	1,353	1,329	1,319
Office of Aerospace Medicine	378	381	377
Office of Rulemaking	38	37	36
Air Traffic Safety Oversight Service	128	130	128
Office of Accident Investigation and Prevention	70	70	69
Office of Unmanned Aircraft Systems Integration	43	57	56
Office of Quality, Integration and Executive Services	64	60	59
Full Time Permanent Employment (FTP)	**7,225**	**7,266**	**7,236**
Flight Standards Service	5,157	5,202	5,172
Aircraft Certification Service	1,351	1,329	1,329
Office of Aerospace Medicine	373	381	381
Office of Rulemaking	39	37	37
Air Traffic Safety Oversight Service	129	130	130
Office of Accident Investigation and Prevention	69	70	70
Office of Unmanned Aircraft Systems Integration	45	57	57
Office of Quality, Integration and Executive Services	62	60	60

As of January 2018

Safety Critical / Operational Support Staffing
End of Year Employment, Full Time Permanent

	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Flight Standards Service	**5,157**	**5,202**	**5,172**
Engineers	18	4	4
Aviation Safety Inspectors	3,963	4,103	4,079
Safety Technical Specialists	429	428	425
Operational Support	747	667	664
Aircraft Certification Service	**1,351**	**1,329**	**1,329**
Manufacturing Safety Inspectors	241	267	267
Pilots, Engineers and CSTAs	764	745	745
Safety Technical Specialist	188	165	165
Operational Support	158	152	152
Office of Aerospace Medicine	**373**	**381**	**381**
Physicians, Physician Assistants, Nurses	54	56	56
Alcohol/Drug Abatement Inspectors	54	69	69
Safety Technical Specialist	225	213	213
Operational Support	40	43	43
Air Traffic Safety Oversight Service	**129**	**130**	**130**
Air Traffic Safety Inspectors	84	78	78
Safety Technical Specialist	41	45	45
Operational Support	4	7	7
Office of Rulemaking	**39**	**37**	**37**
Safety Technical Specialist	36	34	34
Operational Support	3	3	3
Office of Accident Investigation and Prevention	**69**	**70**	**70**
Air Safety Inspectors	9	9	9
Safety Technical Specialist	44	51	51
Operational Support	16	10	10
Office of Unmanned Aircraft Systems Integration	**45**	**57**	**57**
Air Safety Inspectors/Engineers	9	28	28
Safety Technical Specialist	23	19	19
Operational Support	13	10	10
Office of Quality, Integration and Executive Service	**62**	**60**	**60**
Safety Critical Staff	12	12	12
Operational Support	50	48	48
Total	**7,225**	**7,266**	**7,236**
Safety Critical Staff	6,194	6,326	6,299
Operational Support	1,031	940	937

Note: In FY 2017, the Unmanned Aircraft Systems Integration Office was established.

As of January 2018

Aviation Safety Organization (AVS)
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$1,289,664**	**7,266**	**20**	**7,266**
Adjustments to Base	**$8,898**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	5,171			
Extra Compensable Day (261)	4,155			
Working Capital Fund	-428			
Other Changes	**-$7,598**	**0**	**0**	**-49**
Workforce Reduction Through Attrition	-7,598			-49
Base Transfers	**-$14,709**	**-30**	**0**	**-30**
Flight Programs Operations	-14,709	-30		-30
FY 2019 Request	**$1,276,255**	**7,236**	**20**	**7,187**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

Working Capital Fund: This cost adjustment is requested to support the Department of Transportation's (DOT) Working Capital Fund (WCF) profile. These adjustments are being made to best align each office's resources within their expected WCF costs.

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

Flight Program Operations (AVS, ANG to ATO): This request transfers funding $15.2K and 34FTP/34FTE from the Aviation Safety Organization, AVS (30 FTP/FTE), NextGen and Operations, ANG (4 FTE/FTP) to the Air Traffic Organization, ATO. In addition, 34FTP/34FTE will transfer from the ATO Franchise Fund account into the ATO Operations account.

COMMERCIAL SPACE
TRANSPORTATION (AST)

Detailed Justification for the Office of Commercial Space Transportation

FY 2019 – Office of Commercial Space Transportation (AST) – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	16,276	16,415	18,630
Program Costs	3,550	3,276	2,948
Total	**$ 19,826**	**$ 19,691**	**$ 21,578**
FTE	**98**	**98**	**104**

What is this program and what does this funding level support?

FAA's Office of Commercial Space Transportation (AST) was established in 1984. The Commercial Space Launch Act granted DOT the authority to license and monitor the safety of commercial space launches and to promote the industry. Executive Order 12465 designated Department of Transportation as the lead federal agency for enabling private-sector launch capability. AST and its responsibilities, which were originally within the Office of the Secretary of Transportation, were transferred to FAA in 1995.

Our mission is to ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation. Recent years have witnessed dramatic growth in both the number of commercial space transportation companies and operations. In addition, both the National Space Policy of 2010 and the National Space Transportation Policy of 2013 reflect a greater reliance by the Federal Government on the commercial space industry to accomplish national objectives. As a result, AST continues to see significant increases in the activities required to achieve its mission.

AST accomplishes its safety mission through the execution of its licensing, permitting, and safety inspection functions.

Indices are:

- The Authorization Index relates the number of new licenses, permits, and safety approvals made by AST in the given year relative to FY 2006. New authorizations are shown to be a leading indicator of increased safety inspections and operations, which are illustrated by those respective indices which are also relative to their baseline FY 2006 level of activity. The Authorizations Index does not include license modifications or renewals at this point.
- Safety oversight – primarily through on-site inspections – is a core AST function, ensuring license and permit holders adhere to regulatory requirements. At least one inspection of launch operations is required at time of flight, but inspection also encompasses sending safety inspectors to launch and reentry operations to ensure an operator's compliance with regulations and the representations made in its application. Other key activities are inspected, including dress rehearsals and the testing and installation of flight termination systems. Each year, AST conducts an inspection of all licensed launch sites. AST safety inspectors thoroughly document their findings and maintain a collection of safety lessons learned and best practices.
- AST is responsible for licensing the operation of launch sites or "spaceports." Since 1996, we have licensed the operation of:
    - California Spaceport at Vandenberg Air Force Base;
    - Spaceport Florida at Cape Canaveral Air Force Station;
    - Mid-Atlantic Regional Spaceport at Wallops Flight Facility in Virginia;
    - Mojave Air and Space Port in California;

- Kodiak Launch Complex on Kodiak Island, Alaska;
- Oklahoma Spaceport in Burns Flat, Oklahoma;
- Spaceport America near Las Cruces, New Mexico;
- Cecil Field in Jacksonville, Florida:
- Houston Airport System Spaceport, at Ellington Airport
- In addition, most recently the Midland International Airport in Midland, Texas.

AST also conducts pre-application consultation with every company or entity that approaches the FAA for a license or permit. This consultation process can last months or even years, as it serves to educate these proponents on the applicable regulations and assist them in identifying potential issues as they develop and shape their plans. Currently, there are eight launch sites in pre-application consultation with AST.

The increasing pace of growth in commercial space transportation brings challenges beyond increasing launch rates. The threat of orbital debris continues to grow and jeopardizes the safety of operations entering and returning from orbit. In addition, new types of space vehicles, such as, balloons and a variety of winged launch and reentry vehicles, increase the complexity of licensing and operations, as do new ventures like small-satellites, cube-satellites, and commercial orbital servicing and commercial space stations, as well as, the dawn of commercial human spaceflight operations. Recognizing these growing needs, the FAA is developing and implementing a strategy to ensure the efficient integration of air and space traffic. This work will be performed in partnership with the FAA's Air Traffic Organization (ATO), NextGen (ANG), and as well as other organizations within FAA.

What benefits will be provided to the American Public through this request and why is this program necessary?

From AST's transfer to the FAA in 1995 through 2017, the Office has licensed or permitted 333 commercial space launches and reentries. Commercial space transportation operations enhance citizens' lives through such activities as launch of supplies for the International Space Station, deployment of communications satellites to ensure reliable cell phone operations, and the development of new transportation concepts and enabling technologies. This request will allow AST to keep pace with the increasing tempo of operations anticipated in the next few years and effectively evaluate the increasingly complex vehicles, systems, and operations.

The AST office has supported licensed commercial launches, reentries, and permitted launches. As the number of launches increases, the number of reviews, analyses, inspections, documents, studies, and regulations and operational integration will increase proportionally. AST has also seen an increase in the number of foreign space agencies seeking AST advice and guidance for activities in their own countries.

Commercial space transportation activities are expanding at the same time NASA is increasingly relying on the commercial sector to provide cargo services for the International Space Station, and someday, astronauts, as well. There also continues to be a growing need to ensure the safe integration of space and air traffic, both domestically and internationally. The budget request allows AST to ensure protection of the public, property, and the national security and foreign policy interests of the United States (U.S.) during commercial space launch or reentry activities, as well as encourage, facilitate and promote U.S. commercial space transportation.

Commercial Space Transportation (AST)
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$19,691**	**97**	**0**	**98**
Adjustments to Base	**$141**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	76			
Extra Compensable Day (261)	65			
Other Changes	**$1,746**	**13**	**0**	**6**
Workforce Reduction Through Attrition	-213			-1
Regulatory Reform	1,959	13		7
Base Transfers	**$0**	**0**	**0**	**0**
FY 2019 Request	**$21,578**	**110**	**0**	**104**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

Regulatory Reform: The FAA will accommodate a program increase within Commercial Space Transportation (AST) for regulatory reform. This is a $2.0 million increase for the AST divisions which conduct licensing, permitting, safety inspections, technical analyses, and regulations development. This funding will help us keep pace with industry demands for products and services, and advance regulatory streamlining efforts.

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FINANCE AND MANAGEMENT (AFN)

Detailed Justification for the Office of Finance and Management (AFN)

FY 2019 – Office of Finance and Management – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	254,547	250,727	246,968
Program Costs	516,795	515,377	524,042
Total	**$771,342**	**$766,104**	**$771,010**
FTE	**1,635**	**1,635**	**1,596**

What is this program and what does this funding level support?

The Office of Finance and Management (AFN) is the FAA's shared services operating entity responsible for providing and streamlining the agency's common business services through a consolidated, integrated approach. AFN oversees the delivery of finance, acquisitions, information technology, property, logistics, technical training, regional emergency operations and integration services to customers across the agency. AFN leads the FAA's efforts to identify cost savings, leverage technology, and optimize resources in order to position the agency to achieve the aviation safety mission while maintaining the flexibility to accommodate changing requirements.

Each year, AFN detects and averts approximately 21 million cyber-alerts for the National Airspace System (NAS) and non-NAS systems throughout FAA and DOT, manages the FAA's nearly $16 billion budget, handles more than 27,000 contract actions for more than $4.3 billion in goods and services, and supports some 55,400 technology users. AFN also manages and supports the FAA Academy, which trains almost 16,000 resident students annually to include new Air Traffic Controllers (ATC). In addition, AFN provides critical crisis response capability for all incidents related to NAS continuity, manages leases and real property assets that house 21,600 personnel in approximately 7.4M sq. ft., and provides management and oversight for over $7 billion in personal property assets.

AFN's five service organizations include:

Financial Services (ABA):

The Office of Financial Services enables the FAA to achieve its aviation safety mission by formulating, executing, and managing budgets for each of the agency's lines of business and staff offices. ABA ensures that funding is available to meet each organization's mission essential needs and that critical Aviation Safety, Air Traffic, and NextGen personnel, programs, and initiatives are prioritized to ensure the uninterrupted and improved efficiency and safety of the National Airspace System (NAS). ABA serves as the agency's Chief Financial Officer, leads the FAA in identifying cost savings, provides responsible financial management of budget appropriations, and manages the agency's workforce planning.

ABA performs three (3) key financial functions:

- Budgeting and Programming
- Financial Management, and
- Financial Analysis

Budgeting and Programming ensures the agency identifies and defines budgetary needs and uses funds and other resources effectively while incorporating performance and budget plans to meet agency goals.

Financial Management develops and maintains corporate FAA-wide management systems, manages the capitalization of FAA's NAS and other capital assets. Implements accounting and financial management policy for the agency and assures the adequacy of internal controls for compliance with laws, regulations and policies. Additionally,

completes multiple required Congressional reports. Serves as the agency's primary financial statements audit liaison and respondent to ensure the success of the OIG's audit of FAA's consolidated financial statement.

Financial Analysis facilitates the agency's cost reductions effort and implements cost control initiatives; develops agency policy and oversees financial guidance and advisory services for agency contracts; ensures business decisions are sound by analyzing the financial impact of proposed agency capital investments and labor contracts; and, develops agency policy for spending and authorization controls. Analysis organizations use data-driven tools to improve financial decision making and to support sound, strategic, investment decision-making. As stewards of the investment analysis process, ABA ensures that major capital investment decisions are in the best interest of the agency and supported by robust business cases.

ABA FY 2019 key goals include:

Function	FY 2019 Anticipated Accomplishments
Budget and Programming	▪ Ensure that required funding needs for agency programs are available through effective resource oversight. ▪ Ensure Agency funds and resources are utilized effectively and that FAA maintains compliance with the Anti-Deficiency Act. ▪ Implement and improve the centralized structure for oversight of well over $400 million in reimbursable work.
Financial Management	▪ Lead the Agency on all accounting operations and provide financial oversight and information to assist FAA organizations with making business decisions. ▪ Ensure an unmodified audit opinion on Agency FY 2019 financial statements with no material weaknesses. ▪ Deliver the air traffic and aviation safety workforce plans.
Financial Analysis	▪ Identify realized net savings through the review of both operations and capital acquisitions of $10 million or more to ensure the procurement represents a good investment of taxpayer resources and appropriate alternatives were considered. ▪ As the Agency investment analysis process stewards, employ business case discipline to any new capital investment categories to attain cost savings.

Acquisitions and Business Services (ACQ):

As the agency's procurement and contracting experts, ACQ enables the FAA to achieve its aviation safety mission by securing the goods, services, resources, space, technologies, expertise, specialized skills, facilities, and tools that every line of business and staff office needs in order to accomplish their mission. ACQ contracted for more than $4.3 billion in goods and services in FY 2017. That total is expected to rise in FY 2019 to keep pace with demands on the agency.

ACQ develops the FAA's Acquisition Workforce Strategy which serves as the FAA's blueprint for building and sustaining a high-performing acquisition workforce consisting of critical positions, such as, Contracting Officers, Program Managers, IT Specialists, Engineers, Financial Specialists, and four other specialized competencies. The models for these nine competencies and the tools necessary to implement them are maintained by ACQ.

Additionally, ACQ manages seven certification programs that provide acquisition professionals opportunities throughout the acquisition lifecycle to achieve and maintain professional development and certifications. Collectively, the over 200 training courses offered annually by ACQ ensures the acquisition community performs critical acquisition functions at the highest levels required to procure, accept, develop, and deliver the programs that result in the safest aviation transportation system in the world. As a result of the commitment to maintaining a strong framework for the agency's acquisition workforce, ACQ is consistently one of the top performers among its peer group and across the government.

ACQ performs three (3) key financial functions:

- Procurements
- Acquisition Professionals, and

- Acquisition Oversight

Procurements: ACQ advises FAA organizations, plans, negotiates and awards cost-effective, best value contracts, purchase orders, delivery orders, agreements, and aviation research grants for FAA headquarters, Technical Center, Aeronautical Center, and the Service Areas.

Acquisition Professionals: ACQ annually updates the FAA's Acquisition Workforce Strategy and ongoing training and certification programs for acquisition personnel.

Acquisition Oversight: ACQ analyzes acquisition data to formulate trends and traceable metrics that identify areas for improvement to leverage government leading practices and recommends improvements regarding agency policy and processes based on lessons learned, potential deficiencies, and best practices.

ACQ FY 2019 key goals include:

Function	FY 2019 Anticipated Accomplishments
Procurement Actions	▪ Ensure contractor performance is in accordance with contract terms and conditions, issue contract modifications, and monitor contract deliverables. ▪ Develop and implement best practices in acquisition to deliver best value for the taxpayer and increase efficiency and effectiveness of procurement methods. ▪ Conduct internal and external small business outreach/training and target at least 25 percent of total direct procurement dollars as Small Business awards.
Acquisition Professionals Support	▪ Provide the annual update of the FAA's Acquisition Workforce Strategy; implement strategies and initiatives and track gains, losses, and actual on-board data for personnel in the various acquisition professions; as well as tracking other workforce metrics, such as certification levels. ▪ Manage training and certification programs for acquisition personnel, including program/project managers, contracting officers/specialists, contracting officer's representatives (CORs), systems engineers, test and evaluation specialists, and logistics specialists.
Acquisition Oversight	▪ Manage audits of cost reimbursable, time & material, and labor hour contracts with an estimated value of $100 million or more and perform audits for at least 15 percent of these contracts with estimated values below $100 million. ▪ Conduct Integrated Baseline Reviews on investment programs along with validations of contractor Earned Value Management (EVM) Systems. ▪ Conduct investment program post-implementation reviews (PIRs) and act as independent reviewer of directorate lead PIRs to assess cost, performance, and benefits baseline expectations achievement.

Information and Technology Services (AIT):

As the agency's information and technology backbone, AIT enables the FAA to achieve its aviation safety mission by providing and overseeing all aspects of the agency's IT enterprise, allowing all lines of business and staff offices, including the Air Traffic Organization (ATO) and Aviation Standards (AVS), to seamlessly connect, interact, and respond to customers, stakeholders, colleagues, and resources easier and more reliably. AIT is responsible for providing IT services to 45,000 employees, as well as 10,400 contractors across the FAA, for a total of 55,400 technology users. AIT maintains a current inventory of 321 Federal Information Security Management Act (FISMA) reportable systems, of which 72 are marked as mission critical (40 NAS and 32 Non-NAS systems). AIT also provides IT support for all mission support technology which includes IT training for FAA personnel. A key focus in FY2019 will be to keep the FAA's network safe from cyber threats. Funding will ensure cyber security, maintain a comprehensive cyber threat intelligence analysis capability, and support innovative technology and tools to prevent attacks while continuing the agency on a path of increased efficiencies and innovation.

AIT performs four (4) key financial functions:

- Cybersecurity,

- Shared Services,
- Enterprise Information Management, and
- Core Services

Cybersecurity: The FAA is committed to advancing its cybersecurity capabilities to maintain protection of FAA information, FAA information systems, and the FAA mission from evolving cyber threats. This entails collecting intelligence in a timely manner to enable a more informed threat and defense capability, as well as strengthening the synergy between the three FAA operating domains: NAS, Research, Engineering and Development (RE&D), and Mission Support. The Department of Homeland Security (DHS) Continuous Diagnostic Mitigation (CDM) program is a dynamic approach to fortifying the cybersecurity of FAA networks and systems. CDM provides the capabilities and tools that identify cybersecurity risks on an ongoing basis, prioritize these risks based upon potential impacts, and enable cybersecurity personnel to mitigate the most significant problems first. AIT's investment in such intelligence tools safeguards the FAA's critical infrastructure by identifying, protecting, detecting, responding to, and recovering from malicious activities which could damage or disrupt services.

Shared Services: AIT works collaboratively with other LOBs, including NAS ATO and AVS mission support programs such as Aeronautical Information Systems, Terminal and Air Traffic Products and RCISS and ASKME, to support aviation safety applications that impact all national and international aerospace activity. AIT supports all FAA devices, IT infrastructure components, and specialized software applications. AIT also supports the National Offload Program (NOP) to improve public safety by providing NAS flight data to Safety Analytics and Controller Training applications. FY 2019 funding will provide operations and maintenance activities for agency-wide infrastructure computing power, support multiple application systems that are used by all personnel to conduct work, and all security and privacy controls and protections to keep FAA data and systems safe, accessible and reliable.

Enterprise Information Management (EIM): The EIM Enterprise Capability platform will continue to support the transition and integration of data and information management services and capabilities to support or enable the integration of designated legacy capabilities with obsolete or failing architectures.

Core Services: AIT enhances and expands core services as necessary to meet required mandates and initiatives. In FY 2019, FAA anticipates a continuing IT organizational evolution to provide a customer-driven service organization that is efficient and effective in providing secure access to support enterprise organizational and operational excellence.

AIT FY 2019 key goals include:

Function	FY 2019 Anticipated Accomplishments
NAS of the Future: Deliver Benefit through Technology/ Infrastructure: *Optimize Information Access through Technology Innovation*	▪ Expand FAA Cloud Services core capabilities ▪ EIM Enterprise Capability will ingest and store streaming System Wide Information management (SWIM) data sets and feeds and provide access to support post operational analysis and business functions and eliminate the need to build and maintain individual system based storage capability for this data. ▪ Provide application development, Web and Collaboration Services, (EIM), Cybersecurity, Continuity of Operations (COOP) and other related services in support of FAA mission critical requirements
Make Aviation Safer and Smarter: Risk Based Decision Making: *IT Risk Management & Information Systems Security*	▪ Update Notices, Policies, Orders, Directives, such as SORN (System of Records Notice), Privacy Management Process, Privacy Appeal Process, Cyber Incident Response Process. ▪ Collaborate with AIT service offices to update the FAA's security architecture in accordance with FAA's and Federal's enterprise architecture framework. ▪ Validate full packet capture capability at strategic network points. ▪ Conduct incident response, tests, scans, simulation exercises, analysis and compliance reviews to ensure information security and privacy of all FAA information systems.
Workforce of the Future: Empower and Innovate through FAA's People: *Enable FAA's Employees to*	▪ Identify and remediate operational and technical risk to improve the Application Enterprise Repository. Gather and analyze an expanded set of data about the application portfolio resulting in a better managed portfolio. Identify technology reaching end of life, better track security vulnerabilities,

Work Smarter, Resource Optimization	and capitalize on opportunities for application rationalization and migration to the Cloud.

Regions and Property Operations (ARO):

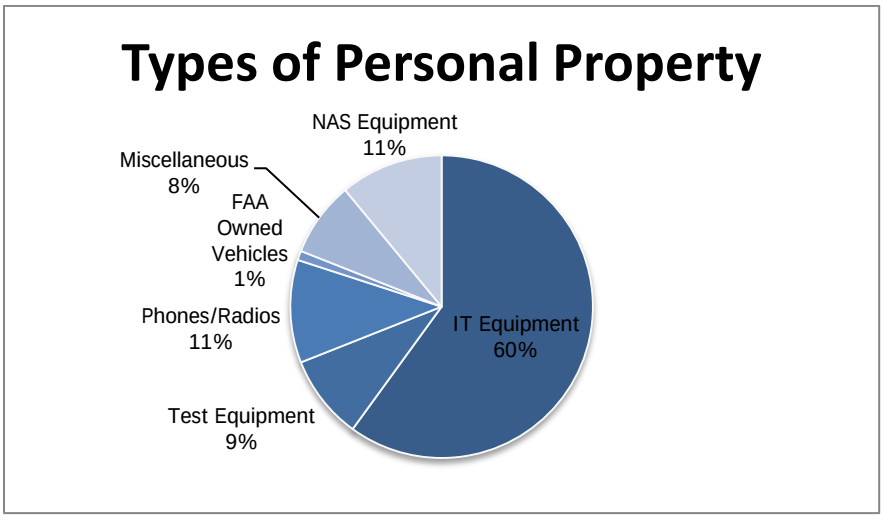
ARO enables the FAA to achieve its aviation safety mission by providing emergency readiness, real and personal property management and oversight, facilities management, corporate outreach, crisis response, and horizontal integration. ARO manages facilities at FAA Headquarters, six Regional Offices, and three Service Center Regional Offices in addition to managing the FAA's portfolio of $7 billion in global agency assets throughout the National Airspace System. ARO oversees and manages the space needs of more than 21,600 personnel from every FAA line of business and staff office housed in over 7.4 million square feet of leased FAA properties across the NAS. Three Regional Operations Centers (ROCs), located within the Service Centers operate around the clock and provide critical crisis support to the NAS.

ARO performs three (3) key financial functions:

- Regional Administrators
- Personal Property Management and Oversight, and
- Real Property Management Services

Regional Administrators represent the Agency among regional stakeholders that include, but are not limited to military services, aviation industry, federal, state, and local government agencies, aviation organizations, elected officials, educational institutions, and civic and private groups. The Regional Administrators serve as local representatives for the FAA Administrator and they are responsible for communicating with FAA's internal and external customers, disseminating information, and answering inquiries. They monitor all Air Traffic events (Mandatory Occurrence Reports – MORs) and make appropriate notifications to Air Traffic offices in the service centers. Upon notification of an aircraft accident or incident, they make notifications to regional flight standards offices and local Flight Standards District Offices (FSDOs).

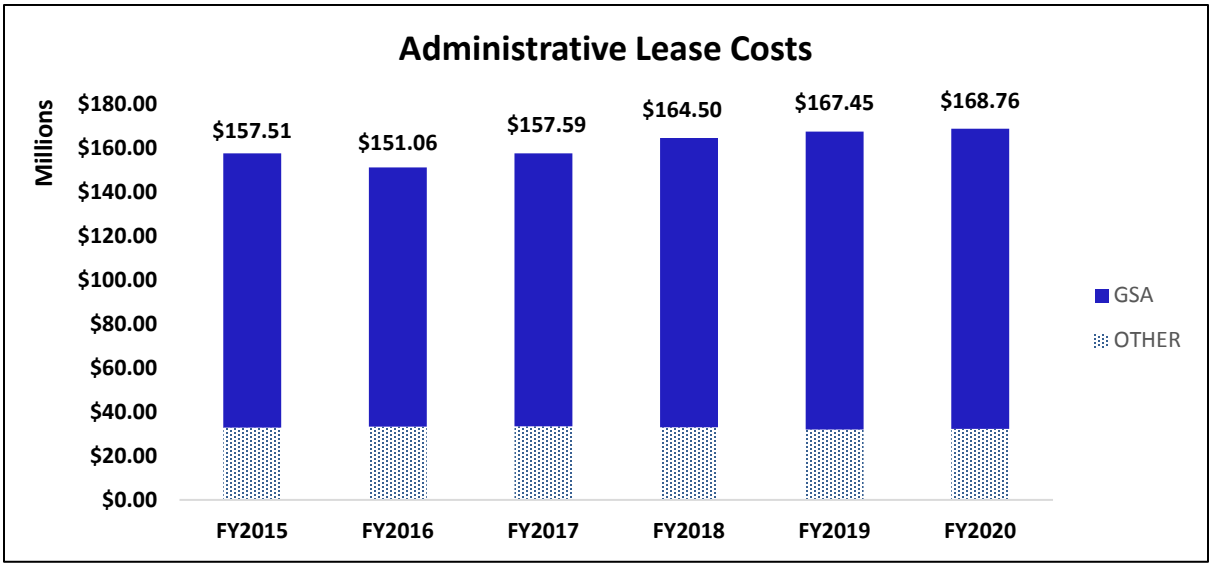
Personal Property Management and Oversight provides support in leading and integrating logistics initiatives within the FAA and DOT. As part of ARO's personal property responsibilities, ARO establishes and oversees the agency's property management system for the management and physical control of over 150,000 assets valued at $7 Billion in global agency assets throughout the National Airspace Systems (NAS) and international facilities. Types of agency assets include IT and NAS Equipment, Phones/Communications Radios, Test Equipment, and FAA Owned Vehicles.



Real Property Management Services are provided in support of the FAA. ARO maintains the Department-wide inventory of real property and the data and performance measures associated with more than 58,300 buildings, structures, and land parcels. These include administrative offices, structures, and land leases for NAS operational

sites. ARO establishes customer commitment agreements with customers for ARO's real property management responsibilities. This includes overseeing administrative space leases within each of the nine regions administered by the GSA and field facilities for the Agency's Aviation Safety (AVS) and Security Hazard Material (ASH) organizations.

GSA budget requirements will increase by approximately 18 percent between FY17 and FY20. New or succeeding leases that are negotiated are subject to rising market rents. ARO's primary avenue for mitigating rising budget costs is exiting or renegotiating unfavorable or underutilized leases and relocating staff into space at the appropriate size and rent. While these ongoing efforts produced a onetime offset credit in FY16 and a reduction in square footage, the overall lease portfolio cost continues to grow.



ARO FY 2019 key goals include:

Function/Office	FY 2019 Anticipated Accomplishments
Regional Operations Centers (ROCs)	▪ Conduct one DOT Crisis Management Center (CMC) devolution exercise with the Southern Region Operations Center covering operations for the CMC; and ▪ Conduct one FAA Washington Operations Center (WOC) devolution exercise with the Southwest Region Operations Center covering operations for the WOC.
Real Estate Management	▪ Complete 95 percent of the annual real property inventory target and report to DOT; ▪ Achieve 32,000 square feet space reduction goal across FAA administrative space; ▪ Complete new Western Pacific Regional Office project. The agency footprint will be reduced by 49,529 Rentable Square Feet.
Personal Property Management	▪ Implement management performance targets that measure adequacy of property management policies and procedures, staffing and training, performance review and improvement program; and ▪ Implement performance targets that measure the quality and appropriateness of property management activities, staff productivity, and adequacy of checks and balances.

Mike Monroney Aeronautical Center (AMC):

The Aeronautical Center, located in Oklahoma City includes three key functions: the FAA Academy, the FAA Logistics Center and the Enterprise Services Center (ESC). AMC maintains and operates over 130 buildings at the Mike Monroney Aeronautical Center that include the physical infrastructure plant. AMC provides architecture and engineering design, construction, and space management support for the approximately 6,500 personnel located at AMC. AMC also houses three unique services for the FAA: the **FAA Academy** is the primary provider of technical training for the agency and the largest training facility within the DOT; the **FAA Logistics Center (FAALC)** is the primary provider for parts and logistics services in support of the Air Traffic Organization (ATO) and the National Airspace System (NAS); and the **Enterprise Services Center (ESC)** is one of four OMB-designated Shared Service Providers for financial services within the federal sector.

Office of Facility Management (AMP) provides facility oversight, operations, and maintenance for the AMC campus which is comprised of 133 buildings for a total of 3.39M square feet of space located on 1,057 acres; 7400 employees, students, and contractors; and 10-11,000 annual visitors. AMP directly supports the functions of the FAA Academy, FAA Logistics Center, and the Enterprise Services Center as well as other FAA organizations located at the AMC that do not report to AFN.

AMC FY 2019 key goals include:

Function/Office	FY 2019 Anticipated Accomplishments
Facilities	▪ Integrate environmental, occupational safety and health requirements, minimize pollution and waste, conserve natural resources, and prevent injury and illness while at work through utilization of a Quality Management System with management reviews and internal and external audits. ▪ Reduce energy intensity by 2.5 percent annually through the end of FY-25 to meet goals specified in Executive Order 13693 as compared to FY-15 baseline.
Information Technology / Financial Services at AMC	▪ Maintain 99.5 percent availability for IT systems as defined in customer agreements detailing specific commitments; ▪ Improve service provision through timely mitigation of audit findings focusing on strengthening processes and closing process gaps.
Franchise Fund Director	▪ Manage over 2,000 active agreements worth $400M of activity across FAA and the Federal space employing best practices for an Office of Management and Budget (OMB) and a General Services Administration (GSA) designee. These agreements are a part of the Franchise Fund activities, which include six franchise services lines.

What benefits will be provided to the American public through this request and why is this program necessary?

AFN's shared services approach to delivering the agency's common finance, acquisitions, information technology, property, logistics, technical training, and regional integration services promotes financial integrity, IT infrastructure security, continuous improvement, and streamlined products and services to support the FAA's vital aviation safety mission. AFN's integrated delivery model also focuses on reducing costs across the agency, saving taxpayer dollars while providing added value to all customers and stakeholders. As an innovative, forward-thinking organization, AFN strives to empower FAA personnel across the country to focus on the mission, lessening the administrative support burden on front-line organizations critical to maintaining the safest airspace system in the world. Ultimately, AFN

benefits the American public by ensuring a more efficient, reliable, transparent, and financially responsible FAA while providing additional support to other agencies and bureaus.

Each AFN service area works to move the agency forward by streamlining processes previously handled at the line of business or staff office level. IT support for systems, efficient, adequate space to house staff, a procurement group that can acquire needed materials and services, and a strong financial engine all substantially contribute to both ATO and AVS and is critical to support the daily air traffic control work in ATO and safety inspections in AVS. As a whole, AFN continues to find new and innovative ways to lessen the administrative burden on the agency's employees, allowing them to more efficiently and effectively meet their individual responsibilities to support the safety of the NAS.

The requested funding for FY 2019 will support all of FAA's 14 lines of businesses and staff offices and key initiatives that include:

- Overseeing the FAA's $16 billion annual budget and operating financial, cost accounting, and procurement systems.
- Ensuring efficient operations of backup command, control, and communications centers for the NAS;
- Protecting and updating the agency's IT infrastructure;
- Competing, negotiating, awarding, and managing more than $4 billion in key contracts that support critical programs and projects including NextGen;
- Training more than 16,000 resident students in safety related occupations annually to keep the NAS operating at optimal capacity and efficiency at any given time;
- Maintaining 270,000 property and equipment assets.

Office of Finance and Management (AFN)
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$766,104**	**1,610**	**15**	**1,635**
Adjustments to Base	**$10,939**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	1,251			
Extra Compensable Day (261)	1,023			
GSA Rent	6,600			
Working Capital Fund	2,065			
Other Changes	**-$6,033**	**0**	**0**	**-39**
Workforce Reduction Through Attrition	-6,033			-39
Base Transfers	**$0**	**0**	**0**	**0**
FY 2019 Request	**$771,010**	**1,610**	**15**	**1,596**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

GSA Rent: GSA Direct Lease Portfolio increases required for annual escalations in rent, utilities, and taxes.

Working Capital Fund: This cost adjustment is requested to support the Department of Transportation's (DOT) Working Capital Fund (WCF) profile. These adjustments are being made to best align each office's resources within their expected WCF costs.

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

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Detailed Justification for NextGen and Operations Planning (ANG)

FY 2019 – NextGen and Operations Planning – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	29,402	29,230	27,967
Program Costs	30,753	30,516	30,569
Total	**$ 60,155**	**$ 59,746**	**$ 58,536**
FTE	**191**	**191**	**181**

What is this program and what does this funding level support?

Realizing the future vision of aviation through integrated strategies and solutions that achieve national and international goals encapsulates the mission of the ANG organization. The organization champions the evolution of NextGen through program management, enterprise system engineering, and technical integration expertise. The William J. Hughes Technical Center (WJHTC) is FAA's national scientific test base for the research, development, test, and evaluation of air transportation systems. The research, testing and prototype development conducted by WJHTC staff helps shape the future of our Nation's air transportation system and make NextGen a reality.

The WJHTC owns and operates approximately 1.6 million square feet of test and evaluation facilities, NAS field support facilities, research and development facilities, administrative facilities and numerous project test sites. As the FAA's Federal Laboratory, WJHTC is the principal source for conducting NextGen research, test, and evaluation. These sites and facilities provide the necessary technical platforms for research, development, and testing of NextGen programs. WJHTC also provides around the clock operational support to En Route, Terminal, and other Air Traffic Control (ATC) facilities throughout the nation. Annual operations and maintenance costs for WJHTC are approximately $24,922,900 or 42 percent of ANG's operations budget.

This Program maintains facilities and support services for all properties at the William J. Hughes Technical Center including land, buildings and infrastructure.

Managing program performance and resource utilization, analyzing and measuring implementation benefits and testing new NAS capabilities are all essential elements of a successful transformative program. Program benefits assessment and resource management elements perform continuous analyses to support optimal NextGen resource investment decisions.

WJHTC capabilities include research and development, verification and validation, test and evaluation, and sustainment of the FAA's full spectrum of aviation systems. The Center specializes in sustaining and modernizing air traffic control automation, communications, surveillance, navigation, traffic flow management, and weather systems, and supports advancements in airport and aircraft safety, human factors, and separation standards.

FY 2019 Anticipated Accomplishments:

Function/Activity	FY 2019 Anticipated Accomplishments

Facility Related:	• Provide the technical platform for research in aircraft safety (fire, structural, unmanned aircraft systems, etc.), airport technologies (safety, capacity), human factors, and weather.
	• Provide laboratory systems for:
	  o Conducting integrated concept evaluations, modeling and simulations, and test and evaluation for all NextGen technologies in the National Airspace System (NAS).
	  o 24x7x365 field support for all operational systems within the NAS.
	• Provide facility operations and maintenance, environmental management and maintenance, and engineering support for all facilities located at the WJHTC.
	• Safeguard both employees and campus infrastructure by ensuring compliance with environmental laws, policies, directives, and initiatives.

NextGen and Operational Related:	• Conduct successful research, development, testing and evaluation that lead to deployment of NextGen systems, capabilities and intended benefits to stakeholders. The deployment of several NextGen transformational programs, which are funded through the Facilities and Equipment account, are ongoing. • Prepare NextGen Program Performance measurement and benefits analyses. • Develop and coordinate the annual publication of the NextGen Implementation Plan. • Provide analytical studies and related safety monitoring services in support of separation reductions in U.S. sovereign airspace and international airspace where FAA has delegated authority to provide air traffic services. • Conduct the bi-annual review of the Performance of Reduced Vertical Separation Minimum Operations (RVSM) in North America (U.S., Canada, and Mexico) compared to International Civil Aviation Organization (ICAO) Recommended Requirements. • Conduct maintenance and operations of independent performance based monitoring for Altimetry System Error (ASE), a key component to the implementation of RVSM. • Provide improved advisories for Flight Operations Center (FOC)/Airline Operations Center (AOC)

Other measures indicating this program works are:

- Research and Development accomplishments indicated in the R&D Annual Review document published with the National Aviation Research Plan (NARP).
- Technology transfer of research to industry and academia via Cooperative Research and Development Agreements and Grants.

What benefits will be provided to the American public through this request and why is this program necessary?

Aviation enables the economic benefits of tourism, shipping and travel for business or pleasure. Airports provide economic impact to large and small communities across this country. Continued economic growth in the aviation industry is supported through the ongoing implementation of NextGen technologies, policies and procedures.

The WJHTC is a world class research institution that provides the American public with research, engineering, development, test, evaluation, and maintenance of air navigation, air traffic management, and future air transportation system capabilities. These capabilities directly affect the day-to day operation of the National Airspace System, ensuring that safety critical operational systems are constantly maintained and improved. The technical expertise provided by the labs is also key to the implementation of future NextGen capabilities.

Through a continuous roll-out of improvements and upgrades, NextGen builds the capability to more precisely and efficiently guide and track air traffic, while saving fuel and reducing noise and pollution. The FAA and its partners continue to make significant progress in the modernization of our air traffic infrastructure and transformation of our operation. NextGen improvements in every phase of flight are resulting in more and more benefits to airlines, passengers, the FAA and other users.
We estimate that implemented changes already have accrued $1.6 billion of benefits since 2010. We expect that by 2030, the total benefits of NextGen improvements will be $160.6 billion, at a cost of $35.8 billion to the FAA and the aviation industry. After discounting to present value, the benefit-to-cost ratio is 3-to-1.

NextGen and Operations Planning (ANG)
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$59,746**	**183**	**5**	**191**
Adjustments to Base	**$302**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	138			
Extra Compensable Day (261)	111			
Working Capital Fund	53			
Other Changes	**-$750**	**0**	**0**	**-5**
Workforce Reduction Through Attrition	-750			-5
Base Transfers	**-$762**	**-5**	**0**	**-5**
Global Leadesrhip Initiative	-250	-1		-1
Flight Programs Operations	-512	-4		-4
FY 2019 Request	**$58,536**	**178**	**5**	**181**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

Working Capital Fund: This cost adjustment is requested to support the Department of Transportation's (DOT) Working Capital Fund (WCF) profile. These adjustments are being made to best align each office's resources within their expected WCF costs.

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

Global Leadership Initiative (ANG to APL): This request transfers funding $250K and 1FTP/1FTE from NextGen, ANG to Policy, International Affairs & Environment, APL.

Flight Program Operations (AVS, ANG to ATO): This request transfers funding $15.2K and 34FTP/34FTE from the Aviation Safety Organization, AVS (30 FTP/FTE), NextGen and Operations, ANG (4 FTE/FTP) to the Air Traffic Organization, ATO. In addition, 34FTP/34FTE will transfer from the ATO Franchise Fund account into the ATO Operations account.

SECURITY AND HAZARDOUS MATERIALS SAFETY (ASH)

Detailed Justification for Security and Hazardous Materials Safety (ASH)

FY 2019 – Security and Hazardous Materials Safety (ASH)– Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	74,433	74,670	74,118
Program Costs	32,728	31,763	31,440
Total	**$107,161**	**$106,433**	**$105,558**
FTE	**490**	**490**	**482**

What Is This Program and What Does This Funding Level Support?

The Office of Security and Hazardous Materials Safety (ASH) ensures aviation safety, supports national and homeland security, and promotes an efficient airspace system through focused development and execution of its safety and security policies and programs. ASH develops and implements policies to protect the flying public, FAA employees, contractors, information, facilities and assets; provides Agency crisis management coordination, manages continuity of operations/continuity of government plans, facilities, and communications, executes and supports FAA and other government agencies' national security responsibilities, and protects the flying public, through identification and analysis of security threats to FAA, the National Airspace System (NAS), and U.S. civil aviation, regulatory oversight of safe air transport of hazardous materials, and investigation of airmen and employee misconduct. Any failures or lapses in executing these programs negatively impacts NAS safety and security, and degrades FAA's ability to provide one of the key components of our country's transportation infrastructure and emergency response.

FY 2019 Anticipated Accomplishments:

Function / Activity	FY 2019 Anticipated Accomplishments
Office of Hazardous Materials Safety (AXH) is responsible for ensuring and promoting the safe transportation of hazmat in air commerce ▪ Regulatory oversight of hazmat carried by the flying public or transported on aircraft ▪ Utilization of risk-based decision making principles and a Safety Management System (SMS) approach to identify and address aviation risks ▪ National and international stakeholder engagement and safety promotion to address risks from air transportation of hazmat ▪ Representation of FAA on hazmat-related International Panels, Committees, Multi-Disciplinary Groups and teams to develop standards, regulations, and mitigation strategies for safe transportation of hazmat by air ▪ Partnerships with internal and external stakeholders to share information that continues to promote informed aviation safety decisions.	▪ Complete integration of SMS and certificate management principles into hazardous materials safety oversight of FAR Part 135 air carriers; leverage industry's use of safety management principles among FAR Part 121 air carriers to continue resourcing and focusing safety oversight efforts on areas of highest risk. ▪ Continue to use risk-based decision making processes to support national surveillance of regulated entities; conduct continuous improvement and internal evaluations of safety program data; and collaborate with other FAA Lines of Business to increase access and improve agency safety data for analysis, hazard tracking, and risk mitigation. ▪ Lead/support global activities and initiatives through International Civil Aviation Organization (ICAO), International Air Transport Association (IATA) and other international bodies, such as the SAE Lithium Battery Packaging Performance Committee, U.N. Informal Working Group on Lithium Batteries, and the ICAO Cargo Safety Group and Dangerous Goods Panel Working Groups on aviation safety. ▪ Implement a stakeholder engagement strategy to educate domestic and international regulated entities, including passengers, on the safety ramifications of transporting lithium batteries and undeclared hazardous materials, and engage industry associations, distributors, airports, and other stakeholders, to more efficiently promote aviation safety. ▪ Coordinate and collaborate with FAA Flight Standards (AFS) to capitalize on technology, including using AFS's Safety Assurance System (SAS) for air carrier activities, and, resources permitting, integrate oversight of air transportation of hazmat by shippers into SAS. ▪ Through collaboration with other FAA Lines of Businesses, gain access to additional safety data sources, such as FAA's Aviation Safety Information Analysis and Sharing (ASIAS) and Aviation Safety Action Program (ASAP)for use along with other data sources such as the Voluntary Disclosure Reporting Program (VDRP), to support risk based decision making. ▪ Advance safety in the NAS through continued leadership and participation in International Safety Organizations, collaborations with State Civil Aviation Authorities (CAAs), engagement with stakeholders, such as lithium battery manufacturers and/or distributors, and multi-disciplinary cargo safety groups, to address global safety oversight issues and international standards. ▪ Conduct strategic coordination with FAA Aviation Safety (AVS) to address the known and anticipated risks related to the transportation of air cargo to, from and within the U.S. to support the development and implementation of strategies to mitigate risks. ▪ Continue to identify ways to drive efficiencies and reduce duplication through collaboration with other FAA Lines of Businesses and Offices.

Function / Activity	FY 2019 Anticipated Accomplishments
Office of Personnel Security (AXP) provides Personnel Security program policy guidance, oversight, and evaluations, for: ▪ Personnel Security Program ▪ Identification Media and Credential Program	▪ Provide oversight to ensure FAA workforce is in compliance with federal personnel security requirements to access classified information or be in sensitive positions; and meet suitability and fitness requirements to work in FAA. ▪ Continue actions to complete recommendations from the Chicago (ZAU) Security Review to enhance the Personnel Security, Identification Media and Credential Programs that protect critical FAA personnel, infrastructure, and information in the NAS. ▪ Process background investigations and fingerprint checks for FAA employees and contractors. ▪ Issue PIV cards to new employees and contractors, and renew expired ones and enable 100 percent of issued PIV cards for use within FAA facilities and information systems.
Office of Infrastructure Protection (AXF) supervises nationwide Facility Security programs and provides program policy guidance, oversight, and evaluations for almost 1,100 staffed facilities and over 10,000 unstaffed facilities. ▪ Facility Security Management Program (FSMP) ▪ Information Security Program	▪ Ensure FAA facilities are in compliance with facility and information security requirements that protect agency employees, visitors, and information through robust oversight, inspection, and assessment program. ▪ Enhance the Facility Security Management Program that protects critical FAA infrastructure and personnel in the NAS. ▪ Increase complexity of FAA facility inspections and assessments and provide oversight to ensure FAA facilities are in compliance with facility and information security requirements that protect agency employees, visitors, information, systems and facilities at every level daily. ▪ Continue actions to complete recommendations from the ZAU Security Review to enhance the Information and Facility Security Programs that protect critical FAA personnel, infrastructure, and information in the NAS. ▪ Develop standards, programmatic safeguards and controls for protecting classified national security and sensitive unclassified information from loss, compromise or unauthorized disclosure.

Function/Activity	FY 2019 Anticipated Accomplishments
Office of National Security Programs and Incident Response (AXE) ensures Agency-level emergency readiness, crisis management, threat identification and analysis, and national security support to promote and ensure national airspace and aviation safety and security. ▪ Washington Operations Center ▪ Current Intelligence and Threat Evaluation Watch Operations ▪ Special Operations and Law Enforcement Support ▪ Command, Control and Communications ▪ Emergency Preparedness and Response ▪ Regulatory Investigations ▪ Law Enforcement Assistance Program (LEAP)	▪ Manage the Washington Operations Center Complex (WOCC) and support the Air Traffic Security Coordinators (ATSC), who manage the Domestic Events Network (DEN); provide FAA, DOT, and the White House with situational awareness of all incidents impacting aviation and the National Airspace System. ▪ Provide threat analysis to support FAA decision-making regarding emerging threats to aviation safety from technologies, such as, Unmanned Aircraft Systems (UAS) or in overseas locations; maintain a 24/7 intelligence watch to provide threat intelligence and analysis to FAA executives, the WOC, ATSCs, and the Office of the Secretary as necessary. ▪ Maintain emergency operations network capability and ensure continued situational awareness of daily and emergency events. Integrate the WOCC and Regional Operations Centers (ROCs) with the Emergency Notification System (ENS). Meet communications requirements for Executive Department and Agency headquarters, and operating continuity facilities that support the continuation of the Agency and Department Mission Essential Functions (MEFs). ▪ Ensure national incident preparedness, and response policy guidance and structure support national and regional operations during serious or catastrophic incidents (natural, technical, terrorist incidents, wide-spread communications outage, etc.) and national special security events. Provide management of National Exercise Program exercises and other appropriate exercises that require FAA-wide coordination. ▪ Support regulatory investigations. Obtain National Driver Registration information and review for DUI/DWI violations that have not been reported to the FAA, and take subsequent enforcement actions, as appropriate, to prevent airmen who present a safety risk to the NAS from flying. Obtain Federal and State prison information to compare against the Airman Registry, identify matches and recommend enforcement action, as appropriate, to prevent safety threats to the NAS. ▪ Manage the FAA's Law Enforcement Assistance Program. Assist and support Federal, State, local, territorial, tribal, and international law enforcement agencies that investigate and interdict illicit use of aircraft in narcotics, weapons, and human trafficking. Investigate and support Flight Standards and law enforcement agencies in building enforcement and/or criminal cases against persons who operate UAS non-compliantly or for malicious purpose. ▪ Draft and promulgate national policy to support regulatory investigations as well as LEAP activities, such as aircraft registration violations. Develop standards to enhance LEAP mission effectiveness.

Function/Activity	FY 2019 Anticipated Accomplishments
Office of Investigations (AXI) conducts administrative and civil investigations involving FAA employees, contractors, and non-employees suspected of violating FAA orders, policy, and federal regulations. Additionally, AXI provides cyber analysis, insider threat detection and mitigation, and defensive counter intelligence services including foreign travel briefings and debriefings. ▪ Internal Investigations ▪ Investigations Standards and Policy ▪ Technical Investigations: Insider Threat, Defensive Counter-Intelligence, Cyber Investigations	▪ Execute internal investigations of FAA employees and contractors for misconduct. Conduct administrative, civil, and regulatory investigations that fall under the FAA's jurisdiction. ▪ Develop standards to enhance the efficiency and effectiveness of internal investigations. Draft and promulgate national policy to support and guide internal investigators in the consistent execution of their duties. ▪ Develop and execute FAA's Defensive Counterintelligence Program (DCIP), including cyber threat analysis, as well as the Insider Threat Detection and Mitigation Program (ITDMP) to detect and respond to threats from foreign intelligence and FAA employees and contractors who may present an insider threat to Agency personnel, infrastructure, NAS operations, or information. ▪ Execute Cyber Investigations in support of FAA's internal investigations, DCIP and ITDMP.

What Benefits Will Be Provided to The American Public Through This Request and Why Is This Program Necessary?

We are responsible for the FAA's critical infrastructure protection, personnel security, emergency operations, threat identification and analysis, contingency planning and crisis response, investigations of employees, contractors, and airmen who may present a safety or security risk to the NAS, and the safe transportation of hazardous materials in air commerce. Protecting our critical infrastructure is a national and homeland security concern, which continues to demand a high level of attention and innovation. In recognition of the criticality of the NAS in our country's transportation infrastructure and economic health, ASH develops and executes policies and programs to protect FAA employees, contractors, facilities, and assets, as well as airmen, aircraft, and the flying public. We are committed to continuously improving the safety, security, and efficiency of flight, and continue to work with all of our partners and stakeholders to focus our experience, expertise, and new technology to ensure a safer and more secure global airspace.

Office of Security and Hazardous Materials Safety (ASH)
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$106,433**	**486**	**1**	**490**
Adjustments to Base	**$327**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	353			
Extra Compensable Day (261)	297			
Working Capital Fund	-323			
Other Changes	**-$1,202**	**0**	**0**	**-8**
Workforce Reduction Through Attrition	-1,202			-8
Base Transfers	**$0**	**0**	**0**	**0**
FY 2019 Request	**$105,558**	**486**	**1**	**482**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

Working Capital Fund: This cost adjustment is requested to support the Department of Transportation's (DOT) Working Capital Fund (WCF) profile. These adjustments are being made to best align each office's resources within their expected WCF costs.

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

STAFF OFFICES

Detailed Justification for - Staff Offices

FY 2019 - Staff Offices – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	157,867	154,149	149,793
Program Costs	51,234	53,532	52,892
Total	**$209,101**	**$207,681**	**$202,685**
FTE	**999**	**999**	**962**

What is this program and what does this funding level support?

The Staff Offices of FAA include the Office of the Administrator, Chief Counsel and six assistant administrators who provide mission support services to the four lines of business, including legal counsel, economic trend analysis, diversity leadership, government and industry liaisons, communications, public relations and human resources management. A brief description of staff offices is outlined as follows:

- The Office of Audit and Evaluation performs audit and investigative review functions primarily for internal safety disclosures and concerns, including the FAA Whistleblower Protection Program.
- The Office of Civil Rights advises, represents, and assists the FAA Administrator on civil rights and equal opportunity matters.
- The Office of Government and Industry Affairs serves as the Administrator's principal adviser and representative on matters concerning relationships with the Congress, aviation industry groups, and other governmental organizations, developing and reviewing plans and strategies involving these groups to enhance aviation safety.
- The Office of Communications is responsible for the policy, direction, and management of the agency's communications programs for the news media and FAA's employees nationwide.
- The Human Resources Management organization provides human resource services to all operating lines of business and staff offices (LOB/SOs) at the headquarters and to all the FAA regions including the two centers and overseas.
- The Office of Policy, International Affairs, and Environment serves as the principle advisor to the Administrator on international matters.

What benefits will be provided to the American public through this request and why is the program necessary?

Through the leadership of the Administrator, FAA successfully manages the most complex and safest aviation system in the world. By executing their mission responsibilities and providing management, leadership, and oversight, the FAA's Staff Offices have contributed to the overall success of the FAA.

Staff Offices provide services and resources necessary for the operations of our business. Without these services, lines of business would not have the resources needed to meet their goals. From performing mission-critical services to receiving guidance and counsel on regulatory or legal issues, or managing annual appropriations, Staff Offices make a significant contribution to the mission of FAA. Reductions below the requested level would hinder our ability to provide key support services.

Detailed Justification for – Office of the Administrator (AOA)

FY 2019 - Office of the Administrator – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	3,063	2,969	2,723
Program Costs	1,007	1,093	1,093
Total	**$4,070**	**$4,062**	**$3,816**
FTE	**19**	**19**	**17**

What is this program and what does this funding level support?

The Office of the Administrator (AOA), leads the Federal Aviation Administration (FAA) in its mission to provide the safest, most efficient aerospace system in the world. This office is responsible for the overall planning, direction, coordination and control of FAA programs, and represents FAA in its work with the Department of Transportation and other agencies, the White House, Congress, the aviation community and the general public.

AOA directs and controls the operations of the (FAA) and acts as principal adviser to the Office of the Secretary (OST) on civil aviation matters and air transportation. Throughout FY 2019, AOA will continue to lead FAA toward achieving the agency's performance goals and targets.

In leading the FAA, the Administrator oversees the Agency's employees in maintaining, operating, and overseeing the largest and most complex aviation system in the world. The agency determines the regulatory and operational standards for the United States, and effectively sets the benchmark for aviation safety around the world.

The funding level supports Executive direction of the FAA and provides for the Administrator's and Deputy Administrator's direct staff.

What benefits will be provided to the American public through this request and why is this program necessary?

AOA provides direction and executive oversight for the management and operation of the world's largest, safest, and most efficient airspace system. Aviation is a significant contributor to the U.S. economy and the FAA provides continuous operational Air Traffic Control services to airlines and general aviation; safety oversight of operators and manufacturers; management of airport improvement grants; and acquisition of the FAA's NextGen air traffic control system.

Detailed Justification for –Audit and Evaluation (AAE)

FY 2019 – Audit and Evaluation (AAE) – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	3,172	3,130	3,156
Program Costs	110	110	110
Total	**$3,282**	**$3,240**	**$3,266**
FTE	**19**	**19**	**19**

What is this program and what does this funding level support?

The Office of Audit and Evaluation (AAE) has two primary functions: safety audit and investigation review analysis, hotline operations & reporting.

- **Safety audit and investigation analysis** staff perform audit and investigative review functions primarily for internal safety disclosures and concerns, including the FAA Whistleblower Protection Program. It also coordinates and evaluates FAA responses to Department of Transportation (DOT), Office of Inspector General (OIG), General Accounting Office (GAO) and US Office of Special Counsel (OSC) generated audits, investigations and evaluations.

- **Hotline operations** is a reporting and data function that provides for analysis of hotline submissions, coordination of AAE investigations, and reviews for completeness investigations conducted by appropriate FAA organizations. The Office also operates and manages several administrative and safety hotlines. While AAE coordinates and provides independent quality control evaluations of certain investigations conducted by the lines of businesses, the Office does not determine the technical merits of safety-related issues or make recommendations for resolution of particular safety-related cases. Such determinations remain the ultimate responsibility of the appropriate safety offices.

Some of AAE's critical supporting activities include: The mission of the office primarily and directly supports the Departmental goal of increased safety, but also supports in a more generalized way the goal of building and enhancing our high performance work place. The FY 2019 funding will support the operation and management of consolidated safety hotlines and provide a centralized focus for internally and externally generated safety-related complaints, critical audits, and investigations. Additionally, the Office provides an impartial agency venue for investigation and early resolution of safety disclosures.

- Serving as primary interface and maintaining a continuous liaison with GAO, OSC, and the DOT OIG investigations/audit staffs concerning safety-related investigations.
- Recording, tracking, reviewing, and confirming implementation of FAA responses to DOT OIG, OSC, and GAO audits and investigations that are under the purview of AAE.
- Managing the Whistleblower Protection Program established under 49 U.S.C. § 42121.
- Analyzing data from the Safety Hotline, the Administrator's Hotline, and Whistleblower contributions to identify trends.
- Serving as an alternative point of contact for receipt of safety-related contributions or allegations of retaliation against whistleblowers in general.
- Conducting initial reviews of contributions and investigations received, including an immediate assessment (in consultation with appropriate parties), and review of responses for accuracy, thoroughness and internal consistency of handling.

Detailed Justification for – Civil Rights (ACR)

FY 2019 - Civil Rights (ACR) – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	9,943	9,555	9,170
Program Costs	2,312	2,617	2,617
Total	**$12,255**	**$12,172**	**$11,787**
FTE	**71**	**71**	**68**

What is this Program and what does this funding level support?

Internally, the Office of Civil Rights (ACR) mission is to aid in the prevention of unlawful discrimination on the basis of race, color, national origin, sex, age, religion, sexual orientation, and individuals with disabilities employed by the FAA. The Office of Civil Rights works in conjunction with FAA managers and the Administrator to ensure Equal Employment Opportunity (EEO) awareness and adherence to EEO policies and guidelines. FAA employees are trained in respectful and equitable treatment of one another and in turn, each FAA organization plays a role in the implementation of an effective EEO program where individuals are treated with equity and respect regardless of differences.

Externally, the ACR mission is to provide airport oversight with regard to civil rights laws and regulations. ACR works to ensure that all beneficiaries of federally assisted transportation programs are offered equal opportunity for participation and are free from discrimination. These efforts address airport compliance with the Americans with Disabilities Act (ADA), Rehabilitation Act, Disadvantaged Business Enterprise Program, Title VI, Limited English Proficiency (LEP), Environmental Justice (EJ), and other civil rights regulations.

FY 2019 Anticipated Accomplishments:

Function / Office	FY 2019 Anticipated Accomplishments
Internal Civil Rights Services ▪ EEO Complaint Services/Alternative Dispute Resolution Services ▪ Model EEO Program ▪ Diversity and Inclusion ▪ EEO Training	▪ Process 100% of the allegations and inquiries regarding EEO complaints by providing quality counseling, mediation and consulting services. ▪ Assist and provide resources for agency selecting officials to increase the hiring of People with Targeted Disabilities (PWTD). ▪ Assist the Agency in building a Model EEO Workplace through outreach, consultations, collaboration, and educational partnerships. ▪ Manage nationwide Special Emphasis Programs (SEPs) to foster a diverse applicant pool for FAA vacancies, promote EEO, and oversee the advancement and retention of a diverse workforce.

	▪ Encourage the FAA workforce to engage in the Alternative Dispute Resolution (ADR) process as a method to resolve disputes in the EEO Complaint Process at the lowest possible level to avoid the cost, delay, and unpredictability of the traditional adjudicatory processes. ▪ Develop the annual EEO Plan in conjunction with FAA lines of business and staff offices (LOB/SO) to identify and eliminate EEO barriers and agency deficiencies. ▪ Assist Agency efforts to create a FAA culture in which managers and employees understand their role in developing and maintaining an inclusive workplace by providing training on EEO laws, FAA policies, and appropriate workplace behavior. ▪ Increase FAA managers and employees conflict resolution skills through the Conflict Coaching Program and reduce the number of EEO complaints that are filed in the agency through the use of early intervention techniques.
External Civil Rights Services ▪ Disability Airport Compliance ▪ Airport Non-discrimination Compliance (Title VI of the Civil Rights Act) ▪ Disadvantaged Business Enterprise (DBE)/Airport Concession Disadvantaged Business Enterprise (ACDBE) Compliance	▪ Conduct DBE compliance reviews and ensure that small and disadvantaged business enterprises are able to compete with larger companies for airport construction projects and concessions. ▪ Adjudicate external complaints from the public and other customers. ▪ Maintain an online FAA dbE-connect system to connect DBEs and relevant airport opportunities and allow airports to identify certified DBEs in areas of work needed to support their DBE goals. ▪ Deliver training, technical assistance and consultations in order to increase knowledge in the areas of DBE/ACDBE, ADA/ 504 and Title VI/LEP/EJ at our nation's airports.

Over the past several years, ACR has taken a very proactive approach to conflict management. Alternative Dispute Resolution (ADR) is a means for employees and managers to resolve disputes before they become formal EEO complaints. ACR has helped to reduce the number of informal complaints by utilizing a robust EEO training program.

EEO complaints can be very costly to FAA in terms of employee productivity as well as funding. ACR's mission is to prevent and address discrimination by providing civil rights training, guidance, compliance and oversight in our FAA workplace and at airports throughout the country. ACR takes actions that challenge, assist, and support our customers to create an environment where all are able to contribute meaningfully to the mission. ACR aids in the prevention of discrimination through the implementation of agency-wide EEO policies, practices, and procedures including a Model EEO Program that stresses the prevention of discrimination before it occurs.

ACR will utilize FY 2019 funding to continue to provide guidance and support in numerous areas including:

- EEO Compliance
- Workforce Diversity
- Conflict Resolution
- Training

Function / Activity	Services Provided
EEO Compliance	• Provide oversight regarding civil rights laws and regulations by administering the agency's Internal Civil Rights and the External Civil Rights (Airports) Programs. • Utilize information technology to increase compliance at airports in the areas of DBE/ACDBE, ADA/ 504 and Title VI/LEP/EJ. • Oversee the process for developing and reporting to the EEO Commission (EEOC) the Annual Management Directive (MD)-715 EEO Plan and continue to monitor Agency accomplishments. MD-715 is the policy guidance which the Equal Employment Opportunity Commission (EEOC) provides to federal agencies for their use in establishing and maintaining effective programs of equal employment opportunity. • Conduct and follow up on MD-715 EEO Assessments.
Workforce Diversity	• Increase the effectiveness of the EEO Outreach Program to minority groups with lower than expected employment rates in the agency. • Conduct trend analysis to determine if there is any evidence of disparate treatment of applicants or employees based on race, sex, national origin, or other protected categories. • Manage, coordinate, and promote activities that support the Office of Personnel Management (OPM) Executive Order on Diversity and Inclusion.
Conflict Resolution	▪ Assist agency efforts to address discrimination by addressing EEO complaints through the National Intake Unit, EEO counseling, and EEO consultation services. ▪ Provide an EEO discrimination process that can process 100 percent of the allegations and inquiries regarding EEO complaints by having adequate counseling, mediation and consulting services. • Continue to encourage the FAA workforce to engage in the ADR process as a method to resolve disputes in the EEO Complaint Process at the lowest possible level to avoid the cost, delay, and unpredictability of the traditional adjudicatory processes.
Training	▪ Develop, revise, track, and report on EEO training activities throughout FAA.

Function / Activity	Services Provided
	▪ Deliver training and provide technical assistance to external stakeholders regarding disability, disadvantaged businesses, and nondiscrimination.

What benefits will be provided to the American public through this request and why is this program necessary?

ACR provides leadership and direction with regard to civil rights, diversity, and Equal Employment Opportunity (EEO) matters. The ACR mission is to implement civil rights and EEO policies and operational programs to ensure their full and successful development in support of FAA's mission which is to provide the safest, most efficient aerospace system in the world. ACR ensures the elimination of unlawful discrimination on the basis of race, color, national origin, sex, age, religion, sexual orientation, genetic information, and individuals with disabilities in federally operated and federally assisted transportation programs; that all beneficiaries and potential beneficiaries of these programs, including employees and job applicants are offered equal opportunities to participate in them; and a positive environment in the FAA by valuing, using, and managing the differences that individuals bring to the workplace.

ACR works to foster diversity and inclusion activities that lead to a healthy work environment that promotes diversity in all its dimensions and harmony across the FAA. Inclusion means a work environment where everyone has an opportunity to fully participate in creating an organizational success and where every person is valued for his or her distinctive skills, experiences, and perspectives. Inclusion is also about creating a global community where the FAA connects everyone and everything through our programs, our activities, our products, our services and our winning workforce. Inclusion also cultivates a culture that encourages collaboration, flexibility, and fairness to further retention and enables individuals to contribute to their full potential. ACR helps to develop structures and strategies to equip leaders with the ability to manage diversity, be accountable, measure results, refine approaches on the basis of such data, and institutionalize a culture of inclusion.

ACR is committed to providing a workplace that promotes equal opportunity, is free of harassment, and is an environment where employees can focus on productivity, not conflict. The FAA Office of Civil Rights has oversight of internal and external EEO policy, which needs to be properly funded and staffed to ensure we can maintain a proactive EEO program. The result of these efforts is a diverse and satisfied workforce that collaboratively helps to ensure the safety of the flying public.

Detailed Justification for – Government and Industry Affairs (AGI)

FY 2019 – Government and Industry Affairs (AGI) Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	1,306	1,253	1,264
Program Costs	123	300	300
Total	**$1,429**	**$1,553**	**$1,564**
FTE	**8**	**8**	**8**

What is this program and what does this funding level support?

The Office of Government and Industry (AGI) supports the Administrator and represents the Federal Aviation Administration (FAA) by being the principal linkage between the agency and Congress.

AGI works with FAA offices to coordinate, facilitate, and present FAA's legislative message. AGI consistently monitors and gauges the interest and needs of leadership on Capitol Hill (United States Congress). This relationship also extends to coordinating our legislative initiatives and responses with the Department of Transportation. AGI also serves as liaison with the aviation industry, from manufacturers to carriers, and with other aviation related organizations. Additionally, AGI serves as the principal point of contact for state and local governments.

The following core activities represent the FY 2019 budget request:

- Communicate to Congress on behalf of the Administrator and Management Board.
- Enhance AGI's daily interaction with the Lines of Business (LOB), Staff Offices (SO) and senior management officials by proactively soliciting LOB and SO information sharing in order to improve communication on areas of interest or concerns to Congress.
- Inform key members of Congress and their staff on FAA safety policies and initiatives.
- Manage the Reports to Congress program, and function as the agency's Report to Congress liaison with congressional authorizing and appropriations staffs to clarify definitions of congressional intent. Also manage the coordination process between the Federal Aviation Administration (FAA), the Office of the Secretary (OST), and the Office of Management and Budget (OMB), to encourage timely LOB and SO responses to targeted deadlines.
- Assist in preparing agency officials for congressional meetings and briefings.
- Work in coordination with The Office of the Chief Counsel (AGC) on congressional hearings.
- Provide OST Governmental Affairs with factual, concise, and complete information from significant AGI congressional contacts and activities.
- Serve as focal point for congressional follow-up on written agency responses.
- Foster strong partnerships with key industry stakeholders.
- Meet with aviation industry representatives to strengthen industry relationships.

What benefits will be provided to the American public through this request and why is this program necessary?

AGI continuously improves the quality, timeliness, and usefulness of our core business functions and performs the following:

- Serves as FAA's focal point to coordinate agency actions relating to Congressional oversight of FAA programs;
- Manages the Reports to Congress program within the FAA. Serves as the FAA Reports Control Officer and is responsible for providing the DOT Congressional Reports Officer information to disseminate to Congress and interested parties;
- Coordinates with Departmental officials to ensure consistency in furthering policies relating to Congressional and intergovernmental relations issues;
- Keeps FAA offices informed of Congressional and public concerns which may influence their operational responsibility;
- Coordinates all incoming Congressional Correspondence, Congressional Hearings, and Briefings;
- Ensures witnesses are well-prepared to answer questions at hearings

AGI fosters productive relationships with key members of Congress and Congressional Oversight Committees. AGI solicits information from program offices within the Agency to better understand and communicate areas of interest or concerns to the United States Congress.

AGI's mission is to provide high quality timely communications to Congress. It is essential that public policy is debated on its merits so that the best outcomes can result. The work of AGI enables the Administrator, Deputy Administrator, and Associate Administrators to effectively interact and communicate the policies and positions of the FAA before the United States Congress. Our established congressional relations are vital to advancing the aviation priorities of the FAA, the Department of Transportation, and the Administration.

Detailed Justification for – Communications (AOC)

FY 2019 – Communications (AOC) – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	6,163	5,985	6,039
Program Costs	305	305	305
Total	**$6,468**	**$6,290**	**$6,344**
FTE	**32**	**32**	**32**

What Is This Program and What Does This Funding Level Support?

The Office of Communications (AOC) delivers critical safety information to the news media, stakeholders, and Federal Aviation Administration (FAA) employees worldwide to support the FAA's operations, programs and mission. AOC helps the FAA achieve its mission by providing timely and accurate information and performing robust outreach to an increasingly diverse set of stakeholders. Using a variety of communications tools, AOC delivers its services through two major programs: Public Affairs and Corporate Communications.

Public Affairs
Public Affairs works closely with other FAA offices to provide timely and accurate information to the media, the aviation community and the public about FAA initiatives and activities. Public Affairs develops and implements communication strategies and public outreach to alert and inform the traveling public and aviation stakeholders about urgent safety issues. It creates and manages agency messaging, speeches and media responses, leveraging AOC's entire creative, web, media and social media resources to help advance the FAA's safety mission.

Corporate Communications
Corporate Communications manages the FAA's digital communications, including FAA.gov, MyFAA and the agency's social media accounts, which generate more than 470 million impressions annually. Corporate Communications leads the FAA's creative and multimedia services, including video, audio and application development. The team coordinates with other FAA offices to provide more than 40,000 FAA employees with accurate and timely information on programs and activities. Corporate Communications also manages the DOT-wide Idea Hub platform, which enables employees to share ideas, promote efficiencies, and support the FAA's safety mission.

Programs	Anticipated FY 2019 Accomplishments
Public Affairs	• Increase awareness and understanding of FAA safety, NextGen initiatives, unmanned aircraft systems (UAS), commercial space entrants, runway safety, airport operations, General Aviation safety, child safety, laser awareness, global leadership, weather, and other issues through press conferences, media briefings, roundtables, direct outreach to reporters, press releases, websites, social media, and other communication channels.

	• Conduct public awareness campaigns about General Aviation safety and the authorized and unauthorized use of UAS. • Increase awareness of the FAA's role as a world leader on aviation issues. • Support open government initiatives to make data available, improve online services, and increase collaboration with citizens, stakeholders, and other government agencies.
Corporate Communications	• Expand the use of social media platforms to educate new audiences who are not familiar with aviation terminology such as drone hobbyists to ensure safety. • Use more interactive sessions such as live chats and webcasts to enhance awareness and increase customer service. • Use a variety of internal communication vehicles to educate employees about agency strategic goals, programs, and activities. Obtain feedback that helps the FAA meet those goals. • Achieve an average American Customer Satisfaction Index (ACSI) customer satisfaction score of 74 or better on the FAA public website. • Further optimize FAA.gov for a better user experience on mobile platforms. • Ensure external website exceeds 90% compliance with 508 requirements and all DOT compliance goals.

What Benefits Will Be Provided To The American Public Through This Request and Why Is This Program Necessary?

With more than 119 million page views a year, www.faa.gov provides a wealth of resources to the American public. Pilots, mechanics, and other members of the flying public consistently read our news, directives, hazardous materials information, and airworthiness information every second of every day of the year. Due to our outreach, many passengers knew they could not bring dangerous cell phones on airplanes and more than 800,000 unmanned aircraft operators knew that they had to register their drones. The appetite for information has increased over the years, and now, more than two million subscribers opt to be auto-notified when our content is updated. Visits to the FAA's news content increased by 30 percent over the previous year.

Users downloaded more than 9.5 million documents from FAA.gov related to pre-flight safety procedures and planning, airmen/aircraft certification, aircraft mechanical records, airport safety regulations, and accident/incident data. The MyFAA Website, our internal site, generated 28 million views of our content and 7 million visits. Our social media's reach has grown to 262 million over the last year. As mobile devices continue to overtake desktops as the preferred choice for Internet access, the FAA has seen a persistent increase in demand for secure access to critical aviation safety information that operates seamlessly on mobile devices.

Readership and engagement have increased significantly through these communications channels. The reach of our social media channels grew exponentially, increasing followers by 86% over the last 11 months, reaching an organic audience of more than 781,744 individuals across six unique platforms. Social media allows the FAA to connect with more members of the flying public and the aviation community on important safety issues, as well as communicating breaking news. Information for air traffic operations, General Aviation safety, NextGen, and UAS are delivered via text, video, and graphical formats that members of the public expect to find through social channels. Other offices within the FAA have come to

expect social media as a communications service that AOC provides for them to help convey important information about the agency programs.

With more than 40,000 employees working in offices and in the field, around the country and abroad – the FAA intranet, employee news, daily broadcast, and audio/video production services are a vital part of ensuring employees are connected with the vision, mission and values of the agency. These vital communications vehicles ensure that employees are able to access information about everything from Human Resource (HR) benefits to changes in compensation programs that may directly affect them. Strong internal communications generate a more engaged, productive, and loyal workforce.

As the demand for safety information continues to grow from all stakeholders (employees, the public, the media, and the aviation community), these groups expect unfettered and 24/7 access to information the FAA provides, and interaction with that information through the Web, email, and social media. AOC must continue to provide accurate critical information about FAA operations, safety oversight, efficiency initiatives and other programs to all of these groups as quickly as possible.

Detailed Justification for – Chief Counsel (AGC)

FY 2019 – Office of Chief Counsel (AGC) – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	39,089	38,555	37,612
Program Costs	6,007	6,235	6,192
Total	**$45,096**	**$44,790**	**$43,804**
FTE	**225**	**225**	**217**

What is this program and what does this funding level support?

Funding at the FY 2019 requested level will provide necessary legal services, including representation in support of significant FAA program responsibilities and functions.

This funding will contribute to ensuring the FAA meets its mission obligations consistent with our legal requirements. Additionally, the requested funding will ensure that the actions of the FAA and its employees are vigorously represented in administrative and judicial forums. The request will be deployed in a manner designed to best provide timely and responsive legal services in support of the FAA's most critical program responsibilities.

The Office of the Chief Counsel (AGC) provides mission critical legal services for the FAA. Within the FAA, AGC is both a key partner to each line of business and staff office and an integral contributor to the success of every major agency program and function. Across every line of business and every agency program, AGC provides legal advice, reviews agency action for legal sufficiency and conformity, represents agency interests in various administrative and court forums, defends the agency's actions, and enhances risk management by proactively seeking to identify and mitigate risk. In addition, AGC is responsible for internal FAA adjudicative functions responsible for adjudicating bid protests and contract disputes, aviation civil penalties below a specified threshold, and challenges made to airport grant recipients compliance with their grants. This office also provides alternative dispute resolution services.

AGC's principal legal practice areas provide services in support of DOT goals in the following manner:

1) Safety, through its activity in enforcing aviation safety rules, rulemaking, acquisition and commercial law, aircraft and other tort litigation;

2) Innovation through its rulemaking activity, environmental legal services, airport legal services which support airport expansion and capacity, and acquisition of technologies that support increased capacity and efficiency; advancing global collaboration through international activity and harmonization of safety rules, enhancing Livable Communities and ensuring Environmental Sustainability through its rulemaking activity and environmental legal services; and

3) Accountability by enhancing our high performing workforce, supporting numerous agency-wide strategic initiatives, and providing legal services in support of agency administrative functions including employment and labor law, ethics counsel, FOIA and Privacy Act services and legislative services.

Funding at the FY 2019 requested level will provide necessary legal services, including representation, in support of significant FAA program responsibilities and functions. Among the more significant are:

- Rulemaking, including critical safety rules and regulatory aspects of NextGen and the safe but also timely integration of new entrants into the National Airspace System (NAS). In particular, AGC has had to devote a steadily increasing amount of resources to aiding in the safe integration of Unmanned Aerial Systems (UAS). Just one UAS rulemaking project, for example, involved the substantial time of nine attorneys. More than 10% of the personnel of AGC are engaged in UAS matters, and the workload is expected to continue to increase.
- Enforcement of safety regulations.
- Acquisition of operational safety systems and equipment, including acquisition aspects of NextGen development, and compliance with commercial and fiscal requirements.
- Airports capacity enhancement and grants, environmental streamlining for airport projects, and environmental aspects of NextGen development.
- Personnel and labor matters.
- Key international agreements, harmonization of safety requirements and safety assessments.
- International technical assistance agreements and safety assessments.
- Dispute resolution services and/or administrative adjudication of acquisition related disputes, and administration of the Civil Penalty Program; representation of agency interests and choice of actions before United States federal courts and various administrative forums, including the National Transportation Safety Board (NTSB), the Merit Systems Protection Board, and the Equal Employment Opportunity (EEO) Commission.

What benefits will be provided to the American public through this request and why is this program necessary?

AGC contributes to the overall success of FAA programs and functions that reside with the various lines of business and staff offices with programmatic responsibility. Generally, AGC is not a program in the traditional sense and our contribution cannot be assessed through a single measure. Rather AGC contributes on many fronts to many programs to ensure overall that FAA actions are consistent with legal requirements, risks are defined and managed to the extent practicable, and the interests of the government and the flying public are strongly represented.

AGC acquisition attorneys provide key support in the development, acquisition, and deployment of NextGen air traffic control, and safety systems and technologies. The rulemaking attorneys play a critical role in establishing regulatory requirements and certification of new avionics equipment. The environmental attorneys are critical to ensuring environmental assessments are timely completed for new systems and airspace redesigns. The employment attorneys have a significant role in addressing the staffing and labor implications of a system where air traffic is managed rather than controlled.

The direct beneficiaries of our services are the agency organizations that have operational and programmatic responsibility for carrying out FAA's mission, and by extension, the goals of the Department of Transportation. More significantly, the flying public is the overarching beneficiary of the increased safety and efficiency of a modern air transportation system. AGC is a key partner supporting the agency's success in all of our various program areas.

Detailed Justification for – Policy, International Affairs, and Environment (APL)

**FY 2019 – Policy, International Affairs, and Environment (APL) –
Budget Request ($000)**

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	24,607	24,403	23,812
Program Costs	9,301	9,275	9,275
Total	**$33,908**	**$33,678**	**$33,087**
FTE	**124**	**124**	**118**

What is this program and what does this funding level support?

The Office of Policy, International Affairs, and Environment (APL) consists of the following offices:

Aviation Policy and Plans improves the FAA's effectiveness with corporate planning and performance management; makes coordinated and well-informed policy decisions for crosscutting and novel civil aerospace issues using independent economic, quantitative and qualitative analysis, information and tools; and positions the FAA for the future by identifying, researching, and projecting emerging issues and trends.

International Affairs is responsible for coordinating all of FAA's international efforts and advancing the nation's longstanding leadership on the international front including collaborative engagement and cooperation with counterparts across the world.

Environment and Energy is responsible for developing, recommending, coordinating, and implementing national and international standards, policy and guidance, research and technology goals, and analytical capabilities on aviation environmental and energy matters.

Anticipated FY 2019 Accomplishments:

Function/Activity	FY 2019 Anticipated Accomplishments
Aviation Policy and Plans	▪ Facilitate the implementation of a long-term FAA reauthorization bill, working across the agency, with the Administration, and with Congress and stakeholders. ▪ Monitor implementation of other legislation with FAA requirements, and analyze forecasts of the Aviation Trust Fund. ▪ Enhance Unmanned Aircraft Systems (UAS) forecasting capability, develop credible estimates of UAS activity, and support safety analysis by UAS data acquisition and analysis. Deployment of a FAA UAS survey to commercial operators will provide vital data to the UAS forecast effort and the regulatory policy for UAS. ▪ Develop commercial space forecasts of future launches which will capture future growth in the commercial space industry and the integration into the National Airspace. ▪ Monitor congestion at US airports and, support congestion management efforts and operational initiatives such as in the New York metropolitan area. ▪ Identify and address cross-cutting NextGen and emerging manned and unmanned aviation and commercial space policy issues, which

Function / Activity	FY 2019 Anticipated Accomplishments
	includes remote tower technologies, by working across the agency, with the Administration, Congress, and stakeholders. ▪ Provide timely economic analysis to enable the agency to send critical safety rules, cost relieving regulation, and economically enabling rules such as unmanned aerial systems (UAS) advanced operations to the Office of the Secretary of Transportation and the Office of Management and Budget. ▪ Support the FAA Contract Tower and remote tower programs and their stakeholders with updated safety and efficiency benefit analysis. ▪ Develop the FAA Aerospace Forecasts at the national level and the Terminal Area Forecasts at the airport level for the FAA and the aviation industry for use in NAS planning, staffing, rule-making, development, and investment analysis. ▪ Support the Administrator by staffing the Management Advisory Council and other similar advisory bodies as directed by Congress. ▪ Improve FAA's effectiveness by leading a streamlined and responsive corporate planning, performance, and risk management processes for the agency, and implementing a new-generation digital enterprise planning and performance visualization and reporting system.
International Affairs	• With other U.S. Government agencies, prepare, negotiate, manage, and conclude international agreements in support of the FAA's international activities. • Advance FAA policies and programs through the fostering and maintenance of aviation relationships within the U.S. Government and with national, regional and multilateral aviation organizations. • Promote best practices on air traffic system operation and modernization with global air navigation service providers and organizations such as the Civil Air Navigation Services Organization (CANSO). • Promote safety oversight activities in all regions and through the International Civil Aviation Organization (ICAO) to enhance the capabilities of Civil Aviation Authorities (CAAs), regional organizations, industry, and other stakeholders around the world. • Promote global interoperability by working on research, validation and implementation of new concepts, systems, and procedures through maximizing resources to assist key countries and regional organizations to implement interoperable air traffic management (ATM) technologies and procedures. • Coordinate FAA-wide efforts to support U.S. interests in ICAO global safety, efficiency, and environmental initiatives and programs. • Serve as the Secretariat of the Interagency Group on International Aviation. • Coordinate the FAA's Global Leadership Initiative, including chairmanship of the International Advisory Board and International Steering Committee. • Finalize an updated FAA International Strategy that includes data-informed regional priorities and key initiatives that drive the agency's GLI strategic plan. • Finalize an updated FAA International Strategy that includes data-informed regional priorities and key initiatives that were developed through collaboration across the entire agency. • Finalize an FAA Order to institutionalize the GLI governance structure, its functions, and roles and responsibilities.

Function / Activity	FY 2019 Anticipated Accomplishments
	• Support the FAA's international decision making process for determining agency priority international technical assistance, training and other initiatives through available data and global drivers. • Complete key activities in the Caribbean to improve airport safety and airspace efficiency, and with the Association of South East Asian Nations (ASEAN) to influence regional system wide information management policy and practices.
Environment and Energy	▪ Support activities to reduce aviation's environmental impacts, including reducing the number of people exposed to significant aircraft noise, air quality impacts associated with aircraft engine and airport ground support vehicle emissions, and aviation's carbon dioxide (CO_2) emissions. ▪ Finalize updated noise exposure targets, policies and guidance pertaining to the mitigation of significant aircraft noise, taking into consideration research outcomes related to annoyance, sleep disturbance, and impacts on children's learning. ▪ Support activities to improve aviation fuel efficiency and augment the development, deployment and use of sustainable aviation fuels. Finalize updated targets for commercial deployment of sustainable alternative fuels. ▪ Refine, as necessary based on case by case experience, the enhanced NAS-wide operational framework for assessing implications of proposed air traffic procedural changes on fuel burn and noise, taking into account geographic constraints and demographics, without detriment to safety. ▪ Continue to identify areas for streamlining environmental review processes as prescribed in FAA's revised National Environmental Policy Act (NEPA) implementation order 1050.1 to ensure more efficient and effective implementation of NEPA across the agency; revise the associated desk reference as necessary. ▪ Continue to update our processes, procedures and best practices for engaging with officials of state and local governments, representatives of the community, and the public at-large on our airport or airspace actions that might have environmental consequences. ▪ Ensure global interoperability of NextGen technologies and procedures by shaping international standards for effectiveness and to enable new entrants (e.g. next generation supersonic, unmanned aircraft). ▪ Continue development of guidance and training materials, as well as oversight processes, for implementing the aircraft noise and exhaust emissions certification regulations and expanded delegation authority to the extent possible. ▪ Support US Government and International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP) activities to finalize the standards and recommended practices for the global market-based measure to reduce international aviation greenhouse gas emissions, and continue implementation plans for domestic application. ▪ Work with other federal agencies to continue implementing the National Alternative Jet Fuels R&D Strategy and Plan and identify next steps with regard to streamlining the international fuels approval process to enable broader use of sustainable alternative fuels.

Function/Activity	FY 2019 Anticipated Accomplishments
	▪ Harmonize and promulgate aircraft noise and emissions regulations consistent with standards adopted by ICAO and the balanced approach to aircraft noise mitigation. ▪ Provide updated implementation guidance on the use of the Aviation Environmental Design Tool (AEDT) for demonstrating environmental compliance with the National Environmental Policy Act.

What benefits will be provided to the American public through this request and why is this program necessary?

The American Public benefits from FAA's global leadership with increases in global aviation safety, efficiency, environmental sustainability, exports, and leverage to achieve broader international objectives. U.S. citizens travelling abroad, and flights between the U.S. and other countries, benefit from increased safety and operational efficiency due to FAA expertise and leadership in developing global regulations and standards. Worldwide acceptance of U.S. policies and regulatory approaches removes barriers for the U.S. aerospace industry, a vital component of the U.S. economy. Nothing supports these benefits more than the fact that the global aviation system moves more than 7.7 million people and more than 130 thousand tons of cargo to their destinations every day. To achieve these benefits and ensure the safety, efficiency and sustainability of global aviation, APL collaborates across the FAA as well as our domestic and international partners to ensure the U.S. will continue to be the gold standard for aviation.

APL is the agency lead for Aviation Policy, International Aviation, and Environmental issues. Specifically, APL coordinates the agency's reauthorization before Congress, and is responsible for national aviation policies and strategies including aviation activity forecasts, economic analyses, aircraft noise and emissions analyses and mitigation, and environmental policy.

APL serves multiple international functions and is the principal advisor to the Administrator on international matters and management of the agency's international strategic outreach. The FAA is very active in working with ICAO and its member States, civil aviation authorities and air navigation service providers, U.S. and global aviation industry, and international partners and organizations to ensure the safety and security of the global aviation system, enhance global air traffic system efficiency, and increase environmental stability. The FAA also actively promotes the development of global standards (such as, global aircraft noise) and recommended practices that are based on, or complementary, to U.S. Next Generation Air Transportation System (NextGen) systems, procedures and concepts.

FAA also participates in international standards setting and harmonization activities in transportation, and engages in implementing programs that provide technical assistance for transportation capacity building to developing countries. Outreach efforts include cooperation and technical/operational exchanges to enhance safety, efficiency, environmental sustainability; development and coordination of international civil aviation policies, positions and standards based on U.S. systems, procedures and practices; provision of support to the U.S. Mission at ICAO; and technical assistance (over 1,500 cooperative agreements with 150 countries).

Detailed Justification for – Human Resource Management (AHR)

FY 2019 – Human Resource Management (AHR) – Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	70,524	68,299	66,017
Program Costs	32,069	33,597	33,000
Total	**$102,593**	**$101,896**	**99,017**
FTE	**501**	**501**	**483**

What is this Program and what does this funding level support?

The FAA workforce is the backbone of the agency's success in providing the safest and most efficient aerospace system in the world. The Office of Human Resource Management (AHR) request covers daily work in providing human resource services to the nearly 46,000 FAA employees. AHR provides the strategic management of human capital, which ensures the FAA has the skilled workforce needed to meet the changing demands of the industry we serve. In FY 2019 we will:

- Continue implementing agency-wide leadership development programs to build a solid pipeline of future leaders and provide existing leaders with the tools needed to provide transformational leadership in support of the FAA mission.
- Refine efforts to improve the engagement, commitment and satisfaction of FAA's workforce, which is a significant factor in enabling the Department of Transportation (DOT) to advance the multi-modal transportation system of the future.
- Employ a corporate strategy that fosters effective, positive, and collaborative labor management relations.
-

As the FAA builds the foundation for the aerospace system of the future through the implementation of NextGen, the agency's workforce will play an increasingly critical role. AHR is focused on the FAA's human capital by identifying, recruiting, and training our workforce with the leadership, technical, and functional skills needed to meet the challenges of the future while maintaining the world's safest and most efficient aerospace sector. The cross-organizational workforce strategy supports the agency's transformation through the following four sub-initiatives:

- Leadership Development: Launching leadership development activities and tools grounded in FAA's strategic leadership capabilities, to support our current leaders while building a pipeline of future leaders.
- Skills Identification: Assessing the skills needed to maintain the strongest technical and functional talent for positions critical to meeting the FAA's mission.
- Skills Development: Proactively providing training to our employees to develop their skills and close any skills gaps that exist in order to ensure the FAA has a strong workforce with the right technical and functional skills to meet the industry's needs.
- Attracting Talent: Attracting and retaining talented, high-performing professionals and positioning the FAA as a competitive employer of choice.

By 2019, AHR will have assessed the skills requirements of priority mission critical occupations and will have implemented training and recruitment improvements to close technical and functional skills gaps.

Core Services:

The Office of Human Resource Services	
Critical Responsibilities:	Recruitment and hiring operations to recruit, assess, hire, and develop the FAA workforce. Processing personnel transactions, including payroll actions. Corporate recruitment and marketing; targeted outreach and agency branding.
Key Activities:	• HR management consultation • Workforce planning, position management, and classification • Recruitment, applicant assessment, referral of qualified applicants, and job offers • Personnel action processing and pay administration • Employee onboarding • Oversight and processing of personnel actions including the development of systems to support processing
FY 2019 Anticipated Accomplishments	• Position FAA as an attractive employer for prospective employees through a streamlined and easy to use process for applying to FAA jobs • Recruit new talent and maintain existing talent pipelines and explore new talent pipelines • Continue maturation of strategic HR services to forecast, recruit, and onboard the optimal number of FAA employees needed to execute the air traffic control and aviation safety missions, including full implementation of tools to align and integrate human resources with organizational goals and strategic priorities • Implement an agency-wide strategic workforce planning framework • Continue plans to optimize FAA's automated hiring system, including integration with the shared service system managing personnel actions and payroll processing • Continue efforts to improve quality of applicants referred for selection by restoring classification authority to the corporate HR office • Refinement of tools to forecast and project hiring requirements • Continued efforts to automate the end-to-end hiring process • Improvement in Executive staffing by strengthening the executive hiring, development, and performance systems.
The Office of Compensation, Benefits and Worklife	
Critical Responsibilities:	Manages the FAA's employee benefit, retirement programs, compensation, performance management, work-life and worker's compensation programs
Key Activities:	• Provide pre and post retirement counseling including providing retirement estimates • Process applications and providing counseling on survivor benefits, disability compensation, and changes to Federal Employees Health Benefits (FEHB), Federal Employees Group Life Insurance (FEGLI), and the Thrift Savings Plan (TSP) • Administer two distinct performance management systems: Valuing Performance (VP) and the Performance Management System (PMS) • Manage the FAA and DOT's Office of Worker's Compensation Program (OWCP)
FY 2019 Anticipated Accomplishments	• Continue achievement of workers' compensation cost avoidance through facilitating return to duty and ensuring careful adjudication of claims of questionable veracity • Contain FAA's annual workers' compensation chargeback bill at a greater rate than the rest of government • Ensure timely submission of claim forms to the Department of Labor (DOL) via paperless transmission through the Employees' Compensation Operations & Management Portal (ECOMP). • Complete ECOMP deployment to remaining FAA workforce (NATCA members) • Facilitate prompt payment of entitled benefits to injured employees

	• Work with DOL headquarters to share workers' compensation best practices and identify and address instances of program abuse • Continue cost-savings from centralization and standardization of core services • Introduce new retirement, financial planning, and Thrift Savings Plan seminars for FAA employees • Create tools and resources for new and transferring employees related to benefits and work life resources • Continue to enhance FAA Total Rewards programs and services • Expand Agency readiness and use of telework flexibilities and alternative work arrangements • Implement pilot programs in several Lines of Business (LOBs) to automate process for concurrence and tracking of telework agreements • Continue utilization of regional and virtual Worklife Fairs • Continue best practices delivery of Employee Assistance Program (EAP) services that support agency objectives, provide crisis management support services, and promote program utilization • Analyze labor-market to address any inequities in pay bands and technical series and to address compression issues in the upper bands • Implement approved enhancements to agency award and recognition programs • Deliver Management Performance Incentive Program (MPIP) and complete payments based on FY 2018 final performance ratings and achievement of organizational goals • Expand core compensation and performance management training offerings for managers

The Office of Labor and Employee Relations	
Critical Responsibilities:	Manages the relationships between FAA and the unions that represent its employees
Key Activities:	• Manages Labor relations with the eight unions (with a total of 33 bargaining units) which represent 35,200 (76%) of the approximate 45,500 employees working at the FAA • Represents the agency in all national and headquarters negotiations, and most regional negotiations • Handles third party matters, such as unfair labor practices proceedings and arbitrations, at both the national and regional levels of recognition. Provides labor and employee relations training and guidance to management • Handles third party matters, such as unfair labor practices proceedings and arbitrations, at both the national and regional levels of recognition. Provides labor and employee relations training and guidance to management
FY 2019 Anticipated Accomplishments	• Provide day-to-day operational support and services to FAA managers on labor and employee relations • Implement a labor and employee relations (LER) strategy • Manage oversight and compliance of all bargaining with FAA unions • Support employee engagement through continued collaboration with the unions • Develop knowledge and skills of LER employees and FAA management through training
The Office of Talent Development	
Critical Responsibilities:	Manages the development of talent and leadership bench strength
Key Activities:	• FAA Leadership & Learning Institute (FLLI) • FAA Learning Services (eLMS) • Executive Development (EXD) • Organizational Effectiveness (OE) • Human Capital Planning (HCP)
FY 2019 Anticipated Accomplishments	• Identify and implement innovative approaches to the development of eight Strategic Leadership Capabilities with an emphasis on leaders developing leaders • Deliver leadership and management training courses to at least 2,200 FAA managers • Facilitate strategic team development meetings with Executives and their leadership teams • Provide FAA organizations with succession planning data analysis required to support the long term health of the leadership pipeline • Arrange senior level rotation assignments to drive transformational leadership behaviors, fostering collaboration and encouraging effective cross-agency communication • Provide learning services to all FAA employees through the Electronic Learning Management System (eLMS) • Conduct the annual Federal Employee Viewpoint (FedView) Survey • Analyze, interpret, and report FedView and Best Places to Work results and metrics to agency stakeholders • Conduct workshops on FedView results and action planning to improve capability of FAA organizations to address survey results

	• Update the FAA Human Capital Plan to improve strategic management of the agency workforce • Coordinate OMB human capital benchmarking data collection and results reporting
The Office of the Accountability Board	
Critical Responsibilities:	Provides oversight, and ensures that management is held accountable for responding to allegations of sexual harassment, misconduct of a sexual nature, and other allegations of harassment and misconduct
Key Activities:	• Develop and deliver anti-harassment training • Monitor management's timeliness in addressing allegations • Provide LOB/SO specific data to include: Accountability Board (AB) analytics, reports and training completion
FY 2019 Anticipated Accomplishments	• Foster a workplace free of harassment and inappropriate behavior through investigation and adjudicating allegations of employee misconduct • Ensure 96% of allegations are addressed by management timely • Ensure at least 90% of FAA Leadership (Executives, Supervisors and Managers) completes the mandatory AB Training on an annual basis • Develop multi-media training, corporate communications and education platforms to address improper workplace behavior • Demonstrate the agency's commitment to eliminating harassment or misconduct within the scope of the order from the workplace • Review, analyze, interpret, and report AB allegations, Other Matter cases, dispositions and LOB/Region specific metrics to applicable agency stakeholders • Ensure a uniform and consistent approach to address and track all such allegations and create and maintain a model work environment to enhance mission accomplishment • Conduct internal review on allegations and dispositions and develop action plan to improve capability of the Accountability Board and support FAA organizations to address areas of allegations and need for specific training

The Office of Human Resource Management will focus on five major areas as the FAA moves forward with NextGen implementation. AHR will:

- Achieve mission requirements through collaborative relationships between organizations and labor partners
- Focus on FAA leadership continuity and capability to lead in a NextGen environment
- Recruit new talent and build our NextGen talent and leadership pipelines
- Develop a highly capable workforce with the necessary skills, competencies, and professional certifications needed in the next generation aviation workforce
- Position FAA as an attractive employer for current and prospective employees through our mission, values, safety culture, and human capital practices

What benefits will be provided to the American public through this request and why is this program necessary?

Funding at the requested level is critical to continue providing personnel services to all FAA employees. The non-pay costs within AHR's budget include systems like CASTLE for time and attendance and other systems. AHR also supports the FAA's learning management system, the Employee Assistance Program (EAP), the FAA's Accountability Board, and the Agency's worker's and unemployment compensation program, all of which are necessary for FAA's lines of business to be successful.

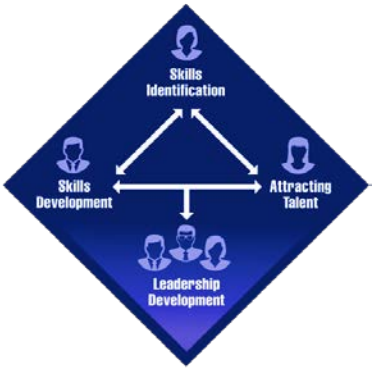
Most of the FAA's hiring efforts are for our safety organizations, with ATO and AVS being the most active. At the requested level, AHR will be able to support multiple recruiting events (e.g. virtual career fairs). This will maintain the FAA's ability to reach qualified candidates, and support DOT and FAA's goals of maintaining a diverse workforce including veterans and persons with targeted disabilities. As more federal employees become eligible to retire in FY 2019 and beyond, the competition for talent will increase.

With an increasingly retirement eligible workforce, acquiring new talent and managing the talent pipeline from entry-level to senior management is a priority for the FAA. The benefits to the American public of AHR's core missions have a direct result in FAA achieving its safety and regulatory mission. Past performance indicates the worthwhile investment of funds. For example, In FY 2015, the agency hired approximately 1,400 air traffic controllers, including over 1,000 air traffic controller trainees. In FY 2016, FAA hired 1,680 air traffic controllers, exceeding the FY 2016 target by 4 percent and in FY 2017, FAA hired 1,889 air traffic controllers, exceeding the FY 2017 target of 1,781 by 6 percent. In FY 2018, FAA is on track to meet the hiring target of 1,701. The pace of air traffic controller hiring will level out to approximately 1,200 in FY 2019 and maintain a steady state of approximately 900 – 1,000 thereafter to meet the demands of an aging workforce and increased operational requirements.

Over the past several years, the FAA has been laying the foundation for the aerospace system of the future through the implementation of Next Generation Air Transportation System (NextGen). Meeting this challenge will take the collective strength of its employees. As the FAA strengthens the foundation of the aerospace system of the future through NextGen, the Agency's workforce will play an increasingly critical role in making the FAA safer, smarter, and better together. AHR focuses on the FAA's human capital by identifying, recruiting, and training our workforce with the leadership, technical, and functional skills to meet the challenges of the future while maintaining the world's safest and most productive aerospace sector through the following four sub-initiatives:

- Launching leadership development activities and tools grounded in FAA's strategic leadership capabilities, to support our current leaders while building a pipeline of future leaders
- Identifying the skills needed to help FAA meet its current and future challenges
- Developing necessary skills in current and new employees
- Attracting and retaining talented, high-performing professionals at FAA

The FAA's greatest asset is its workforce. The dedication, professionalism, skill, and expertise of our past and present workforce have created this world-renowned agency. The FAA is poised to adapt to the changing aviation industry and empower the current and future workforce with the proper tools, knowledge, and leadership skills to be successful.



The four initiatives interact to prepare FAA's workforce for the future by identifying, recruiting, and training employees with skills and behaviors needed to meet FAA's mission.

Staff Offices
($000)

	Dollars	FTP	OTFTP	FTE
FY 2018 Annualized CR	**$207,681**	**975**	**21**	**999**
Adjustments to Base	**$722**	**0**	**0**	**0**
Annualization FY 2018 Pay Raise 1.9%	766	0	0	0
Extra Compensable Day (261)	596	0	0	0
Working Capital Fund	-640	0	0	0
Other Changes	**-$5,968**	**0**	**0**	**-38**
Workforce Reduction Through Attrition	-5,968	0	0	-38
Base Transfers	**$250**	**1**	**0**	**1**
Global Leadesrhip Initiative	250	1	0	1
FY 2019 Request	**$202,685**	**976**	**21**	**962**

Annualization of FY 2018 Pay Raises: This increase is required to provide for costs associated with base salary increases (October - December) resulting from the government-wide pay raise. The factor used is (0.25) of 1.9 percent.

Extra Compensable Day: There are 261 Compensable days in FY 2019 vs. 260 days in FY 2018.

Working Capital Fund: This cost adjustment is requested to support the Department of Transportation's (DOT) Working Capital Fund (WCF) profile. These adjustments are being made to best align each office's resources within their expected WCF costs.

Workforce Reduction Through Attrition: Restricted hiring to achieve savings through attrition.

Global Leadership Initiative (ANG to APL): This request transfers funding $250K and 1FTP/1FTE from NextGen, ANG to Policy, International Affairs & Environment, APL.

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FACILITIES AND EQUIPMENT
(AIRPORT AND AIRWAY TRUST FUND)

For necessary expenses, not otherwise provided for, for acquisition, establishment, technical support services, improvement by contract or purchase, and hire of national airspace systems and experimental facilities and equipment, as authorized underpart A of subtitle VII of title 49, United States Code, including initial acquisition of necessary sites by lease or grant; engineering and service testing, including construction of test facilities and acquisition of necessary sites by lease or grant; construction and furnishing of quarters and related accommodations for officers and employees of the Federal Aviation Administration stationed at remote localities where such accommodations are not available; and the purchase, lease, or transfer of aircraft from funds available under this heading, including aircraft for aviation regulation and certification; to be derived from the Airport and Airway Trust Fund, $2,766,572,000, of which $489,572,000 shall remain available until September 30, 2020 and $2,277,000,000 shall remain available until September 30, 2021: Provided, That there may be credited to this appropriation funds received from States, counties, municipalities, other public authorities, and private sources, for expenses incurred in the establishment, improvement, and modernization of national airspace systems: Provided further, That no later than 60 days after the submission of the President's Budget request, the Secretary of Transportation shall transmit to the Congress an investment plan for the Federal Aviation Administration which includes funding for each budget line item for fiscal years 2020 through 2024, with total funding for each year of the plan constrained to the funding targets for those years as estimated and approved by the Office of Management and Budget.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for2018 reflect the annualized level provided by the continuing resolution.

Program and Financing
(in millions of dollars)

Identification code: 69-8107-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Obligations by program activity:			
	Direct program:			
0001	Engineering, development, test and evaluation	186	172	157
0002	Procurement and modernization of (ATC) facilities and equipment	1,697	1,904	1,895
0003	Procurement and modernization of non-ATC facilities and equipment	151	197	197
0004	Mission support	214	246	229
0005	Personnel and related expenses	485	483	490
0006	Hurricane Sandy	1	2	. . . . .
0007	Spectrum Efficient National Surveillance Radar (SENSR)	9	11	. . . . .
0100	Subtotal, direct program	2,743	3,015	2,968
0799	Total Direct obligations	2,743	3,015	2,968
0801	Facilities and Equipment (Airport and Airways Trust Fund)	82	84	84
0900	Total new obligations, unexpired accounts	2,825	3,099	3,052
	Budgetary resources: Unobligated balance:			
1000	Unobligated balance brought forward, Oct 1	1,277	1,468	1,366
1001	Discretionary unobligated balance brought fwd Oct 1	1,227	. . . . .	. . . . .
1021	Recoveries of prior year unpaid obligations	81	. . . . .	. . . . .
1050	Unobligated balance	1,308	1,468	1,366
	Budget authority: Appropriations, discretionary:			
	Appropriations discretionary:			
1101	Appropriation (special or trust fund)	2,855	2,836	2,767
	Spending authority from offsetting collections, discretionary:			
1700	Collected	104	161	103
1701	Change in uncollected payment, Federal sources	12	. . . . .	. . . . .
1750	Spending authority from offsetting collections, disc (total)	116	161	103
1800	Collected	20	. . . . .	. . . . .
1900	Budget authority (total)	2,991	2,997	2,870
1930	Total budgetary resources available	4,299	4,465	4,236
	Memorandum (non – add) entries:			
1940	Unobligated balance expiring	-6	. . . . .	. . . . .
	Special and non-revolving trust funds:			
1941	Unexpired Unobligated balance, end of year	1,468	1,366	1,184
1950	Other balances withdrawn and returned to unappropriated receipts	37	. . . . .	. . . . .
1951	Unobligated balance expiring	6	. . . . .	. . . . .
1952	Expired Unobligated balance, start of year	56	89	89
1953	Expired Unobligated balance, end of year	46	89	89
1954	Unobligated balance canceling	37	. . . . .	. . . . .
	Change in obligated balances:			
3000	Unpaid obligations, brought forward, Oct 1	1,770	1,814	1,825
3010	Obligations incurred, unexpired accounts	2,825	3,099	3,052
3011	Obligations incurred, expired accounts	3	. . . . .	. . . . .
3020	Outlays (gross)	-2,673	-3,088	-3,028
3040	Recoveries of prior year unpaid obligations, unexpired	-81	. . . . .	. . . . .
3041	Recoveries of prior year unpaid obligations, expired	-30	. . . . .	. . . . .
3050	Unpaid obligations, end of year	1,814	1,825	1,849
	Uncollected payments:			
3060	Uncollected pymts, Fed sources, brought forward, Oct 1	-58	-52	-52
3070	Change in uncollected pymts, Fed sources, unexpired	-12	. . . . .	. . . . .
3071	Change in uncollected pymts, Fed sources, expired	18	. . . . .	. . . . .
3090	Uncollected pymts, Fed sources, end of year	-52	-52	-52

Identification code: 69-8107-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Memorandum (non-add) entries:			
3100	Obligated balance, start of year	1,712	1,762	1,773
3200	Obligated balance, end of year	1,762	1,773	1,797
	Budget Authority and outlays, net:			
4000	Budget authority, gross	2,971	2,997	2,870
4010	Outlays from new discretionary authority	928	1,339	1,263
4011	Outlays from discretionary balances	1,740	1,739	1,760
4020	Outlays, gross (total)	2,668	3,078	3,023
	Offsets:			
	Against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
4030	Federal sources	-42	-58	-52
4033	Non-Federal sources	-80	-103	-51
4040	Offsets against gross budget authority and outlays (total)	-122	-161	-103
	Additional offsets against gross budget authority only:			
4050	Change in uncollected pymts, Fed sources, unexpired	-12	. . . . .	. . . . .
4052	Offsetting collections credited to expired accounts	18	. . . . .	. . . . .
4060	Additional offsets against budget authority only (total)	6	. . . . .	. . . . .
4070	Budget authority, net (discretionary)	2,855	2,836	2,767
4080	Outlay, net (discretionary)	2,546	2,917	2,920
4090	Budget authority, gross	20	. . . . .	. . . . .
4100	Outlays from new mandatory authority	5	. . . . .	. . . . .
4101	Outlays from mandatory balances	. . . . .	10	5
4110	Outlays, gross	5	10	5
4120	Federal sources (Spectrum 011-X-5512000)	-20	. . . . .	. . . . .
4180	Budget authority, net (total)	2,855	2,836	2,767
4190	Outlay, net (total)	2,531	2,927	2,925

Funding in this account provides for the deployment of communications, navigation, surveillance, and related capabilities within the National Airspace System (NAS). This includes funding for several activities of the Next Generation Air Transportation System, a joint effort between the Department of Transportation, the National Aeronautics and Space Administration, and the Departments of Defense, Homeland Security, and Commerce to improve the safety, capacity, security, and environmental performance of the NAS. The funding request supports the Federal Aviation Administration's comprehensive plan for modernizing, maintaining, and improving air traffic control and airway facilities services.

Object Classification
(in millions of dollars)

Identification code: 69-8107-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent	315	320	321
11.3	Other than full-time permanent	1	1	1
11.5	Other personnel compensation	7	7	7
11.9	Total personnel compensation	323	328	329
12.1	Civilian personnel benefits	102	102	102
21.0	Travel and transportation of persons	39	39	44
22.0	Transportation of things	3	4	4
23.1	Rental payments to GSA	1	.....	.....
23.2	Rental payments to others	26	51	51
23.3	Communications, utilities, and miscellaneous charges	42	50	50
25.1	Advisory and assistance services	1,640	1,779	1,712
25.2	Other services from non-federal sources	114	141	119
25.3	Other goods and services from federal sources	31	35	35
25.4	Operation and maintenance of facilities	67	73	72
25.5	Research and development contracts	.....	.....	1
25.7	Operation and maintenance of equipment	62	72	72
25.8	Subsistence and support of persons	1	2	1
26.0	Supplies and materials	26	33	28
31.0	Equipment	153	169	203
32.0	Land and structures	111	137	143
41.0	Grants, subsidies, contributions	.....	.....	1
43.0	Interest and dividends	2	.....	1
99.0	Direct obligations	2,743	3,015	2,968
99.0	Reimbursable obligations	82	84	84
99.9	Total new obligations, unexpired accounts	2,825	3,099	3,052

Employment Summary

Identification code: 69-8107-0-7-402	FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
1001 Direct civilian full-time equivalent employment	2,687	2,664	2,649
2001 Reimbursable civilian full-time equivalent employment	54	54	55

EXHIBIT III-1

FACILITIES and EQUIPMENT
SUMMARY BY PROGRAM ACTIVITY
Appropriations, Obligations Limitations, and Exempt Obligations
($000)

	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Engineering, Development, Test and Evaluation	156,960	151,100	166,889
Air Traffic Control Facilities and Equipment	1,791,710	1,783,312	1,681,193
Non-Air Traffic Control Facilities and Equipment	182,930	192,000	201,899
Facilities and Equipment Mission Support	237,400	226,500	227,019
Personnel and Related Expenses	486,000	482,700	489,572
Total	2,855,000	2,835,612	2,766,572
FTEs			
Direct	2,687	2,664	2,649
Reimbursable	54	54	55

Program and Performance Statement

This account provides funds for programs that improve operational efficiency, constrain costs, modernize automation and communication technology and systems, and deal with aging facilities. Particular emphasis is placed on en route and terminal air traffic control, satellite navigation and landing systems, and communications.

Funding is organized within the following activity areas of FAA:

Activity 1: Engineering, Development, Test and Evaluation

Activity 2: Procurement and Modernization of Air Traffic Control Facilities and Equipment

Activity 3: Procurement and Modernization of Non-Air Traffic Control Facilities and Equipment

Activity 4: Facilities and Equipment Mission Support

Activity 5: Personnel and Related Expenses

Facilities and Equipment (F&E) Index

2B09	Airport Surveillance Radar (ASR-9) Service Life Extension Program (SLEP)	$12,800,000	95
2B10	Terminal Digital Radar (ASR-11) Technology Refresh and Mobile Airport Surveillance Radar (MASR)	$1,000,000	97
2B11	Runway Status Lights	$2,000,000	98
2B12	National Airspace System Voice System (NVS)	$43,150,000	100
2B13	Integrated Display System (IDS)	$19,459,000	102
2B14	Remote Monitoring and Logging System (RMLS)	$18,100,000	104
2B15	Mode S Service Life Extension Program (SLEP)	$15,400,000	106
2B16	Terminal Flight Data Manager (TFDM)	$119,250,000	108
2B17	NAS Voice Recorder Program (NVRP)	$14,000,000	111
2B18	Integrated Terminal Weather System (ITWS) Sustainment	$2,100,000	112
2B19	Performance Based Navigation and Metroplex Portfolio	$20,000,000	113
	c. Flight Service Programs		
2C01	Automated Surface Observing System (ASOS)	$10,976,000	115
2C02	Future Flight Service Program (FFSP)	$10,100,000	117
2C03	Alaska Flight Service Facilities Modernization (AFSFM)	$2,650,000	119
2C04	Weather Camera Program	$1,100,000	120
2C05	Juneau Airport Wind System (JAWS) – Technology Refresh	$1,000,000	121
	d. Landing and Navigation Aids Programs		
2D01	VHF Omnidirectional Radio Range (VOR) Minimum Operation Network(MON)	$15,000,000	122
2D02	Wide Area Augmentation System (WAAS) for GPS	$96,320,000	124
2D03	Instrument Flight Procedures Automation (IFPA)	$1,400,000	127
2D04	Runway Safety Areas – Navigational Mitigation	$2,000,000	128
2D05	NAVAIDS Monitoring Equipment	$3,000,000	130
2D06	Landing and Lighting Portfolio	$42,372,000	131
	e. Other ATC Facilities Programs		
2E01	Fuel Storage Tank Replacement and Management	$25,700,000	135
2E02	Unstaffed Infrastructure Sustainment	$51,050,000	136
2E03	Aircraft Related Equipment Program (ARE)	$13,000,000	138
2E04	Airport Cable Loop Systems – Sustained Support	$10,000,000	140
2E05	Alaskan Satellite Telecommunications Infrastructure (ASTI)	$16,300,000	141
2E06	Facilities Decommissioning	$9,000,000	143
2E07	Electrical Power System – Sustain/Support	$140,834,000	145
2E08	Energy Management and Compliance (EMC)	$2,400,000	148
2E09	Child Care Center Sustainment	$1,000,000	149
2E10	FAA Telecommunications Infrastructure (FTI-2)	$6,700,000	150
2E11	Data Visualization, Analysis and Reporting System (DVARS)	$4,500,000	152
2E12	Time Division Multiplexing (TDM)-to-Internet Protocol (IP) Migration	$3,000,000	153
	Total, Activity 2	**$1,681,193,000**	

Activity 3, Procurement and Modernization of Non-Air Traffic Control Facilities and Equipment

	a. Support Programs		
3A01	Hazardous Materials Management	$29,800,000	154
3A02	Aviation Safety Analysis System (ASAS)	$18,899,000	156
3A03	National Air Space Recovery Communications (RCOM)	$12,200,000	158
3A04	Facility Security Risk Management	$18,608,000	160
3A05	Information Security	$16,000,000	162
3A06	System Approach for Safety Oversight (SASO)	$25,400,000	164
3A07	Aviation Safety Knowledge Management Environment (ASKME)	$6,000,000	166
3A08	Aerospace Medical Equipment Needs (AMEN)	$14,078,000	168

Executive Summary – Facilities and Equipment (F&E) Budget Summary

What is this program and what does this funding level support?

The President's Budget requests $2.767 billion to enable FAA to meet the challenge of both maintaining the capacity and safety of the current National Airspace while continuing its comprehensive system modernization. Within these funds, the FY 2019 President's Budget requests $832.6 million for Next Generation Air Transportation System (NextGen) capital related investments. The remainder of the investment, $1.93 billion, will be in legacy areas to sustain current systems, including maintaining aging infrastructure, power systems, information technology, navigational aids, communications, surveillance, and weather systems.

The F&E budget is structured around five activities that group programs according to a common purpose. NextGen and Legacy Programs are found across all five activities and are specifically identified as such further in this overview.

Activity 1 - Engineering, Development, Test and Evaluation:

$166,889,000 is requested for FY 2019 to develop new air navigation systems from initial research, to production, and facilities to support those activities. Activity 1 programs are undertaken to validate operational concepts and proof-of-concept systems and equipment prior to making decisions about moving forward on capital investments that will be deployed across the NAS. This means defining operational requirements and completing system engineering.

Activity 1 projects include NextGen and Advanced Technology Development and Prototyping (ATDP) Pre-implementation programs, which represent the developmental pipeline for advancing the NAS. Individual Activity 1 projects are moved into other activities as they mature and achieve a Final Investment Decision (FID). Additionally, this funding sustains the facility and infrastructure at the William J. Hughes Technical Center (WJHTC).

Activity 2 - Procurement and Modernization of Air Traffic Control Facilities and Equipment:

$1,681,193,000 is requested for FY 2019 to perform modernization of air traffic control facilities, systems, and equipment, and to support infrastructure upgrades, system replacements, and technology refresh at manned and unmanned facilities.

Activity 2 supports major systems acquisitions and facilities infrastructure programs in the implementation phase. These programs and initiatives fund the procurement and modernization of air traffic control facilities and equipment, including all funding related to the acquisition of air traffic control facilities, navigation and landing aids, surveillance equipment and facilities, automation systems, and communications systems and equipment. Activity 2 programs provide funding for control equipment and agency-owned aircraft that are used for flight inspections and other activities. With this funding, we continue to ensure that current operational facilities and equipment deliver reliable and accurate services until investments in new technologies are ready to deliver the operational improvements needed for enhanced safety and future growth.

Activity 2 funding will support the following work:

- Upgrades to existing equipment
- Acquiring production systems to replace existing systems, extend serviceable life, or technology refresh system components
- Deploying systems for installation or transition to operational status
- Deploying new, satellite-based technologies such as Automatic Dependent Surveillance-Broadcast (ADS-B) and Wide Area Augmentation Systems (WAAS)
- Deploying communications infrastructure to provide surveillance and navigation services
- Replacing or modernizing manned and unmanned ATC facilities

- Replacing or modernizing automation, communications, navigation, surveillance/weather infrastructure, systems, and equipment
- Decommissioning and disposal of the systems and facilities that have been replaced

Activity 3 - Procurement and Modernization of Non-Air Traffic Control Facilities and Equipment:

$201,899,000 is requested for FY 2019 to support modernization of non-air traffic control facilities, business systems, and equipment. The programs under Activity 3 support safety, regulation, security, information technology security, and regional and service center building infrastructure and support. Training equipment replacement and all materials courseware for computer based instruction and related facility improvements at the Aeronautical Center are requested in this Activity. A key outcome to be achieved with the requested resources is increasing functionality enhancements of existing systems to allow FAA to be proactive in analyzing safety data.

Activity 4 – Facilities and Equipment Mission:

$227,019,000 is requested for FY 2019 to provide system wide integration, transition engineering, and technical contractual support in direct support of system acquisition or installation. This will provide for the following:

- System engineering, transition engineering, integration, and support
- National airspace integrated logistics support
- Technical support services for implementation
- Program Support and Aeronautical Center Leases

Activity 5 - Personnel, Compensation, Benefits, and Travel (PCB&T):

$489,572,000 is requested for FY 2019 to provide for the direct cost of federal salaries, benefits, travel, related personnel costs of FAA employees supporting all capital projects under the F&E account.

This budget request includes funding for critical system and facility infrastructure and takes into account the near term priorities identified by the NextGen Advisory Committee. In recent years, sequestration, government shutdowns, short-term reauthorization extensions, and declining budget levels have forced FAA to reduce or defer capital investment. The Agency had to choose between sustaining current infrastructure and keeping NextGen progress on track. As we work with our industry partners to take aviation into the future, it is critical that FAA carefully balance the need for sustaining the current infrastructure with the need to advance NextGen and to continue achieving ongoing benefits to users.

NextGen

NextGen is not a single program but rather a portfolio of many programs, systems, and procedures at different levels of maturity that will provide enhanced capabilities for the movement and management of Air Traffic. The work in the portfolio is being deployed in stages. Some enhancements are currently in deployment, some are nearing implementation, and some of the capabilities of NextGen are being defined and matured as the technology to support them becomes available (Pre-Implementation).

Pre-Implementation - $100.9 million is requested to continue multiple basic and applied research efforts in support of future NextGen technologies and concepts. FAA is focusing on the following programs for FY 2019.

- **Separation Management Portfolio:** $16.6 million is requested for the pre-implementation activities to reduce risk and support the safe and efficient separation of aircraft and other vehicles in the NAS. The Separation Management Portfolio will identify improvements to runway access through the use of various air traffic monitoring tools that will enable more arrival and departure operations.
- **Traffic Flow Management Portfolio:** $14.0 million is requested to provide greater flexibility to the flight planners as well as to make the best use of available airspace and airport capacity. The Traffic Flow Management Portfolio supports the NAS operators and FAA traffic managers, alongside advanced

automation, in managing daily flight and flow decision-making and airspace and airport capability issues to improve the efficiency of the NAS.

- **On Demand NAS Portfolio:** $20.5 million is requested to conduct pre-implementation work to reduce the risk in supporting the efficient and secure exchange of information within the FAA and between the FAA and other NAS users. The On Demand NAS Portfolio provides flight planners, Air Navigation Service Providers (ANSP), and flight crews with consistent information on condition changes in the NAS.
- **NAS Infrastructure Portfolio:** $13.5 million is requested to provide research, development, and analysis of validation activities, human engineering, and demonstrations in order to reduce the risk for aviation weather-related and cross-cutting engineering issues.
- **NextGen Support Portfolio:** $12.8 million is requested to continue execution of work within the NextGen Support Portfolio, for Operational Assessment Activities, and to provide for enhancements to the NextGen Integration and Evaluation Capability (NIEC) and the Florida NextGen Test Bed (FTB).
- **Unmanned Aircraft Systems (UAS):** $14.0 million is requested to support the development and integration of UAS products, systems, and implementation plans for the UAS Concept Validation and Requirements Development Program and the Flight Information Management System (FIMS) Program.
- **Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio:** $9.5 million is requested to conduct three enterprise level activities: Enterprise Concept Development, Enterprise Human Factor Development, and Stakeholder Demonstrations. This portfolio will promote safety, efficiency, and reduction of air traffic delays.

Implementation - $666.9 million is requested to continue the implementation of NextGen programs that have achieved or are near a FID. As NextGen has progressed over the last several years, more programs have transitioned into the implementation phase. FAA is focusing these FY 2019 portfolio resources in a manner consistent with NextGen Advisory Committee (NAC) recommendations for prioritizing NextGen activities.

- **En Route Automation Modernization Technology Refresh (ERAM)**: $102.1 million is requested to perform critical component replacements as necessary in order to ensure En Route's continued supportability and security. Improvements in the efficiency and effectiveness of air traffic management and reduction in operational errors are the expected outcomes of this investment.
- **System-Wide Information Management (SWIM)**: $58.8 million is requested to continue the implementation of an information management and data sharing system for FAA's internal and external stakeholders. This program will provide policies and standards to support data management, secure its integrity, and control its access and use.
- **Automatic Dependent Surveillance Broadcast (ADS-B)**: $123.7 million is requested for the continued implementation of satellite-based surveillance capabilities that will provide a more complete picture of airspace conditions and more accurate position data of aircraft. ADS-B will continue implementation of baseline applications and allow for the continued execution of ATC Separation Services, In Trail Procedures, Airport Surface Surveillance Capability (ASSC), and NAS-wide deployment of Ground Interval Management (GIM).
- **Collaborative Air Traffic Management (CATM) Technologies**: $17.7 million is requested to continue software enhancements designed to deliver improvements on existing capabilities and new modeling functions for the Traffic Flow Management System (TFMS). FY 2019 will mature Work Package 4 capabilities like Improving Demand Predictions (IDP) capability and Integrated Departure Route Planner (IDRP) capability.
- **Time Based Flow Management (TBFM)**: $21.2 million is requested to maximize traffic flow and airport usage by improving flow management into and out of the busy metropolitan airspaces and corresponding airports.
- **NextGen Weather Processor (NWP)**: $24.7 million is requested to establish a common weather processing platform that will functionally replace the legacy FAA weather processor systems and host new capabilities in all FAA Towers, Terminal Radar Approach Control (TRACON) Facilities, and Air Route Traffic Control Centers.
- **Data Communications**: $113.9 million is requested for data communications, to deploy a text-based data communication system in both the Terminal and En Route domains. This program will enable air traffic controller productivity improvements, and will permit capacity growth without requisite cost growth associated with equipment, maintenance, and labor.
- **National Airspace System Voice System (NVS)**: $43.2 million is requested to advance voice communications services to Air Traffic Controllers in support of continuous air traffic operations in the

Terminal and En Route environments of the National Airspace System (NAS). Voice communication connectivity will be provided to aircraft flight crews, Unmanned Aircraft System (UAS) operators, and communication connectivity between Air Traffic Controllers.

- **Terminal Flight Data Manager (TFDM)**: $119.3 million is requested to provide an integrated approach to maximize the efficient collection, distribution, and update of data supporting flight information in the terminal area (airspace around an airport and airport surface data).
- **Performance Based Navigation**: $20.0 million is requested to support Optimization of Airspace and Procedures in the Metroplex (OAPM) implementation and install distance measuring equipment to fill in coverage gaps and provide resilient Area Navigation (RNAV) operations during GPS outages.
- **System Safety Management Portfolio**: $14.7 million will support improvements to Safety Management Systems as a result of safety information discovered and shared through this portfolio. Work under this portfolio provides a national resource for use in discovering common, systemic safety problems that span multiple airlines, fleets and regions of the global air transportation system.
- **Aeronautical Information Management Program (AIM)**: $6.8 million will support delivery of digital aeronautical information that conforms to international standards and supports NextGen objectives. Digital aeronautical data enables the processing of data to improve mapping, flight planning, and the timeliness and accuracy of air traffic control instructions.
- **Cross Agency NextGen Management:** $1.0 million is requested to collaborate with partner agencies in supporting multi-agency research, coordination of emerging issues, cross-agency analytical efforts, and the documentation and reporting of interagency NextGen activities, strategies, and technologies.

NAS Infrastructure

This funding will assure modernization of air traffic control facilities, systems, and equipment that provide direct automation, communication, surveillance, and navigation functions within the NAS. FAA must sustain the current facilities, systems, and functions that NextGen is built upon. Key work components include infrastructure upgrades, system replacements, and technology refresh at manned and unmanned facilities. Infrastructure sustainment is also completed on systems that are repositories for safety and certification data, training infrastructure, and support aeromedical research and records.

NAS Facility Infrastructure Sustainment:

FAA has a multi-billion dollar maintenance backlog for programs areas included in the Air Traffic Control (ATC) Facilities Sustainment Strategic Plan. $531.2 million is requested to advance the state of good repair for FAA infrastructure facilities. This infrastructure funding will improve and maintain the Facility Condition Index (FCI) ratings at FAA facilities that provide the backbone for the NAS and NextGen functionality. While the request represents a shift to re-invest resources in critical infrastructure, the deferred maintenance backlog is so large that additional incremental increases for these facilities are necessary in order to reduce FAA operational risk. This undertaking targets the following projects:

- **En Route Traffic Control Center (ARTCC) and Combined Control Facility (CCF) Building Improvements** - Projects will replace obsolete plant equipment and provide improved work areas at selected ARTCCs (21). Projects include asbestos abatement, replacement of mechanical/electrical systems, installation of fire detection and protection upgrades and interior architectural construction.
- **Air Traffic Control En Route Radar Facilities Improvements** - 157 Long Range Radar (LRR) surveillance facilities provide aircraft position information to FAA, to the Department of Defense, and Homeland Security for security monitoring of the NAS. Eighty percent of the LRR inventory is older than 30 years. The 66 LRRs established in the early 1950's have reached the end of their useful life.
- **Terminal Air Traffic Control Facilities Improve** - Initiates modifications, improvements, and repairs to Tower/TRACON facilities. System engineering, configuration management, facility planning, and facility condition assessment activities determine the projects to be accomplished and scheduling.
- **National Airspace Systems (NAS) Facilities Occupational Health and Safety Administration (OSHA) and Environmental Standards Compliance** – Funds initiatives that safeguard FAA personnel from occupational hazards and minimize the impact of FAA activities on the environment.
- **Fuel Storage Tank Replacement and Management** – Funding is requested for 153 tank unit replacements, modernization, and upgrades at approximately 63 locations across the US in support of electrical power systems.
- **Unstaffed Infrastructure Sustainment** - Program is responsible for sustaining more than 12,000 Communications, Surveillance, Navigation, Weather, and support sites across the country.

- **Facilities Decommissioning** – Program is responsible for final disposition of decommissioned infrastructures and associated property restorations.
- **Electrical Power Systems – Sustain/Support** - Is an infrastructure sustainment and renewal program that replaces and refurbishes components of the emergency power system and cable infrastructure to maintain and improve the overall electrical power quality, reliability, and availability.
- **Energy Management and Compliance (EMC)** – Program saves operational costs by installing advanced electric meters, monitoring energy and water consumption, developing cost-effective recommendations to reduce energy and water use, and implementing energy and water efficiency projects.
- **Hazardous Materials Management (HAZMAT)** - Will remediate the most serious FAA owned or leased sites that have experienced environmental contamination.
- **Facility Security Risk Management (FSRM)** - Implements standardized facility access and protective measures at all FAA staffed facilities.
- **Mobile Assets Management Program** - Provides easily transportable NAS equipment to establish, restore, or augment air traffic control operations. Funding will refurbish or replace 20 years old Mobile ATCT's.
- **Terminal Air Traffic Control Facilities Replace** – Program evaluates which of the more than 500 Tower and TRACON Facilities need to be replaced because of condition or operation needs. For FY 2019 design funding is needed for three sites and disposition funding is requested for the old Charlotte, NC Tower and TRACON.

NAS System Sustainment:

Funding in FY 2019 is requested for Automation, Communication, Navigation/Landing, and Surveillance Air Traffic Control (ATC) systems infrastructure. These systems allow the NAS to operate at the highest safety standards and provide airline operators and general aviation the dependable ATC services they require. Providing continued safe and expected services to these users requires sustainment of the aging systems infrastructure. The inventory of radio's supporting terminal communications is between 40 to 50 years old, voice switches used to communicate between pilots and air traffic controllers are 17 to 22 years of age, and on-airport radars are 15 to 20 years old. Of the 1,200 Instrument Landing Systems in operation today, 125 are over 25 years old. Funding is requested to replace unsupportable components and systems for this NAS System Infrastructure. As FAA progresses to satellite based services and technology, a number of these systems will continue to provide required support for advanced NextGen capabilities or to provide redundant and safety backup capabilities in the event of satellite service outages and interference. Included among these programs are:

- **Standard Terminal Automation Replacement System (STARS)** provides a common and standardized automation system/software infrastructure across the NAS. During FY 2019, the replacement of ARTS IIEs with STARS and the technology refresh of STARS at remaining facilities will continue.
- **Next Generation Very High Frequency (VHF) Air/Ground Communications System (NEXCOM)** – This program will modernize the existing Air/Ground voice communication system using the limited available radio frequency spectrum more efficiently.
- **Voice Switch and Control System (VSCS)** –This is the existing legacy En Route voice switch and it will have to remain operational until the full deployment of the NextGen NAS Voice System (NVS), which is currently planned for 2025.
- **Wide Area Augmentation System for GPS (WAAS)** - WAAS supports the FAA mission need of providing a satellite navigation capability across the NAS. WAAS messages are broadcast to user receivers via leased navigation transponders on three commercial geostationary (GEO) satellites.
- **FAA Telecommunications Infrastructure 2 (FTI-2)** – Will replace the existing services provided by the current FTI program and will address the aging owned infrastructure obsolescence.
- **TDM-to-IP Migration –** FAA currently depends on Time Division Multiplexing (TDM)-based services that major U.S. telecommunications carriers have stated their intention to discontinue as soon as 2020. FAA has developed a migration strategy to address the phase-out of these services. This project will modernize NAS systems to support Internet Protocol (IP) communications.
- **The VHF Omni-Directional Range (VOR) Minimum Operational Network (MON) Implementation Program -** Will conduct activities that will transition the legacy network of approximately 957 VORs to a MON of approximately 650 VORs with a target date of 2025. Downsizing provides an opportunity for cost avoidance and would allow aircraft to navigate and land safely under

Instrument Flight Rules (IFR) in the event of disruption in a Global Navigation Satellite System (GNSS) signal.

- **Surveillance Service Life Extension Programs** – These projects procure and manufacture replacement parts for radar components that are no longer supportable for primary radars such as Airport Surveillance Radars (ASR) and secondary radars like Mode S. These systems must remain operational through the next decade.

What benefits will be provided to the American public through this request and why is this program necessary?

The procurement and modernization of the nation's air traffic control system was first highlighted in 1980 with the publication of the first NAS Modernization Plan. Since that time, FAA has replaced old technologies with new systems that perform required functions better and more efficiently. During this period, aviation services were extended to new, small and medium-sized localities through the expanded deployment of updated air traffic control technologies, equipment, and infrastructure at these locations.

FAA has met most of the cost and schedule goals for the programs within F&E. F&E programs contribute to the success of metrics that show a safe and efficient Airspace System and include runway incursion reduction, Air Traffic Control (ATC) system operational availability, and NAS on-time arrivals.

Detailed Justification for - 1A01 Advanced Technology Development and Prototyping

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Advanced Technology Development and Prototyping	$24,800	$26,800	$33,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Runway Incursion Reduction Program (RIRP)	---	$3,000.0
B. System Capacity Planning and Improvements	---	2,000.0
C. Operations Concept Validation and Infrastructure Evolution	---	5,000.0
D. Major Airspace Redesign	---	4,000.0
E. Strategy and Evaluation	---	1,000.0
F. Dynamic Capital Planning	---	2,500.0
G. Operational Analysis and Reporting System (OARS)	---	3,000.0
H. Operations Network (OPSNET) Replacement	---	5,000.0
I. Operational Modeling Analysis and Data	---	2,000.0
J. Enterprise, Management, Integration, Planning and Performance	---	4,100.0
K. In Service Engineering	---	1,400.0

What is this program and what does this funding level support?

The FAA's mission is to provide the safest and most efficient aerospace system in the world. To accomplish this mission, FAA's Advanced Technology Development and Prototyping (ATDP) program develops and validates technology and systems that support air traffic services. For FY 2019, a total of $33,000,000 is requested to support the requirements associated with the evolving air traffic system architecture and improvements in airport safety and capacity.

A. Runway Incursion Reduction Program (RIRP)

In FY 2019, $3,000,000 is requested for technology prototype development, testing, demonstration and documentation within the Runway Incursion Reduction Program (RIRP). This work will reduce risk to people and property, caused by collisions in the runway environment. The RIRP's objective is to discover research and innovative technologies that will detect the incorrect presence of an object in the Runway Safety Area at every airport, and deliver a directive cue to the individual who can take corrective action.

Consistent with standing National Transportation Safety Board recommendations, RIRP research emphasis will remain on testing the application of technology for pilot, controller, and vehicle operator situational awareness tools. Current initiatives include:

- Runway Safety Assessment (RSA) studies such as Runway Incursion Prevention Shortfall Analysis (RIPSA) to identify candidate small-to-medium sized airports with historically high rates of Runway Incursions. Candidate technologies best suited to an airport based on causal factors encountered at that site (e.g. converging runways, ground vehicle operations, taxiway/runway hotspots, etc.) will be identified. In FY 2019, RIRP will initiate the prototype operational evaluations of RIPSA technologies at candidate test locations in order to assess system suitability and performance.

- The RIRP is prototyping and evaluating the Small Airport Surveillance Sensor (SASS) at Hanscom Field, Massachusetts. SASS provides lower-cost secondary surveillance capability to augment or provide standalone cooperative airport surface and terminal area airborne surveillance at small to medium sized airports. In FY 2019, RIRP will initiate the process of transferring the key hardware and software design requirements of SASS to industry to enable system hardening and capability enhancement.
- The RIRP also intends to continue development of Surface Taxi Conformance Monitoring (STCM) technologies in FY 2019. STCM research will focus on the development and demonstration of prototype tower-based and/or cockpit-based taxi conformance monitoring systems to reduce Runway Incursions at controlled airports. Specifically, activities will focus on researching capabilities needed to digitize taxi route instructions and the development of airport surface database requirements to support STCM.

B. System Capacity, Planning, and Improvements

The System Capacity, Planning, and Improvements program provides data and analyses on National Air Space (NAS) operations to FAA executives and managers to help them identify deficiencies and develop proposals to improve NAS performance. This program also sponsors NAS performance and airport capacity studies where experts from the FAA, academia, and industry collaborate to analyze and develop recommendations for improving capacity and system efficiency, and reducing delays at specific airports. It has the added capability of using its performance measurement systems and operations research to quantify the efficiency of the NAS and form the basis of proposals for overall system improvements. System Capacity, Planning and Improvements support the FAA metric "Maintain an average daily airport capacity for Core airports of 57,975 or higher, arrivals and departures."

For FY 2019, $2,000,000 is requested to:

- Conduct International Memorandums of Cooperation and Business Case Analysis
- Conduct Strategic Analysis and FAA Reporting Requirements
- Conduct Economic Analysis

FAA international performance activities under its Memorandums of Cooperation are used to improve capacity enhancements worldwide, which benefits U.S. airlines and manufacturers.

The System Capacity, Planning and Improvements program produces the bi-annual assessment of aviation operational performance. Produced in collaboration with the European Union, this bi-annual assessment provides EU/US trends in aviation performance. These include the effects of construction, increases in demand at key facilities, and decreases in delays due to traffic management initiatives.

The work reports metrics from the airline perspective of on-time performance, and block time, as well as delay measures more commonly used by service providers and included in the how do European Performance Scheme.

The program also produces economic studies and projects in relation to the future advancement of the NAS, including Commercial Space. This works includes research, modelling, analysis of benefits of capital investment and future trends; and identifying the relationship factors between NAS modernization and industry performance. These efforts will ensure the NAS remains the safest and most efficient ATC system in the world.

C. Operations Concept Validation and Infrastructure Evolution

This program develops and validates operational concepts that are the underpinnings of the FAA Air Traffic Management (ATM) modernization programs. Through structured analysis, it identifies the functional changes necessary for the FAA that increase productivity, enhance throughput, improve flight efficiency, increase access to airspace/airports, and reduce net cost. This information helps the aviation community anticipate what changes are required in aircraft equipment and procedures in order to operate with the new technology being implemented in the NAS.

The ATDP Operational Concept Validation program conducts research for advanced operational concepts to ensure they are well understood and are based on valid assumptions. This project assesses the interaction of changing roles and responsibilities of NAS service providers and pilots, airspace changes, procedural changes and new automation systems for distributing weather, traffic and other flight related information.

Specifically, concept development includes developing and validating shortfalls, exploring, developing, and validating concepts, and ensuring any new concept can be effectively integrated with other emerging concepts.

This program is necessary because for the following:

- Conducts analyses to support assessments of new air traffic control operational concepts
- Develops concepts to describe the operational use of new communication, navigation, automation, surveillance and flight deck capabilities
- Produces reports on concept development and validation findings including 2nd-level concepts, fast-time analyses, and human-in-the-loop real time studies
- Develops operational, information and performance requirements

It also supports the development of international standards to assure global harmonization across the aviation industry and ATM enterprise through collaboration with RTCA.

D. Major Airspace Redesign

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. The FAA prioritizes candidate airspace redesign projects to determine which projects provide the most benefits and develops criteria for assessing a project's system-wide impact.

This program supports increased efficiency and enhanced safety by funding the physical changes in facilities necessary to accommodate airspace redesign. Redesign projects have taken on increased emphasis at both the national and regional levels to ensure that FAA is able to effectively manage the projected growth in demand at FAA facilities and airports.

Implementation of airspace redesign efforts frequently results in changes in the number and shape of operational positions or sectors, including changes to sector, area, or facility boundaries. Required infrastructure changes can include communication modifications such as changes in frequencies, connectivity of a radio site to the control facility, controller-to-controller connectivity; surveillance infrastructure modifications to ensure proper radar coverage; automation modifications to the En-Route Automation Modernization (ERAM) data processing or flight data processing; inter-facility transmission modifications; additional consoles and communications backup needs; and modifications to the facility power and cabling.

Airspace Redesign will increase system efficiency the greatest in those areas of the system that are inherently complex such as the Northeast Corridor from Washington DC to Boston and in areas experiencing high air traffic growth such as the region between the U.S and the Caribbean.

For FY 2019, $4,000,000 is requested to address the unique concerns addressed above.

E. Strategy and Evaluation

The Strategy and Evaluation program develops and maintains mathematical models of the NAS which are used to aid organizations throughout the FAA with analyses of proposed new investments, trade-off studies, and analyses of the impacts of changes in operational conditions (e.g., weather, air carrier schedules, commercial space operations, etc.) on NAS performance.

Specifically, the FAA and contractors use a NAS-wide model, known as the System-Wide Analysis Capability (SWAC) to analyze advanced Air Traffic Management (ATM) concepts and aid with NextGen program trade-off studies, investment analyses, and NAS performance analyses. SWAC is being enhanced to support new modeling capabilities and analysis. In addition, an airport capacity model, Airfield Delay Simulation Model (ADSIM+), is being developed for use in analyzing new airport capacity-related projects. The model will facilitate rapid analysis of airport improvements, the impact of air travel demand changes, and ATM technology insertions. It will support runway capacity studies, investment analyses, NextGen analyses, and

the evaluation of airport infrastructure changes. This model provides a de facto standard for airport capacity analyses.
For FY 2019, $1,000,000 is requested to::

- Deliver updated SWAC executable software with improved integration and modeling of Unmanned Aircraft Systems (UAS) to analyze the future impact on the NAS
- Deliver updated SWAC executable software capable of interacting with Geographical Information System (GIS) to better facilitate communication with stakeholders
- Deliver updated ADSIM+ executable software, with an enhanced graphical user interface (GUI), capable of generating arrival/departure sequencing based on user-defined scenarios to support post-implementation analyses of recently deployed NextGen capabilities

F. Dynamic Capital Planning

The Dynamic Capital Planning tools and support will allow FAA to make optimum decisions based on best business practices. These tools and support will provide verification that disciplined management of capital programs continues to be carried out.

Initial procurement of financial analysis tools and support will allow a better evaluation of programs through all phases of the acquisition life cycle.

Focus areas that will be supported include:

- Determining quantitative economic value and internal benefits validation for capital projects
- Milestone tracking, schedule modeling, and performance measurement
- Auditing and trend analysis
- Earned Value Management (EVM) and monitoring through program life cycle
- Field implementation planning and support for capital portfolio management
- Post implementation analysis for corporate lessons learned results

This project will provide reliable data with an automated tracking and reporting system for F&E projects that will enable decision-makers enhanced use of agency resources. This project will help keep major acquisition programs on schedule and within cost by maximizing limited resources linked to budget information and processes. Managers and engineers will have up-to-date reliable data on F&E projects through the resource tracking program (RTP) and productivity continues to improve under standardized project management operating procedures.

G. Operational Analysis and Reporting System (OARS)

The FAA collects and analyzes safety data to make data-driven decisions in order to assess safety risk, determine repeatability, implement mitigation plans, and provide performance monitoring with minimal impact to operations. Due to the vast amount of unintegrated operational data and the limited capacity of available analytical tools, safety practitioners spend excessive time collecting data, manually extracting data from multiple systems, and manually redistributing data to multiple systems. Daily safety information (e.g., reports, dashboards and analytics) based on current data is not available to safety practitioners and operational personnel in a manner easily accessed and manipulated, resulting in increased time to identify operational trends, validate safety risks, refine mitigation strategies, and provide meaningful safety assurance.

Operational Analysis and Reporting System (OARS) Phase 1 (of 3) will bring all of the legacy capabilities under one umbrella to provide the service of collection, validation, integration, and distribution for the tools below that will be defined as producer tools:

- Comprehensive Electronic Data Analysis and Reporting (CEDAR)
- Rapid AT Replay Tool (Falcon)
- Traffic Analysis and Review Program (TARP)
- Risk Analysis Process (RAP) Tools (A-RAP, S-RAP and SI-RAP)
- Compliance Verification Tool (CVT)
- Runway Safety Systems

- Safety Management Tracking System (SMTS)
- Safety Applications and Analytics (key performance indicators, Dashboards, etc.)
- Aviation Common Taxonomy
- Processed Track (e.g. Threaded Track/Flight Story)

OARS will be the official source for ATO safety analysts who require access to the data. OARS will serve as an enterprise portal that provides a single access point to data and applications for safety analysis. OARS will provide a wide range of authorized users via role-based access with unified, consistent, and efficient safety data and improve the efficiency of the safety analysis process. OARS will integrate safety data and streamline risk analysis processes. This will increase capacity, efficiency and effectiveness, provide an integrated platform to facilitate technology transfer of existing analytics and prototypes, and improve consistency and accessibility of data and tools used for safety analyses. OARS will provide improved quality control and life-cycle maintenance through consolidation and reengineering of existing toolsets. OARS will provide an integrated analytical "work space" facilitating continued improvements to the safety of the NAS.

H. Operations Network (OPSNET) Replacement

An accurate understanding of system performance is critical to identifying areas for service improvement for the flying public. Operations Network (OPSNET) is the official reporting system for NAS operations traffic counts and flight delays. The OPSNET Replacement program will correct deficiencies with the legacy OPSNET reporting system while also providing capability enhancements.

The OPSNET data collection consists of an automation component collecting data from multiple systems, and a manual component requiring data entry from personnel at each facility. The OPSNET reporting components generate and distribute delay and traffic activity reports to the Department of Transportation (DOT) and FAA Executive leadership, Air Traffic Management decision makers, and the Aviation Community. Primary uses of OPSNET include NAS performance monitoring, post-operational assessments of traffic management initiatives, measurement of NextGen improvements, financial benchmarking, facility reviews and classifications, and investment planning.

The legacy system is currently constrained by obsolete data definitions, inconsistent data entries, and difficulties in correlating data from multiple sources to resolve flight delay issues. The analysis and resolution of flight delay issues is problematic because the reported flight delays are limited to specific events and the causal code assignments lack needed granularity. The delay definitions and standard codes that govern reports by the FAA and commercial airlines to DOT are different, and similarly the FAA codes differ from those employed by other Air Navigation Service Providers (ANSPs), like Eurocontrol.

During FY 2018, the OPSNET Replacement program will proceed through the FAA Investment Analysis process and conduct Concept Engineering activities for requirements validation. OPSNET Replacement program will finalize Investment Analysis by completing implementation and test plans, establishing an Acquisition Program Baseline, receiving a Final Investment Decision, and awarding a contract in FY 2019.

For FY 2019 the OPSNET Replacement program requests $5,000,000 to:

- Procure planning, analysis, design, and development engineering activities
- Procure hardware and software
- Migrate and transition from the legacy system
- Document and close-out of prototyping

The resourcing and successful outcome of these activities will support the goal of achieving Operational Capability in FY 2020.

I. Operational Modeling Analysis and Data

The Operational Modeling Analysis and Data program provides support to National Airspace System (NAS) performance analysis by improving the efficiency and integration of operational data, NAS performance reporting, and the tools used for both. This program also makes enhancements to the individual and consolidated products to keep up with the growing data demands in the agency.

Many Air Traffic Organization (ATO) operational units, model and analyze NAS data to support both operational and capital investment planning. A study of FAA-wide operational databases identified a shortfall in available analytical products and recommended the creation of a database to capture operational events associated with individual flights to improve the timeliness of operational analyses and reduce the cost. Because many strategic and planning activities rely upon data analysis or modeling, other programs will also benefit from the products developed by this program. This program will help to consolidate many of the stand-alone NAS data products currently used throughout the agency into a unified data solution. This program will ingest and integrate new data sources as they become available, making them accessible to other agency programs and analysts. This program will develop and publish standardized operational events data on a per-flight basis and by facility (e.g. airport). For FY 2019, $2,000,000 is requested to modernize the NAS Data Warehouse (NAS-DW) and the Aviation System Performance Metrics (ASPM) systems.

J. Enterprise, Management, Integration, Planning and Evaluation for NAS/NextGen

The Enterprise Management, Integration, Planning and Evaluation for NAS NextGen program will support human capital management, enterprise management, technical support, and outreach functions required to deliver the NextGen enterprise. Transforming the NAS into a flexible, scalable, and time-based management system is the fundamental objective driving work needed to complete the NextGen research, infrastructure development and operational integration. The successful, ongoing rollout of NextGen is the result of rigorous portfolio, program and acquisition management partnered with stakeholder commitment and engagement. This program supports the integration of management requirements across the NextGen enterprise to monitor and report key performance metrics.

This program provides technical support for conducting proof of concept for new technology planned for implementation into the NAS. This will lead to the transformation of the national airspace system and provide benefits directly supporting the metric of maintaining average daily capacity.

K. In Service Engineering

In-service engineering allows for immediate response and tactical distribution of resources to emerging technology solutions. Funding is requested for ongoing engineering support of all prototyping efforts.

What benefits will be provided to the American public through this request and why is this program necessary?

The projects that are funded under this program will ensure that the essential hardware and software components are in place and operational in order to accurately collect and report operational and safety data associated with air traffic operations. These projects will support management and oversight of implementation for new programs, assess metrics and operational parameters of new programs, and allow for alterations of programs based upon that data. These efforts will ensure the NAS remains the safest and most efficient ATC system in the world.

Detailed Justification for - 1A02 William J. Hughes Technical Center Facilities

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
William J. Hughes Technical Center Facilities	$20,000	$21,000	$21,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. William J. Hughes Technical Center Laboratories	---	$17,900.0
B. William J. Hughes Technical Center Laboratories – Flight Sustainment	---	3,100.0

What is this program and what does this funding level support?

This program sustains the William J. Hughes Technical Center laboratories. This centralized set of laboratories is depended on to support the Acquisition Management System (AMS) lifecycle from concepts and requirement definition to In-Service decision. These laboratories are the only location where it is possible to realistically simulate the NAS and it is necessary to maintain the laboratory systems with capabilities that match field sites that currently exist or are planned for the future. These test beds can be altered to replicate desired field configurations and traffic scenarios providing stakeholders with an understanding of how upgraded systems will perform prior to operational deployment. These labs also provide a flexible high-fidelity environment to conduct research and perform Human-In-The-Loop (HITL) simulations which evaluate advanced air traffic concepts and are fully integrated with the other WJHTC capabilities. The $17,900,000 funding level will support the following activities:

- **Laboratory Support Contracts:** Services include support services to sustain the operation of the laboratories, including infrastructure engineering, technical services, laboratory networking, test and simulation services, laboratory maintenance, scheduling support for multi-user laboratories, and laboratory management.
- **Hardware/Software Licenses and Maintenance Agreements:** Over 79 annually renewed hardware and software licenses and maintenance agreements are required for the Laboratory equipment each year. Examples include Cisco maintenance, Lutron lighting maintenance, AutoCAD License and annual subscription services, Linux, Red Hat, etc.
- **Laboratory Space and Infrastructure Master Plan:** A laboratory consolidation effort (Master Plan) will improve the overall function of the facility and provide continuity of operations for essential Priority 1 systems. Completion of the laboratory reconfiguration, in accordance with the Master Plan, is expected in FY 2020. This reconfiguration of space will free up room for new programs in the labs, such as expansion of the Unmanned Aircraft Systems (UAS) labs, and NAS Voice System, etc.
- **Laboratory Equipment Technology Refresh:** Equipment refresh addresses life-cycle replacement of NAS supporting equipment so that equipment utilized in the laboratories is available for use and in proper operating order. Technology refresh is required of the Laboratory Network Management and Laboratory Network Operations Center systems.
- **Land Leases, Miscellaneous Supplies and Parts:** Items include land leases for three radar sites, and laboratory communications, laboratory cabling, general supplies, and diagnostic equipment.
- **Continued Improvements to Laboratory Systems and Infrastructure:** The FAA's centralized set of laboratories must modify, upgrade, and reorganize the laboratory infrastructure as F&E programs and their supporting systems are delivered, installed, and eventually removed. The laboratory infrastructure encompasses over 210,000 square feet of laboratory space in the main buildings, numerous outlying buildings, and remote sites. Lifecycle replacement of infrastructure includes some of the on-going improvements, such as, transient voltage surge suppression (TVSS) upgrades, raised floor

replacements, electrical distribution panel life-cycle replacements, power monitoring in electrical distribution panels, computer air conditioning (CAC) unit replacements, replacement of main lighting panels, and the computer room air conditioning (CRAC) monitoring system. Some improvement projects may be implemented because an opportunity exists that would generate short and long-term savings. For example, a new lab installation is an opportunity to repair raised flooring.

The funding will also support the continued day-to-day operations and sustainment of the Air Traffic Organization (ATO) Flight Program Operations Research, Development, Test, and Evaluation (RDT&E) support mission. Day-to-day flight program operations include pilot proficiency training, aircraft maintenance/modification and parts, fuel, and other supplies required to maintain fleet readiness and provide services as required. Services provided support programs/projects with flight and ground testing, mission planning, safety analysis, aircraft modification; as well as design, certification, fabrication and installation. Flight test support includes in-flight testing of ATO and NextGen systems (e.g., Surveillance Broadcast System (SBS), System Wide Information Management (SWIM), and Aircraft Collision Avoidance System (ACAS)). ATO provides additional funding to supplement crewmember training/proficiency and aircraft maintenance flights.

What benefits will be provided to the American public through this request and why is this program necessary?

The American public benefits by having their National Airspace System researched, developed, tested, and evaluated at the world class laboratories within the WJHTC. The goal of this program is to modernize the equipment and infrastructure necessary for FAA's centralized NAS laboratory facilities so that F&E programs can deliver products that result in a safe, reliable, and efficient NAS. The WJHTC centralized labs eliminates the need for each acquisition program to establish and sustain separate laboratory facilities to support their individual programs and fielded systems. The capabilities developed in these laboratories will reduce overall cost of NAS and NextGen development increasing traveler safety and decreasing travel times by reducing airspace congestion.

This program is necessary to sustain the WJHTC laboratory test facility which provides direct field support for Operational NAS systems. Problems identified at various field locations are quickly transmitted to the appropriate laboratory where solutions are developed and tested. The test beds are used by acquisition programs and partner agencies for development, test, evaluation, integration, transition testing, and first and second level support to the field. This program is further necessary to maintain these laboratory systems in configurations and capabilities that match field sites that currently exist or are planned for the future.

Detailed Justification for - 1A03 William J. Hughes Technical Center Infrastructure Sustainment

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
William J. Hughes Technical Center Infrastructure Sustainment	$12,200	$10,000	$12,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
William J. Hughes Technical Center (WJHTC) Infrastructure Sustainment	1	$12,000.0

What is this program and what does this funding level support?

For FY 2019, $12,000,000 is requested to accomplish the following projects that promote sustainment of the FAA's infrastructure at the WJHTC:

- **Building 300 Mold Removal** will remediate the mold associated with air handling (AC) units, AC-7 and AC-10, which are scheduled for replacement in FY 2019. Remediation includes the cleaning of high velocity ductwork, replacement of the low velocity ductwork and temporary relocation of employees in the affected areas.
- **Building 300 Mechanical Equipment Replacements** will replace Heating, Ventilation and Air Conditioning (HVAC) equipment in Building 300, specifically two AC units: AC-7 and AC-10. These units are more than 35 years of age and have exceeded the industry lifecycle standard. The new units will be environmentally friendly, reduce utility costs through the use of modern, energy efficient equipment, and reduce maintenance expenses.
- **Building 300 Mechanical Equipment Replacements** design effort to replace HVAC equipment in Building 300, specifically five AC units: AC-2, AC-3, AC-4, AC-5 and AC-13. These units are more than 35 years of age and have exceeded the industry lifecycle standard.
- **Refurbishment of Elevators** in Buildings 27, 287 and 301. These elevators have exceeded their useful lives and are exhibiting numerous points of failure, including door mechanisms failing to open or close, cab shaking, and passenger entrapments. This project will update the elevators, including cabs, machine rooms, hoist ways and controls for conformance to all current building, electrical, fire and elevator codes and standards, which will provide safer, more reliable operation and avoid maintenance expenses associated with repairing the existing legacy control systems.
- **Central Utilities Plant (CUP) Chiller Replacements** are for the replacement of a 1,000 ton centrifugal refrigeration machines (chillers) in the CUP (Building 303). The new machine will tolerate a lower incoming condenser water temperature, enabling use of an energy saving, free-cooling option. The reliability and availability of chilled water for air conditioning will be improved, particularly for the Building 300 laboratory spaces, including 24x7x365 operational mission crucial programs.
- **Building 316 Fire Detection/Annunciation System Upgrades** The fire alarm system in this facility was installed over 20 years ago and has been discontinued. If any component of the current systems fails, there are no readily available replacement parts. Installation of the new system will alleviate maintenance expenses associated with replacing aged and failing components with spare parts.
- **Architectural, Electrical and Mechanical System Improvements to 20 Research and Development (R&D) Buildings (Construction)** Implementation of architectural, structural, plumbing, HVAC, fire protection and electrical improvements to 20 buildings in the R&D area of the WJHTC. These facilities house laboratories and administrative space supporting certain NextGen R&D programs, including the Fire Research and Safety Program, the Aircraft R&D Program, the

Propulsion/Fuel Systems Program and the Flight Safety Program. These facilities are of varying scale and purpose, with the majority having been built in the 1960s.

The FAA William J. Hughes Technical Center (WJHTC) owns and operates approximately 1.6 million square feet of test and evaluation, research and development, and administrative facilities, plus numerous project test sites. In addition, the WJHTC owns and operates a majority of the site infrastructure located on the 5,000+ acres of land, which includes utility distribution lines for electric, water, sanitary sewer and storm water as well as roadways, parking lots, curbing, sidewalks, fencing, gates and airfield ramp space. The current value of the buildings and infrastructure is in excess of $600 million. Accordingly, the infrastructure at the WJHTC requires an annual program of capital improvements and modernization. This program is the only available funding stream to sustain the 1.6 million square feet of space together with the required utility and roadway support systems.

What benefits will be provided to the American public through this request and why is this program necessary?

Infrastructure sustainment at the WJHTC saves taxpayer money by reducing expenses associated with ongoing operation and maintenance activities as well as reducing the frequency of expenses associated with system replacement. System updates reduce energy consumption, and cost, on a per-square-foot basis, thus supporting current Federal Energy Management requirements for sustainability and energy consumption. For example, CUP Chiller No. 1 was recently replaced under this program, and the new equipment has reduced energy, translating into a savings of approximately $200,000 over the past calendar year.

The WJHTC Infrastructure Sustainment Program is necessary as it provides and sustains a reliable environment (i.e. power, cooling, etc.) for numerous NAS and NextGen operational and support programs hosted at the Tech Center, some of which operate 24x7x365. In addition, this program provides site infrastructure support to other governmental agencies residing at the WJHTC. The WJHTC must keep the Central Utilities Plant, utility distribution systems, and the infrastructure supporting these entities in operating order. The WJHTC must also ensure compliance with International Building Codes, the National Fire Codes, the Americans with Disabilities Act (ADA) and current energy policies.

Detailed Justification for - 1A04 NextGen - Separation Management Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Separation Management Portfolio	$32,800	$13,500	$16,589

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. ADS-B In Applications – Flight Deck Interval Management (FIM)	---	$3,000.0
B. Separation Automation System Engineering	---	6,000.0
C. Closely Spaced Parallel Runway Operations	---	1,000.0
D. Integrated National Airspace Design and Procedures Planning (INDP)	---	3,000.0
E. Space Integration Enhancement 1	---	3,000.0
F. Continued Maintenance For One Additional Year	---	589.0

What is this program and what does this funding level support?

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 National Airspace System (NAS). This includes emergent operational needs such as commercial space transportation. This portfolio evaluates and matures concepts and capabilities that focus on the enhancement of separation assurance through the use of both ground based automation and aircraft technology enhancements. Separation Management will provide recommendations to improve the tools, orders and procedures that air traffic controllers use to separate aircraft with different kinds of navigation equipment and wake performance capabilities. This portfolio will identify improvements to runway access through the use of improved technology, updated standards, safety analysis, and modifications to air traffic monitoring tools and operating procedures that will enable more arrival and departure operations.

A. ADS-B In Applications – Flight Deck Interval Management: ADS-B In Applications Advanced Interval Management (A-IM) consists of a set of ground and flight-deck capabilities and procedures that are used in combination by air traffic controllers and flight crews to more efficiently and precisely manage spacing between aircraft. An air traffic controller can issue an Interval Management (IM) clearance that allows flight crews to manage spacing through speed adjustments generated by onboard IM avionics until reaching a planned termination point.

A-IM is applicable to En route and terminal airspace and will require investments in both air traffic management and decision support systems, as well as flight-deck avionics. Changes to En Route Automation Modernization (ERAM), Standard Terminal Automation Replacement System (STARS), and Time Based Flow Management (TBFM) automation systems will be needed to support the initiation and monitoring of A-IM operations. New flight-deck functions implemented in Flight Interval Management avionics will provide speed guidance to a flight crew to achieve and maintain a relative spacing interval from another aircraft.

For FY 2019, $3,000,000 is requested to continue year four of the five-year avionics standards development effort. The major deliverable is to complete the Integrated Test Procedures for the Flight-deck based Interval Management Minimum Operational Performance Standards version 2 (FIM MOPS v2). FIM MOPS v2 provides the avionics equipment specifications for A-IM operations. In FY 2019, the team is responsible for completing modeling, analysis, and working papers in preparation for three meetings with industry and

stakeholders; reaching consensus amongst the different stakeholders; and delivering the Integrated Test Procedures.

B. Separation Automation System Engineering (SASE): The continuous growth of aircraft movement both in the air and on the ground is projected to exceed the capacity of the current system and necessitate improved technologies within the existing framework to prevent delays and gridlock. New air traffic control (ATC) concepts and automation capabilities in the En Route, Terminal, Surface, and Oceanic domains will assist controllers in maintaining safe aircraft separation while optimizing the use of available system capacity. SASE will reduce the risks inherent with introducing new technology and operational procedures using system engineering techniques such as analysis, simulation and modeling, and human-in-the-loop (HITL) simulations that will identify, assess, and validate the impact of new technology and operational procedures on the NAS infrastructure.

For FY 2019, $6,000,000 is requested to provide the following:

- Investigation and modeling of enhanced trajectory modeling capabilities: For example, exploit and prototype flight- specific aircraft performance/intent data using Flight Management System (FMS) Extended Projected Profile (EPP) data downlinked via Automatic Dependent Surveillance – Contract (ADS-C); focus on impact to ground automation platforms (En Route, Terminal and Oceanic) and required System Engineering efforts.
- Develop products in support of concept and requirements definition readiness decision (CRDRD) for ERAM Enhancements 3.

C. Closely Spaced Parallel Runway Operations (CSPO): This program supports the simultaneous approach and departure procedure development for aircraft pairs at airports with parallel closely spaced runways (runways that are less than 4,300 feet apart). CSPO utilizes existing and emerging technology to increase arrival and departure rates to reduce traffic delays, and increase capacity during periods of instrument metrological conditions (IMC).

For FY 2019, $1,000,000 is requested to execute modelling and simulation activities that support CSPO departure procedures using course deviation analysis, fast time simulations, hazard assessments, and the application of emerging NextGen technologies to regain runway throughput and increase predictability in the NAS.

- Complete safety analysis for CSPO Integrated Arrival and Departure Procedure to reduce separation requirements based on parallel runway centerline spacing.
- Complete initial assessment of a dependent departure stagger value depending on runway centerline, runway threshold stagger, divergence point, and divergence angle.

D. Integrated National Airspace Design and Procedures (INDP): The INDP program integrates industry's priorities via the NextGen Advisory committee/NextGen Integration Work Group and agency efforts to improve efficiency by taking advantage of aircraft performance capabilities, Standard Terminal Arrivals and Optimum Profile Descents. INDP supports NAS-wide implementation of Performance Based Navigation (PBN) procedures with the initial focus on Established-on-Required Navigation Performance (RNP) (EoR) Instrument Approach Procedures (IAPs). This effort is aimed at investigating RNP, coupled with Area Navigation (RNAV), as a basis for enabling a new operational capability for simultaneous dependent operations and independent Dual, Triple, and Widely-spaced operations in the NAS for using both Track-to-Fix (TF) and Radius-to-Fix (RF) turns. RF turns are constant radius turns. RF is the most advanced navigation specification and therefore captures a minority of the fleet across the NAS. TF turns utilize a series of fixes with fly-by turns that are meant to emulate the smooth curved path of RF turns. TF requires a lower level of equipage, enabling more operators to equip their fleet with this capability. The program is focused on amending separation standards by leveraging the capabilities provided by modern day PBN-capable aircraft avionics with existing or modified ATC procedures, practices, and policies to increase operational efficiency while maintaining or potentially improving safety in the terminal airspace, in particular on final approach. In addition, the EoR project will begin to leverage their work and pave the way for other innovative PBN concepts to support the Agency's PBN Strategy. Additional PBN initiatives that might be studied are Advanced RNP, RNP to the next type of Landing System (XLS) capture (e.g. ILS, GLS or MLS), and Established on Departure Operations

The program will include performing the safety analyses for all configurations including dependent operations, duals, triples and widely-spaced runway configurations for both TF and RF turns. Following initial implementation of EoR at developmental sites, additional data will be collected to support final safety and benefits validation.

For FY 2019, $3,000,000 is requested to:

- Conduct initial implementation of EoR scenarios at new launch sites to validate EoR operational concept
- Provide updates to the PBN Strategy based on operational testing of improved PBN capabilities
- Complete modeling and safety analysis on one RNP approach scenario and deliver next EoR Safety Analysis Report
- Conduct Advanced-RNP (A-RNP) assessment in support of PBN Strategy for A-RNP next steps
- Develop modeling, safety analysis, and data collection plan for one new RNP approach scenario

E. Space Integration Enhancements 1: The FAA must segregate space launch and reentry operations and amateur rocket activities, both on the ground and within the airspace, from the public in order to effectively manage the hazards that these operations can pose to public safety. As commercial space launch and reentry operations continue to increase in frequency and to occur from new locations within the U.S., the FAA has devoted increasing attention to the manner in which these operations can be safely and efficiently accommodated within the airspace. This NextGen initiative is required to support the integration of commercial space launch information with the NAS automation systems to maintain the safe and efficient operations of increasing commercial space transport.

For FY 2019, $3,000,000 is requested to initiate Service Analysis and Strategic Planning activities for the enhancement of the Space Data Integrator, and for Operational concept, requirements validation, shortfall, and impact assessment of additional technologies for integrating commercial space into the NAS.

What benefits will be provided to the American public through this request and why is this program necessary?

Separation Management Portfolio enhancements will provide controllers with tools and procedures to manage aircraft in a mixed environment of varying navigation equipment and wake performance capabilities. Separation management in the NAS can be accomplished procedurally and/or by using automation support. Through this request, procedures, orders and automation support capabilities will be enhanced, thus improving safety, increasing operational efficiency, and expanding current capabilities throughout the NAS. In general, capabilities in this portfolio will enhance aircraft separation assurance by safely reducing separation between aircraft, and as a result improve capacity, efficiency and safety in the National Airspace System.

Capacity - Capabilities in this portfolio will support an increase in capacity by increasing airport throughput as a result of closer spacing of flights accepted from TRACON airspace and managed on final approach. Automation capabilities will also enable air traffic controllers and pilot through reduced separation between aircrafts to manage increasing traffic levels in oceanic airspace.

Efficiency - This portfolio will provide improved efficiency through the introduction of capabilities that will enable more oceanic flights to ascend and descend to their preferred altitudes. Controllers will also be able to approve additional pilot requests for direct routes and more efficient altitudes.

Safety - This portfolio will provide controllers automated information about wake vortex separation requirements for any given aircraft pair, along with accurate wind data which will help predict more accurate and safer separation standards.

Detailed Justification for - 1A05 NextGen – Traffic Flow Management (TFM) Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Traffic Flow Management Portfolio	$0	$10,800	$14,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Surface Tactical Flow (STF)	---	$2,000.0
B. Time Based Flow Management (TBFM) Work Package 4 (WP4)	---	4,000.0
C. Strategic Flow Management Integration (SFMA)	---	3,000.0
D. Strategic Flow Management Engineering Enhancement (SFMEE)	---	3,000.0
E. Advanced Methods	---	2,000.0

What is this program and what does this funding level support?

The Traffic Flow Management (TFM) portfolio involves NAS operators and FAA traffic managers, along with advanced automation, in managing daily flight and flow decision-making, airspace and airport capability issues, such as special activity airspace and weather to improve overall efficiency of the National Airspace System. The TFM provides greater flexibility to the flight planners, and makes the best use of available airspace and airport capacity.

A. Surface Tactical Flow (STF): STF provides guidelines for the development of a collaborative Surface Traffic Management (STM) system with tools necessary to achieve a fully collaborative surface environment, where airline, airport and air traffic controller input are all used to provide a shared surface situational awareness. In collaboration with National Aeronautics and Space Administration (NASA's) Airspace Technology Demonstration-2 (ATD-2), these efforts will produce new improvements that will increase Terminal Flight Data Manager (TFDM), Traffic Flow Management System (TFMS), and Time Based Flow Management (TBFM) connectivity and integration. STF will collaborate with NASA ATD-2 as a means of risk reduction of TBFM, TFMS, and TFDM Integration and as an option for the NextGen Integration Working Group (NIWG) commitment to Congress to conduct a Departure Management (DM) demonstration.

For FY 2019, $2,000,000 is requested for the following:

- Conduct integrated departure scheduling cognitive walkthrough workshops based on operational scenarios including flight strip and other pre-departure events
- Analyze and model integrated departure scheduling on a metroplex airport, focusing on characteristics of the combined airport environment

B. Time Based Flow Management Work Package 4 (TBFM WP4): This project will build off previous TBFM work packages to deploy existing capabilities to additional locations in the NAS, and provide new capabilities to enable/support the Performance Based Navigation (PBN) NAS Navigational Strategy 2016. This work package will incrementally improve metering to further advance the use of PBN operations and capture associated benefits such as increasing throughput and efficiency, particularly during periods of high traffic demand. New candidate capabilities include: Path Stretch, TBFM Dashboard and Planning Tool, and Weather Source Migration via System Wide Information Management (SWIM) from the FAA's Common Support Service Weather System (CSS-Wx).

For FY 2019, $4,000,000 is requested for the following:

- Develop documents in support of targeting the Final Investment Decision (FID) in FY 2020
- Draft the initial Screening Information Request (SIR) for full and open competition of a prime contract

C. Strategic Flow Management Application (SFMA): This program will identify remaining operational shortfalls and gaps for rerouting of flights after the implementation of Airborne Reroute Automation, Collaborative Trajectory Options Program, and Data Communications in the timeframe between 2018 and 2020. SFMA will provide traffic managers and controllers with automated capabilities and integrated tools for flight-specific trajectory modifications and will address a wide range of input factors, including weather impact and metering time assignment. In addition, SFMA will mitigate TFM shortfalls in monitoring and alerting areas and develop the following capabilities: Enhanced Sector Alert Metric, Single Source for Issued Traffic Management Initiatives (TMI), Integrate User Interface Components. Furthermore, SFMA will leverage the technologies of NASA's Airspace Technology Demonstration 3 (ATD-3). These capabilities are components of an Acquisition Management System (AMS) investment of Collaborative Air Traffic Management – Technologies (CATM-T) Work Package 5 (WP5).

For FY 2019, $3,000,000 is requested for the following:

- SFMA will update artifacts of the above-described capabilities in support of CATM-T WP5 schedule for FID in the fourth quarter of FY 2019.
- Begin to investigate and analyze the remaining shortfalls in TFM, and develop concepts to mitigate them, such as Dynamic RNP, integration of TFMS and TBFM, support of NASA's ATD-3 tech transfer, trajectory modification capabilities to support TBO, weather-impacted sector capacity prediction (CP), and TFM system performance analysis capability (TFM-PAC).

D. Strategic Flow Management Engineering Enhancements (SFMEE): SFMEE is a multi-year project that will support future work packages for TFM enhancements. The concept engineering work for the individual capabilities that comprise these future work packages will be conducted primarily through the SFMA and Advanced Methods (AM) programs. This project will be responsible for using the capability-level concept engineering artifacts developed in SFMA and AM to develop the full suite of future CATM work package AMS artifacts that will ultimately support a FID.

For FY 2019, $3,000,000 is requested for the following:

- Develop acquisition products in support of the FID for CATM-T WP5.

E. Advanced Methods: Advanced Methods will explore technologies, analyze current methods, and propose procedural changes to meet Traffic Management needs. This program will support improvements to increase predictability, route flexibility, and efficiency by providing NAS users and Air Traffic Management with an understanding of the constraints surrounding Traffic Management Initiatives. AM will explore the use of advanced coordination and data storage solutions to drive post operational analysis of Traffic Management coordination. The investigated capabilities include TFM Advanced Coordination Analysis Capability and Advanced Coordination Capability for TFM Recording and Logging.

For FY 2019, $2,000,000 is requested for the following:

- Complete an initial Concept of Operations (ConOps). The ConOps will be used to communicate the scope, proposed solution characteristics, and potential benefits to stakeholders.
- Conduct prototype capability development

What benefits will be provided to the American public through this request and why is this program necessary?

The capabilities being researched and implemented in this portfolio are expected to improve both the efficiency of individual flights while optimizing throughput. This work will make travel safer for the traveling

public, help reduce passenger delays leading to a better traveling experience, and contribute to less pollution as the result of improved prediction performance for TFM decision support systems and flexible TFM around weather constraints.

Detailed Justification for - 1A06 NextGen – On Demand NAS Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
On Demand NAS Portfolio	$11,500	$12,000	$20,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Flight Object	---	$2,500.0
B. Common Status and Structural Data (CSSC)	---	3,000.0
C. Flight Object Exchange Services (FOXS)	---	5,000.0
D. Dynamic Airspace	---	3,000.0
E. Flight Deck Collaborative Decision Making (FD CDM)	---	3,000.0
F. Enterprise Information Management (EIM)	---	4,000.0

What is this program and what does this funding level support?

The On Demand National Airspace System (NAS) Information (ODNI) portfolio conducts pre-implementation work to reduce risk in supporting the efficient and secure exchange of information within the FAA and between the FAA and other NAS users. This portfolio provides flight planners, Air Navigation Service Providers (ANSP) staff, and flight crews with consistent, complete, and easily processed information on changes of conditions in the NAS. The ODNI portfolio examines concepts and matures capabilities through validation activities, demonstrations conducted with stakeholders, and human systems engineering to mitigate adverse impacts to the NAS.

A. Flight Object

The Flight Object program is developing an international data standard, Flight Information Exchange Model (FIXM) and is supporting system implementation of this data standard. FIXM is the standard format of Flight Object data sent between systems, allowing more users to share flight information and coordinate various activities concerning a flight.

For FY 2019, $2,500,000 is requested to provide engineering development of final FIXM 5.0 artifacts and for the continuation of work that identifies data elements critical to describing a flight in a standard format for Air Traffic Management (ATM) system information exchange. The development will include U.S. specific extensions and the International Civil Aviation Organization (ICAO) internationally used core standard. The Flight Object program additionally assists new users in adopting FIXM and recommends new FIXM data elements and changes based on user experience. FIXM will be used alongside with the Aeronautical Information Exchange Model (AIXM) and the Weather Information Exchange Model (WXXM) to achieve global interoperability for flight, aeronautical, and weather information exchange.

The funding is planned to use for the Development of FIXM Standard:

- Develop and complete FIXM v5.0 core artifacts including the Logical Model and XML Schemas. This version may include data elements for future versions of FF-ICE provisions.
- Develop and complete FIXM US extension v5.0 artifacts.

- Update the FIXM messaging standard based on content changes to FIXM message types due to new aircraft, airports, or flight operating procedures implemented after the release of FIXM v4.1 scheduled for December 2017.
- The principal artifacts may be supplemented by additional documentation including HTML documentation, operational data descriptions, implementation guidance, and development guidelines.

B. Common Status and Structure Data

The Common Status and Structure Data (CSSD) program will establish the requirements and information flows for the collection, management, and maintenance of aeronautical information in a digital format for machine to machine exchange. The common data and information services and integration activities enable improved flight planning and pilot briefing services, increased on-demand NAS operational performance information and better airspace management using timely schedule information and a common awareness of Special Activity Airspace (SAA) status across the NAS.

For FY 2019, $3,000,000 is requested to fund work that focuses on the development of requirements for machine to machine information exchange using standardized formats for aeronautical information. This program will work toward maturing the Aeronautical Information eXchange Model (AIXM), which is the internationally accepted standard for describing aeronautical information. FY 2019 requested funding will be used for:

- Development of Final Investment Decision AMS artifacts for the Aeronautical Information Management Modernization (AIMM) Segment 3 including final Program Requirements Document, Business Case Analysis Report, and Implementation Strategy and Planning Document.
- Coordination and collaboration on the use of AIXM with internal and external stakeholders to support improved service functionality optimized to meet the business needs supported through the services. Specifically, this will include the identification of additional mapping layers, optimized queries, and relevant data to support automation.

C. Flight Object Exchange Services (FOXS)

Flight Object Exchange Service (FOXS)/Common Support Services – Flight Data (CSS-FD) is a new investment leveraging the FAA's previous investments in System-Wide Information Management (SWIM) to significantly advance Flight Information Management across the Air Traffic Management (ATM) enterprise and actors. FOXS will develop the following capabilities to meet the FAA's growing need for coordinated strategic flight planning and distribution of standardized flight information:

- Flight Data Sharing (FDS) – The distribution of flight data to systems that use flight data to perform operational and analytical functions throughout the entire life cycle of a flight (i.e., from pre-departure to arrival).
  - Will implement a modern, standards-based flight data exchange mechanism that will simplify global, national, and inter-agency data sharing
  - Will produce consolidated, reconciled values for flight data
  - Will publish flight data in an expandable and machine-readable format that has been filtered according to data access policies established by the FAA and criteria specified by the CSS-FD consume
- Unified Flight Planning and Filing (UFPF) – The provision of a common access method to exchange flight data between the NAS user and the core NAS systems during the flight planning and filing phases of flight.
  - Will improve the exchange of early intent (pre-flight plan filing) data, NAS constraint checking, and Flight Plan submission
  - Will streamline the transition from early flight planning coordination to the actual Flight Plan filing event by consolidating these processes, which today involve disparate interfaces

For FY 2019, $5,000,000 is requested to support the FOXS/CSS-FD Initial Investment Decision (IID) and Final Investment Decision (FID) activities and to prepare Investment Analysis (IA) artifacts.

D. Dynamic Airspace

Dynamic Airspace will provide the necessary research and analysis for a toolset that allows dynamic reconfiguration of existing NAS automation infrastructure to meet changing demand and capacity needs. The program will evaluate the capabilities of existing and planned NAS automation and decision support systems as well as the underlying infrastructure necessary for information exchange and communication to reallocate those functions to various locations.

For FY 2019, $3,000,000 is requested to complete products in support of Dynamic Airspace requirements development and include:

- Operational and System Requirements
- Updated Tech Transfer package for affected systems
- Solution Concept of Operations (CONOPS)
- Quantified Shortfall Analysis
- Enterprise Architecture products
- Safety Risk Management Guidance for System Acquisitions (SRMGSA) required documents
- Information System Security (ISS) risk factor assessment

E. Flight Deck Collaborative Decision Making

The Flight Deck Collaborative Decision Making (CDM) program addresses the disparities in the implementation of flight deck automation advancements to support flight crew decision-making in a collaborative environment. The program will research and implement initial applications, standards, and advanced services for data provided by the FAA to support future NAS operations and collaborative decision-making. This program will determine initial NAS and System Wide Information Management (SWIM) services to be exchanged with the flight deck and support the flight crew decision-making by providing Electronic Flight Bag (EFB) applications that enable future capabilities such as taxi instructions compliance and surface movement monitoring on the flight deck, advanced trajectory modeling, Four Dimensional Trajectory (4DT) negotiations, and synchronization of air/ground procedures. Leveraging research conducted in previous years and advancements in SWIM and ground automation systems, the Flight Deck CDM program will develop, standardize, certify, approve and implement flight deck applications that enable enhanced participation by the flight crew in the collaborative decision-making process.

For FY 2019, $3,000,000 is requested to support Flight Deck CDM, which will be used for the following activities.

- Procure the necessary support to evaluate and develop initial technical and operational assessment
- Initiate and maintain coordination with key industry stakeholders and organizations
- Conduct stakeholder engagement to supply appropriate input to the Flight Deck CDM technical and operational assessment to drive future application development
- Conduct shortfall analysis for Flight Deck CDM applications

F. Enterprise Information Management (EIM)

The Enterprise Information Management (EIM) Enterprise Capability (EC) is a cloud-based platform in the Mission Support environment designed to deliver capabilities and services including big data capabilities, to enable the Agency to move away from silo-centric applications, toward a unified, secure, data and integrated Enterprise Information Management environment. Hosting and providing common data and information management infrastructure, components and services, that can be reused and leveraged to support systems and business functions across the FAA organization, will allow the EIM EC to quickly and strategically grow in content and services, while reducing duplicate capabilities and functions

The current FAA data and information management capabilities are insufficient to provide the FAA workforce and stakeholders with a framework suitable for efficiently accessing and exploiting relevant data resources to meet their unique requirements. Additionally, there are substantial redundancies in data and information systems and inconsistencies in data and information management processes across the agency. Thus, the agency incurs considerable cost and resource overhead as it builds, operates and sustains complex redundant capabilities.

The existing technical infrastructure is aging and is not sustainable or practical considering the rapidly growing volume of FAA data, emerging cybersecurity requirements, and the need to support advanced analytic capabilities in near real time. Existing systems are limited in their storage and processing capabilities, which inhibits the synthesis and analysis of the agency's growing volume of data. Individual systems are resource challenged and unable to leverage the advancements in Big Data technology occurring in the commercial sector.

The requested FY 2019 funding will provide a cloud-based, common Enterprise Information Management platform and infrastructure with data storage and processing power that:

- Creates and provides efficient access to a unified data layer
- Delivers core enterprise scale information management capabilities, and services
- Supports a development environment that enables the integration and development of diverse operational systems and unique applications by providing a common framework for data and application re-use and cross-agency collaboration

The funds will build out and extend the capabilities associated with a Mission Support technology transfer of a cloud-hosted, Enterprise Capability in order to implement a "forward fit strategy" that scales to support requirements of new and modernized systems from across the FAA, and delivers EIM capabilities in development, test, staging and production environments, and the continuation of the systems development life cycle (SDLC) to include the following activities:

- **Systems analysis, requirements definition**: Define project goals into defined functions and operation of the intended application. Analyze end-user information requirements to identify and derive related EC support and interface requirements.
- **Systems design**: Describe desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.
- **Security design:** Describe required security controls and operations in detail, including where applicable screen layouts, business rules, process diagrams, pseudocode and other documentation.

What benefits will be provided to the American public through this request and why is this program necessary?

This portfolio will improve efficiency, minimize delays, and will provide benefits to the American Public in the areas of safety, capacity and efficiency, and cost avoidance.

Planned benefits will include:

- The development of a standard set of flight information under the Flight Object program will benefit airlines by simplifying the flight planning process and providing information that will cross multiple ATC systems and domains with ease, leading to improvements in on-going traffic management initiatives and decision making.
- CSSD provides an increase in safety by increasing the amount of accurate, actionable information available to pilots, airlines and other NAS operators and by ensuring all NAS participants have a common, shared situational awareness which will reduce accidents that are attributable to pilot briefing errors, missing information, and violation of NAS flow constraints and restrictions.
- The FOXS program takes the global Extensible Markup Language (XML) standard developed in the Flight Object program and provides for the implementation and use of this in the NAS.
- Dynamic Airspace will maximize system efficiency through the reallocation of existing resources to address demand and capacity imbalances, as well as creating additional NAS agility in support of contingency operations, enabling an accelerated recovery to optimal operations following a system outage.
- The Flight Deck CDM program will enhance automation capabilities implemented in the traffic management system and improve the collaboration with the flight deck by incorporating flight crew input and aircraft performance variables by leveraging advanced technologies in the flight deck. The incorporation of aircraft performance, flight intent, and improved flight crew situational awareness will result in increased predictability of future aircraft position, allowing traffic managers to strategically manage the airspace based on where aircraft will be. This trajectory based management of the NAS

will increase efficiency and improve capacity in the NAS. Thus, the flying American Public derives benefits in the form of improved flight efficiency and delay reduction.

- EIM EC will streamline common activities so that data collection and preparation can be done once and data stored in a common, shared platform rather than on local systems. This enables the FAA to improve the quality, efficacy and accessibility of the data that is used to support government and commercial services or is provided to the public.

Detailed Justification for - 1A07 NextGen – NAS Infrastructure Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
NAS Infrastructure Portfolio	$17,660	$17,500	$13,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Weather Observation Improvements	---	$2,000.0
B. Weather Forecast Improvements	---	2,000.0
C. NextGen Navigation Engineering	---	1,000.0
D. New Air Traffic Management (ATM) Requirements	---	7,500.0
E. Information Management	---	1,000.0

What is this program and what does this funding level support?

The National Airspace System (NAS) Infrastructure portfolio conducts pre-implementation activities to reduce risk for aviation weather-related and cross-cutting engineering issues. This portfolio provides the research, development, and analysis of validation activities, human system engineering, and demonstrations. Work with this portfolio addresses aviation weather-related issues by supporting the improvement of the following:

- Air Traffic Management (ATM) decision-making during adverse weather conditions
- Weather forecasting in the transformed NAS
- Existing weather infrastructure: NextGen Navigation Engineering, New ATM Requirements, and Information Management conduct analysis to develop solutions that can apply across the NAS domain

A. Weather Observations Improvements

This program develops weather observation sensor improvements to provide the optimal quality of ground, air, and space based sensors. In FY 2019 the program will conduct system engineering activities associated with mitigating wind observation shortfalls in the terminal areas of major airports. Adverse terminal winds (gusts, crosswinds or tailwinds) have been identified by the National Transportation Safety Board (NTSB) as a condition that factors in over 50 percent of all weather related incidents. This program's mitigation of those observing shortfalls enables both safety and efficiency improvements by providing consistent wind observations to weather prediction models and decision support tools used by pilots and Air Traffic Control (ATC) personnel operating in the approach and departure process. Reductions in runway changes, aborted takeoff and landing operations, and departure delays are anticipated benefits of this work.

For FY 2019, $2,000,000 is requested to deliver results, analysis, and recommendations of wind measuring technologies and siting/installation alternatives.

B. Weather Forecast Improvements

The Weather Forecast Improvements (WFI) program seeks to improve weather predictions and determine how to improve the use of that information. Currently, there is minimal automation available to assist with identifying, analyzing, and translating raw weather data into NAS constraints. This program will improve the decision process and the accuracy of aviation weather information to include an automated translation of weather information into constraints placed on the NAS. WFI will improve aviation weather forecasting

models with the goal of determining and reducing weather's effects on air traffic. The program also develops the necessary policies and guidance for aeronautical meteorological services under U.S. commitments to the International Civil Aviation Organization (ICAO).

For FY 2019, $2,000,000 is requested to fund concept work for NWP and CSS-Wx Future Work Packages, as well as to conduct International coordination activities on aviation weather.

C. NextGen Navigation Engineering

NextGen Navigation Engineering (NNE) conducts pre-implementation activities to develop new or enhanced navigation capabilities. This includes activities such as supporting requirements analysis for low visibility operations (LVO) for landing or departing aircraft when the horizontal visibility along the runway is less than 1,200 feet. These LVOs cover takeoff using Heads Up Display (HUD) reference to centerline orientation via a "high quality" CAT I ILS localizer signal. The activity will determine the need for improvements to ground-based navigational aids or lighting systems such as Runway Visual Range (RVR) to support Enhanced Low Visibility Operations (ELVO) Phase 3. This activity will support the investment analysis activities for ELVO Phase 3 program to be established.

For FY 2019, $1,000,000 is requested to complete the final Investment Analysis Readiness Decision (IARD) documentation for ELVO Phase 3 and achieve ELVO Phase 3 IARD. The IARD will allow the FAA to determine the feasibility of EVLO Phase 3 and identify alternatives to proceed to the next phase of the Acquisition Management System (AMS) Final Investment Decision (FID).

D. New Air Traffic Management (ATM) Requirements

This program identifies new opportunities to improve the efficiency and effectiveness of air traffic management operations. In FY 2019, New ATM Requirements will continue activities in support of Enterprise Information Protocol and Exchange Standards, Future Collision Avoidance Systems (CAS), Weather Transition, Synchronization of Air/Ground Procedures, Advanced Air/Ground Procedures, Command and Control in a Cloud Environment, and Command Displays that are Commercial Off-the-Shelf (COTS).

For FY 2019, $7,500,000 is requested for the following:

- Enterprise Information Protocol and Exchange Standards guidance material
- Future Collision Avoidance System (Future CAS) for UAS vehicles
- Conduct weather requirements activities in support of in-flight icing issues
- Synchronization of Air/Ground Procedures
- Promote advanced Air/Ground communications by developing Internet Protocol (IP) Standards to support the FAA's Data Comm Segment 2 and Future Communication Systems.
- Assess gaps in current cloud architecture to support command and control capability for NAS systems

E. Information Management

Information Management (IM) researches the NAS data services most needed by the community and programs, develops prototype technologies to address those needs, develops data governance practices, and further develops data analysis tools and capabilities to help users process the data. This capability will also make discovery and consumption of rich NAS data sets easier and help to improve the FAA's internal analytics capabilities to reduce dependence on external data sources. Specifically, this program is needed for future enhancements to the SWIM program. The concepts demonstrated within Information Management could be leveraged by other information driven FAA programs to support their requirements for data storage, search, extraction, and analysis. For FY 2019, $1,000,000 is requested to develop initial architecture and requirements for enhancement of SWIM service delivery.

What benefits will be provided to the American public through this request and why is this program necessary?

The work under the NAS Infrastructure portfolio supports the NextGen goals of improved capacity, efficiency, and safety though its cross-cutting development programs. There are several programs within NAS Infrastructure that bring weather related benefits. Weather Observation Improvements works to provide consistent wind information to pilots and air traffic control personnel throughout the entire approach and departure process, reducing runway changes, aborted takeoff and landing operations, and departure delays. Through improved weather forecast timeliness and accuracy, WFI will optimize the usage of available airspace. The navigation capabilities developed under NNE will enhance NAS capacity and efficiency. New ATM Requirements' span multiple areas including communications, information management, and weather. The benefits delivered by these efforts support operational improvements that will increase the number of arrivals and departures at major airports. IM will improve the use of enterprise wide data and information management for data analysis purposes while also minimizing costs by providing an enterprise solution for the collection, storage and analysis of operational data for post-operational use. This program will also provide the American public greater access to desired data housed within the FAA.

Detailed Justification for - 1A08 NextGen Support Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
NextGen Support Portfolio	$12,000	$12,000	$12,800

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
NextGen Support Portfolio	---	$12,800.0

What is this program and what does this funding level support?

The NextGen Support Portfolio provides the National Airspace System (NAS) laboratory environments required to evaluate, mature, and validate the broad framework of NextGen concepts, technologies, operational functions, and systems before they are introduced into the NAS. This program provides the evaluation platforms at the NextGen Integration and Evaluation Capability (NIEC) and Florida NextGen Test Bed (FTB). These labs facilitate the conduct of NextGen concept demonstrations using research NAS environments without affecting actual NAS operations.

The NextGen Support Portfolio funding is used to continue laboratory operations in support of on-going NextGen programs, as well as, enhance existing NIEC and FTB lab capabilities as required to support the development and evaluation of advanced capabilities associated with evolving NextGen operational improvements and implementation plans. Following is a brief explanation of the work that will be performed as part of each activity.

For FY 2019, $12,800,000 is requested to continue execution of work within the NextGen Support Portfolio and provide for enhancements to the NIEC and the FTB, and for Operational Assessment activities. New capabilities will be introduced to support emerging NextGen operational improvements related to Collaborative Air Traffic Management, Seamless Integration of Information, Integration of Unmanned Aircraft Systems (UAS), Commercial Space Operations, and Trajectory-Based Operations (TBO).

NextGen Integration and Evaluation Capability (NIEC) Laboratory:

The NIEC is a NextGen integration and evaluation facility located at the William J. Hughes Technical Center (WJHTC) in Atlantic City, New Jersey. The NIEC provides a real-time, NextGen-capable environment that allows for concept development and validation, integration and operations analysis capabilities through Human-in-the-Loop simulation testing and data analysis capability. NextGen systems and procedures will be developed and integrated into the NIEC to support studies that measure and validate concept feasibility, human performance, usability, changes in workload, and safety. The program will include the development and validation of prototypes and analysis capabilities to support the definition of NextGen requirements while researching possible solutions to challenges posed by the integration of NextGen technologies.

FY 2019 funding will support modifying the laboratory infrastructure to support NextGen research projects and simulation requirements; customers require a simulation environment which provides capabilities representative of the future NAS to conduct their simulations and the laboratory infrastructure must therefore constantly evolve to ensure that its environment can support future customers and simulations.

Florida NextGen Test Bed (FTB):

The FTB is located at the Daytona Beach International Airport (DAB) in Florida and provides a platform where early stage NextGen concepts can be integrated, demonstrated, and evaluated. The FTB core infrastructure is architected and configured to enable remote connections with other FAA NextGen and industry partner sites to allow for multi-site demonstration capabilities. Through appropriate governance and oversight, the FTB provides the ability for industry to bring and integrate new concepts and technologies; maintain and sustain their systems at the FTB; and conduct ongoing activities. FY 2019 funding will support modifying the laboratory infrastructure to support a NextGen integration platform which will meet project demonstration requirements. Customers require an integrated environment which is representative of the future NAS to conduct their demonstrations. The laboratory infrastructure must therefore constantly evolve to ensure that its environment is able to support future customers and demonstrations.

Operational Assessments (OA):

The Operational Assessments will support NextGen implementation by performing work in three areas: Systems Analysis, NextGen Performance Snapshots (NPS), and NextGen Segment Implementation Plan (NSIP). The System Analysis component will focus on analyzing the operational impacts of fielded NextGen capabilities, including NextGen Advisory Committee (NAC) requested analyses conducted jointly with the industry. The NPS website will track and report performance progress at specific locations where NextGen programs have been implemented as well as reporting the NextGen priorities. This project will also ensure the NSIP is updated to identify and manage incremental improvements necessary to develop, integrate, and implement NextGen capabilities and NAS current operations. OA has completed assessments of Wake Recat, Metroplex, Optimized Profile Descents, and Established On Required Navigational Performance. Future assessments are expected for DataComm, Terminal Flight Data Manager, and Time Based Flow Management.

What benefits will be provided to the American public through this request and why is this program necessary?

The American public benefits by having an efficient and flexible platform to evaluate future NextGen concepts and technologies that will enhance the safety and efficiency of air travel. The laboratory environments provided by this program are necessary for Air Traffic Management (ATM) enhancements to be assessed at an early stage before implementation decisions or significant investments are made, allowing time to adjust the concepts or technologies, expediting their implementation in the National Airspace System (NAS), and reducing overall risk and cost to the taxpayer.

The Laboratory environments have been critical in evaluating such concepts as the international exchange of standardized ATM messages, Trajectory Based Operations (TBO), Unmanned Aircraft Systems (UAS), Space Operations, and many others. These activities help reduce passenger delays, increase the capacity for number of flights, and allow UAS and space operations to interoperate safely and more efficiently with manned aircraft. Outputs from the projects conducted in the lab environments help to define Air Traffic Management Requirements and Performance Panel standards and guidance documents for International Civil Aviation Organization, which will provide guidelines to ensure the safety of the flying public.

Detailed Justification for - 1A09 NextGen – Unmanned Aircraft Systems (UAS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Unmanned Aircraft Systems (UAS)	$0	$18,500	$14,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. UAS Concept Validation and Requirements Development	---	$6,700.0
B. UAS Flight Information Management System	---	7,300.0

What is this program and what does this funding level support?

These projects will allow integration of UAS without impact to manned aircraft operations or creating disruptions or delays and will ensure NAS operations will be as safe as they are today.

A. UAS Concept Validation and Requirements Development:

This project will continue identifying and maturing UAS needs as they relate to air traffic systems and services, and refining operational requirements associated with Air Traffic Management (ATM) automation, airspace management, policies, and procedures. Work under this project will primarily enable non-segregated UAS operations, and will support aspects of expanded UAS operations expected in the mid-term timeframe. Work under this project will ensure operational implications of UAS are well understood and necessary infrastructure changes are implemented in a timely manner to support Air Traffic Management (ATM) automation enhancements. For FY 2019, $6,700,000 is requested to complete update of UAS concept maturation products (UAS Concept Maturation Plan, UAS Shortfalls, and Operational Requirements), complete development of Investment Analysis (IA) artifacts to support Concept and Requirements Definition Readiness Decision (CRDRD) for "UAS Enhancements 1" investment, and to identify NAS systems that may require augmentation to support emerging UAS capabilities.

B. UAS Flight Information Management System (FIMS):

This project will develop a proposed Unmanned Traffic Management (UTM) system, which is a separate, but complementary system to the Air Traffic Management (ATM) system. The program establishes the concepts, use cases, and requirements associated with UTM/FIMS to safely manage UAS operations primarily through operator-operator sharing of flight intent and operator-FAA sharing of flight intent and airspace constraints. Without FIMS, the pace of increasing UAS access to this airspace will be limited to waivered operations considered on a case-by-case basis. This program will also establish the necessary infrastructure, requirements, and implementation plan to support the integration of UAS operations in a UTM environment. Additionally, work supporting an initial delivery, refined requirements and phased enhancements of a Low Altitude Authorization and Notification Capability (LAANC) will provide an automated near real-time solution for small UAS operators and FAA ATC to comply with the Part 107 Small UAS Rule.

For FY 2019, $7,300,000 is requested to perform phased development and integration planning for LAANC and UTM.

What benefits will be provided to the American public through this request and why is this program necessary?

The UAS programs play a critical role in enabling UAS operations in the NAS without impacting manned aircraft operations and creating disruptions or delays and ensuring NAS operations will be as safe or safer than they are today. Government cost of allowing UAS operations will decrease due to the reduction of "exception handling" of UAS flights, and improvements to NAS capabilities and operations will be made cost effectively due to the integrated framework approach to addressing needs and solutions.

Detailed Justification for - 1A10 NextGen – Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio	$0	$9,000	$9,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Enterprise Concept Development	---	$1,500.0
B. Enterprise Human Factor Development	---	1,500.0
C. Stakeholder Demonstrations	---	6,500.0

What is this program and what does this funding level support?

For FY 2019, $9,500,000 is requested to conduct three enterprise level activities to support NextGen concepts related to trajectory based operations and new entrants such as commercial space operations.

A. Enterprise Concept Development

As the NAS and global Air Traffic Management continue to evolve to Trajectory-Based Operations (TBO), precise trajectories will require accurate monitoring capability to maintain or increase available airspace capacity and efficiency while maintaining safety. The Enterprise Concept Development program is used to identify early NextGen concepts and maturation activities that will transform the National Airspace System (NAS) into the Next Generation of the NAS. Areas of interest include but are not limited to trajectory-based coordination and performance optimization during all phases of flight.

For FY 2019, $1,500,000 is requested to support concept development and validation activities, research, concept engineering, concept analysis, demonstrations and evaluations exploring concepts related to trajectory based operations.

B. Enterprise Human Factor Development

The Human Factor Development program provides proactive guidance on human performance considerations to concept development and validation teams. The identification of potential human performance issues at the concept development and validation stages is essential to the usability, acceptability, and safety of NextGen concepts and systems. This work will be conducted in close collaboration with teams to ensure any human factors risks and issues are documented and mitigated early in the concept design and validation process. Human factors activities are needed during concept development and validation stages to ensure concepts do not mature without appropriate human performance guidance. This work will result in fielded capabilities that are not underutilized or rejected by controllers.

For FY 2019, $1,500,000 is requested to identify human factors considerations of NextGen concepts (e.g., Time, Speed, and Spacing; Managing Automation Trust; Human Factors Considerations for Transitioning to Trajectory Based Operations).

C. Stakeholder Demonstrations

The Stakeholder Demonstration program provides practical application and analysis of proposed NextGen system improvements to validate and prove concept feasibility and to determine which initiatives might be accelerated through fast track modeling. These demonstrations utilize collaboration with users, operators, and other partners early on in the modeling process before capabilities are fully incorporated. Furthermore, demonstrations collect and provide data to support business case and investment decisions tied to the decision points in the NAS architecture. These demonstrations promote industry involvement and attain community buy in, while supporting global harmonization across NextGen. Rigorous demonstrations ensure the integration and interoperability of systems and reveal the need for rulemaking, policy changes, and training.

The program generally supports 2-3 demonstration events per year, with demonstration projects normally lasting anywhere from 24 to 30 months. Project objectives are laid out with clear target decision points in order to identify entry and exit criteria. When a demonstration is completed, the results are assessed to determine whether to proceed into the requirements definition phase.

For FY 2019, $6,500,000 is requested to conduct:

- 4D Trajectory (4DT) Flight Trials Demonstration - This demonstration will include live flight trials to demonstrate globally connected aircraft using airborne internet and data communication to exchange information between air traffic management, flight deck and ground dispatchers flying in the NAS to validate NAS Trajectory Based Operations (TBO) concepts.
- The International Civil Aviation Organization update of the Procedures for Air Navigation Services Air Traffic Management - Demonstration activities are planned to show how to reduce air traffic delays due to more efficient metering and spacing, increased capacity of the airspace, more efficient traffic flow management, and integrated arrival/departure routes.

What benefits will be provided to the American public through this request and why is this program necessary?

The Enterprise Portfolio will promote safety and efficiency and reduce air traffic delays:

- Concepts will be assessed to identify research issues; evaluate benefits; reduce aircraft reroute around the hazard area; develop preliminary operational requirements, data sharing and collaboration, and procedures to enhance safety; increase operational efficiency and airspace capacity; and expand current capabilities throughout the NAS.
- Human factors efforts will assess the intersection of tools and procedures' influence on the end users, and the end-users ability to perform their job. The program will evaluate human performance in the operational environment to ensure the delivery of benefits for the overall integrated system, and provide insight across domains and programs to avoid implementation and integration issues.
- Demonstration activities will show how to reduce air traffic delays due to more efficient metering and spacing, increased capacity of the airspace, more efficient traffic flow management, and integrated arrival/departure routes. These activities will identify key implementation issues, assist the FAA in developing its operational improvement plans to meet NextGen goals and objectives, and assist with implementing initiatives.

Detailed Justification for - 2A01 En Route Automation Modernization (ERAM) System Enhancements and Technology Refresh

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
ERAM System Enhancements and Technology Refresh	$78,000	$86,250	$102,050

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. ERAM Technology Refresh 2	---	$70,200.0
B. ERAM Technology Refresh 3-4	---	6,500.0
C. ERAM Enhancements 2	---	25,000.0
D. Independent Operational Assessment (IOA)	---	350.0

What is this program and what does this funding level support?

A. ERAM Technology Refresh 2

ERAM Technology Refresh 2 is the second step in the planned technology refresh update to the ERAM program. This step in the ERAM Technology Refresh will focus on the following: refreshing existing analog Radar position display with a new digital display, refreshing Radar position keyboard/video/mouse (KVM) switch, refreshing the IBM Power PC/RISC based processor with x86 based processor for both the tactical (Radar display) and strategic (Data entry) controller positions, deployment of Linux Open Source operating system (O/S) on the x86 based processors, refreshing the display graphics adaptor for displays, refreshing the display capture recording, and playback technology, and adding servers to existing backroom server farm to handle emerging increased demand for capacity. The FY 2019 funding will be required to complete the hardware procurement and continue the deployment of the new hardware solution to the 20 ARTCCs.

For FY 2019, $70,200,000 is requested for ERAM Technology Refresh 2. This funding will be used for the continuation/completion of the procurement and implementation contractor activities:

- Continue critical hardware procurement
- Complete key site deployment and test of technology refresh 2 hardware and software
- Complete deployment of technology refresh 2 hardware at 15 of 20 ARTCCs

The core ERAM system became operational at all 20 Continental United States (CONUS) Air Route Traffic Control Centers (ARTCCs) at the end of the second quarter of FY 2015. The original hardware was procured in the 2006-2008 timeframe. The ERAM Technology Refresh 2 Segment is needed to sustain the system. The equipment is in critical need of technology refresh for the service sustainment of ERAM systems.

B. ERAM Technology Refresh 3-4

ERAM Technology Refresh 3 is the third step in the planned technology refresh update to the ERAM equipment sustainment program. The Technology Refresh 3 program is targeted to start in FY 2019 with an Investment Analysis Readiness Decision (IARD)/Initial Investment Decision (IID) in early FY 2018 and Final Investment Decision (FID) in FY 2018. This sustainment program is planned to address the remaining ERAM infrastructure hardware, network equipment and operating system at operational, training and support environments that were not replaced in the previous technical refresh efforts. The ERAM Technology Refresh 3 program execution spans from FY 2019 to FY 2025.

For FY 2019, $6,500,000 is requested for Technology Refresh 3. This funding will be used to achieve Final Investment Decision (FID) and begin Engineering Development for:

- Enterprise Storage and Tape Backup units, replacement
- IBM P5/6 Series processors (including Flight Data Processor, Surveillance Data Processor Servers and Air Traffic Workstations) running AIX (Operational Systems, Support, and ESSC) replacement
- ARTCC and support environment ERAM Network Equipment (e.g., Application LAN)
- ESSC Servers, Configuration Management, and Support tools replacement
- Security/Plan of Action and Milestones (POAM) hardware items
- ERIDS servers, workstations, and networks sustainment/replacement
- Low Resolution KVM for D Position and D/A Positions replacement

The ERAM Technology Refresh 3-4 Segment is needed to complete the sustainment of the ERAM infrastructure systems. The equipment is in critical need of technology refresh for the service sustainment of ERAM systems. This sustainment program also includes security adaptation to align security and network communication features with current FAA FTI standards.

C. ERAM Enhancements 2

ERAM Enhancements 2 (formerly ERAM Sector Enhancements) includes improvements in separation management, trajectory prediction, and human interface capabilities to improve the delivery of air traffic services today and to continue the evolution of NextGen trajectory-based operations. FID was completed in December 2016 and engineering of the first set of capabilities is ongoing. The FY 2019 funding will complete engineering design and requirements for capabilities that the FAA has identified as high priorities, such as Unmanned Aircraft System (UAS) enhancements and Automated Handoffs to Canada, while supporting and software development and deployment of Adaptation enhancements.

For FY 2019, $25,000,000 is requested for ERAM Enhancements 2. This funding will be used for the following development contractor activities:

- Complete software development, testing, and deployment of the ERAM Adaptation Refinement capability.
- Complete systems engineering documentation (A and B level specifications) for the ERAM Enhancements to Support UAS capability.
- Complete systems engineering documentation (A and B level specifications) for the first phase (Infrastructure) of the Automated Handoff to Canada capability.

D. Independent Operational Assessment (IOA)

For FY 2019 $350,000 is requested for IOA.

What benefits will be provided to the American public through this request and why is this program necessary?

The program focus is on maintaining the high availability of the ERAM capability, incorporating improvements in separation management and trajectory prediction. The ERAM technology refresh projects are necessary for the replacement of equipment that is approaching the end-of-life and hardware being discontinued by the manufacturer. This will sustain the safety critical Air Traffic operations as well as lower system life cycle cost.

The ERAM Enhancements 2 program will provide software enhancements for the En Route controller team. It will improve the efficiency and effectiveness of En route sector operations through enhanced trajectory management and improved collaboration between the tactical (R-Side) and strategic (D-Side) controllers, and also involves upgrades to flight data management and system support functions.
The improvements and benefits are:

- ERAM Adaptation Refinement

  - Allowing preset parameters to become locally adaptable will reduce workload and labor costs currently associated with execution of periodic adaptation updates
- ERAM Enhancements to Support Unmanned Aircraft Systems (UAS)
  - Improving performance data and the ability to accept complex flight plans will improve the ability to accommodate participation of UAS in the NAS
- Automated Handoff to Canada
  - Automating the handoff procedure between domestic airspace and international partner Canada will reduce controller workload
- ICAO Flight Plan Processing Enhancements
  - Properly processing updates to ICAO equipage will impact 160,000 flights per year that are currently improperly processed, leading to improvements in safety while slightly improving the ability to perform Optimized Profile Descents (OPDs) due to the correct equipage at the TRACON boundary
- Conflict Probe Enhancements
  - Providing Conflict Probe results on the Radar Controller display and improving accuracy of trajectory modeling will lead to improvements in safety
  - Improvements in Conflict Probe algorithm in transition airspace into and out of airport terminal areas will reduce false alerts
- Aircraft Trajectory Modeling Enhancements
  - Improved trajectory efficiency and application of three nautical mile separation standards in selected airspace will improve the ability to execute OPDs in congested airspace during high volume periods, reducing fuel burn and decreasing CO_2 emissions

Detailed Justification for - 2A02 En Route Communications Gateway (ECG)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
En Route Communications Gateway (ECG)	$2,650	$2,650	$1,650

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Obsolete Equipment Replacement and Program Support Services	---	$1,000.0
B. In Service Engineering	---	650.0

What is this program and what does this funding level support?

The ECG system was a prerequisite to deploying the En Route Automation Modernization (ERAM) System and the Enhanced Backup Surveillance (EBUS) System at the Air Route Traffic Control Centers (ARTCC's). It formats and conveys critical air traffic data to ERAM. ECG increased the capacity and expandability of the National Airspace System (NAS) by enabling the use of new surveillance technology. ECG introduced new interface standards and data formats required for compatibility with International Civil Aviation Organization (ICAO) standards and adds capacity necessary to process data from additional remote equipment such as radars. ECG was planned to operate through 2015. The FAA Enterprise Architecture Roadmap does not show an investment supporting the decommissioning of ECG and there is no definitive date to replace or remove ECG from service. Thus the need for continued technology refresh of the ECG system.

The ECG system is performing these technology refresh activities now because hard-to-get and obsolete components are failing at an increasing rate. Technology refresh activities replace older and more failure-prone components and allow upgrades of operating systems and availability of spares to continue provision of critical surveillance and flight data to ERAM and EBUS in support of Air Traffic Operations.

For FY 2019, $1,650,000 is requested for equipment replacement, engineering services, and program support services for the ECG. Planned activities for FY 2019 include technology refresh of the terminal server and network consolidation, vulnerability remediation including IOS upgrade to Maintenance Local Area Network (LAN) switch, and technology refresh of Operational LAN Switch.

In addition, the request will support in-service engineering work that provides an immediate response to emerging technology solutions.

What benefits will be provided to the American public through this request and why is this program necessary?

The work under this project will provide technology refresh and maintain the availability of the ECG system to support the continued provision of critical surveillance and flight data to ERAM for Air Traffic operations while reducing sustainment costs.

Detailed Justification for - 2A03 Next Generation Weather Radar (NEXRAD)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Next Generation Weather Radar (NEXRAD)	$6,300	$5,500	$5,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Next Generation Weather Radar (NEXRAD)	---	$5,500.0

What is this program and what does this funding level support?

NEXRAD is a long - range weather radar that detects, analyzes, and transmits weather information for use by the Air Traffic Control (ATC) System Command Center (ATCSCC), En Route, Terminal, and Flight Service Facilities. NEXRAD detects, processes, and distributes for display, hazardous and routine weather information which are processed by FAA's Weather and Radar Processor (WARP), Integrated Terminal Weather System (ITWS), and the Corridor Integrated Weather System (CIWS) systems. NEXRAD is a joint program between Departments of Transportation, and Commerce, with National Weather Service as the lead. Agencies share developmental costs in proportion to the number of systems fielded by each agency. The FAA owns and operates 12 NEXRADs, located in Alaska (seven), Hawaii (four), and Puerto Rico (one).

Originally installed between 1990 and 1996 with an economic service life of 20 years, there are currently 160 operational NEXRAD systems in the United States and overseas, jointly operated and maintained by the Tri-Agency partners. In FY 2015 the average age of NEXRAD reached the end of its economic life. A major Service Life Extension Program (SLEP) is required to extend NEXRAD's service life to 2030 when it can be replaced by a newer technology. The FAA's NEXRAD SLEP program will provide the means to fund the FAA's share of the overall NEXRAD mission, and to ensure that FAA priorities are included in the planning for NEXRAD sustainment and improvement.

For FY 2019, $5,500,000 is requested to support National Weather Service's (NWS) Next Generation Weather Radar (NEXRAD) technology refresh planning and procurement efforts. This funding will be used to perform product improvements, procure hardware, perform second level engineering, and deliver icing algorithm upgrade to NEXRAD Radar Operations Center (ROC).

What benefits will be provided to the American public through this request and why is this program necessary?

NEXRAD has been successfully operating since 1996. NEXRAD systems have increased aviation safety with the accurate and timely detection of hazardous aviation weather conditions. Weather related arrival and departure delays have been reduced, thus allowing aviation fuel consumption savings. While Dual-Polarization technology, which provides a two-dimensional view of precipitation, has been utilized in the commercial weather radar community for over 20 years, it was only recently introduced onto the NEXRAD platform. Dual-Polarization will only provide incremental improvements in overall data quality over the present day NEXRAD but the introduction of the in-flight icing and hail detection algorithms will provide features that enhance aviation safety and detection of weather conditions while aircraft are aloft.

Detailed Justification for - 2A04 Air Route Traffic Control Center (ARTCC) and Combined Control Facility (CCF) Building Improvements

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
ARTCC/CCF Building Improvements	$74,870	$100,400	$88,050

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. ARTCC Facility Modernization and Sustainment	23	$85,600.0
B. In-Service Engineering	---	2,450.0

What is this program and what does this funding level support?

The Air Route Traffic Control Center (ARTCC) and Combined Control Facility (CCF) Building Improvements Program supports En Route air traffic operations and service-level availability by providing life-cycle management of the physical plant infrastructure at the 21 ARTCCs and two CCF facilities.

Many of these structures were built in the 1960s and have been expanded several times since then. As of FY 2015, there was a $93.01 million facility backlog of needed repairs or upgrades, which includes all building systems such as heating, ventilation, and air conditioning (HVAC) components; all piping, plumbing, control systems; and both the exterior and interior of the building. This backlog increases the risk of outages and may result in increased maintenance costs. This program modernizes and sustains these buildings to meet air traffic service requirements and to reduce the backlog.

Under the Sustainment Strategic Plan, major construction projects will replace obsolete plant equipment and improve work areas. These projects will include asbestos abatement, replacement of mechanical/electrical systems, and the installation of fire detection and protection upgrades as well as interior architectural construction. These projects include replacement of chillers and cooling towers and associated mechanical and electrical system elements necessary for cooling the facility to meet the operating temperature requirements of sensitive National Airspace System (NAS) electronics and computer equipment. Obsolete and proprietary building automation control systems that are no longer supported by the manufacturer are being replaced with current state-of-the-art open architecture systems. These projects also include replacement of fire detection and annunciation systems that have already achieved life expectancy and are no longer supported by the manufacturer. The new equipment is more efficient than the replaced equipment and would reduce the energy consumption of the facility.

For FY 2019, $85,600,000 is requested for ongoing ARTCC modernization and sustainment projects. The Air Route Traffic Control Center (ARTCC) and Combined Control Facility (CCF) Building Improvements Program is one of the 14 programs that belong to the portfolio supporting the ATC Facilities and Engineering Services. The requested funding amount is required to continue efforts to ensure that critical NAS En Route facilities are brought into and maintained in a state of good repair. This will prevent catastrophic outages and promote the health and safety of the Air Traffic and Technical Operations work force.

In addition, $2,450,000 is requested for in-service engineering activities.

Current major modernization projects include:

- **Control Wing Basement**—This project renovates portions of the control wing basement. It primarily consists of replacing old and obsolete mechanical and electrical systems throughout the control wing necessary to support the NAS equipment located in these areas. Existing fire detection and suppression systems will be maintained and modified as necessary. The FAA will install architectural and building finishes to modernize space that has not been renovated in 50 years and supports NAS operations and mission support functions. Structural and architectural upgrades will be provided to meet current building codes.
- **Major Mechanical Systems**—These projects rebuild or replace the ARTCC chillers and cooling towers along with associated mechanical systems such as piping, pumps, fans, filters, and controls.
- **Building Automation Controls System Replacement**—These projects replace aging direct digital control systems (DDCS) that monitor and control a facility's environmental systems, such as heating, ventilation, air conditioning equipment, chillers, cooling towers, pumps, air handlers, and computer room air conditioners, as well as monitoring water leak detection systems. This project will provide standardization of building automation control systems at all FAA en route facilities.
- **Fire Alarm Replacement Project—**This project will replace the fire detection and annunciation systems at each facility. It includes demolition of the existing system and installation of a new system to include a fire alarm control panel, fire alarm annunciation panels, visual and audible annunciation devices, smoke and heat detectors, manual pull stations, addressable control devices, fire alarm conduit, and fire alarm wiring.
- **Central Plant and Power Service Building Modernization Project**—This project includes the continued modernization of a facility's central heating and cooling plant along with the modernization of the power service building. The work in the plant includes replacement of facility chillers, boiler systems, hot water heaters, lighting and electrical panel board, and motor control center (MCC) replacement. The work in the power service building includes architectural building upgrades (including façade replacement), thermal separation of conditioned spaces from non-conditioned spaces, roof replacement, seismic and other code and accessibility upgrades, toilet and plumbing upgrades, replacement of air handling units, and lighting and panel board replacement.

Specific mission-critical and local sustainment projects will also be accomplished at each facility to replace obsolete equipment and infrastructure to support the air traffic control (ATC) mission, operation of the facility, and maintenance of the facility in an acceptable condition.

Construction

- Building Automation Controls System Replacement— Los Angeles, Atlanta, Guam, Denver, and Minneapolis ARTCCs
- Fire Detection and Alarm System Replacement—Los Angeles, Jacksonville, Memphis, Boston, Indianapolis, and Albuquerque

Design

- Fire Detection and Alarm System Replacement—Fort Worth, Houston, Kansas City, Anchorage, San Juan, Minneapolis, Miami, Cleveland, and New York

What benefits will be provided to the American public through this request and why is this program necessary?

This program sustains 23 ARTCC and CCF facilities, which are critical and vital to facilitate the FAA's mission to serve the flying public. The mission of the En Route Facilities Planning and Modernization Program is to support En Route Air Traffic operations and service level availability through facility life-cycle program management of the 21 ARTCCs and the CCFs at San Juan and Guam. Much of the plant equipment within these buildings has exceeded its life expectancy and must be replaced. This program replaces obsolete equipment and provides an efficient, reliable, and safe work environment for En Route air traffic control operations. There are no viable programs or alternatives for achieving the same results.

Detailed Justification for - 2A05 Air Traffic Management (ATM)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Air Traffic Management (ATM)	$20,000	$4,900	$6,200

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Traffic Flow Management (TFM) Improvements	---	$2,000.0
B. TFM Modernization (TFM-M) Part 2	---	2,500.0
C. In-Service Engineering	---	1,700.0

What is this program and what does this funding level support?

The Traffic Flow Management System (TFMS) is used to facilitate planning teleconferences every two hours to proactively plan impact mitigation strategies between the Air Traffic Control System Command Center (ATCSCC), Traffic Management Units (TMU) at all major Air Traffic Control (ATC) facilities, and flight operators. When the NAS is impacted by severe weather, congestion, and/or outages, TFMS predicts chokepoints and facilitates the execution of initiatives that alleviate developing traffic situations and avoid unnecessary congestion and delay by exchanging real time data with many essential National Airspace System (NAS) components. TFMS is the nation's primary source for capturing and disseminating flight information across the aviation community.

TFMS serves as the primary platform for NextGen Collaborative Air Traffic Management Technology (CATMT) capabilities, built from 2010 to present and expected to host new NextGen functionality, including elements of the Terminal Flight Data Manager (TFDM), through 2025.

For FY 2019, $6,200,000 is requested to support the TFMS activities listed below.

A. TFM Improvements

Traffic Flow Management (TFM) Service Enhancements (TFM-SE) respond to stakeholder-identified inefficiencies in current TFM systems. The scope of these NAS enhancements is limited to operational changes that do not require significant capital investments nor involve significant systems complexity, interdependencies, or National Airspace System (NAS) operational changes. The identification, management, documentation, and overall governance of these changes are articulated in an Air Traffic Organization (ATO) Standard Operating Procedure and coordinated with applicable stakeholders. This program will support operational and engineering analyses, solution development, and solution implementation activities designed to improve the delivery of TFM services.

For FY 2019 $2,000,000 is requested to continue support for these improvements.

There are currently three projects underway to improve overall TFM efficiency. They are:

- Time-based Flow Management (TBFM) Replay through System-Wide Information Management (SWIM), which provides for shared playback of significant traffic flow management events between FAA and stakeholder facilities.
- Traffic Management Initiative (TMI) Attribute Standardization (TAS) is a program that strives to develop a common vernacular for all traffic management decision support tools. This will provide the ability to

better integrate the various systems and share data between them, providing a better system view and traffic solution modelling capabilities.
- Workload-Based Monitor Alert Parameters (MAP) is a new automated capability that is used to calculate when enroute traffic control center sectors (airspace allocated to a controller position) will experience higher than normal traffic levels.

B. TFM-M Part 2

A new initiative in FY 2019 will upgrade remaining legacy software applications supporting the TFMS and will increase integration and interoperability by establishing a robust, commercially-available and standards-compliant system. These upgrades will reduce complexity and remove the current need for technical workarounds, specialized adaptors and unique, internal high-maintenance interfaces.

Modernization efforts for the TFMS were completed in 2010. Since then some additional incremental improvements have been made but many legacy applications and functions remain. These legacy applications are now impediments to development; are difficult to maintain and modify, and are linked to unplanned downtime that reduces the system reliability, dependability, and availability.

For FY 2019, $2,500,000 is requested to begin the engineering analysis and preliminary shortfalls analysis required for Investment Analysis activities to support a Concept Requirements and Definition (CRD) Readiness Decision.

In addition, the request will support in-service engineering work that provides an immediate response to emerging technology solutions.

What benefits will be provided to the American public through this request and why is this program necessary?

The TFMS provides direct mission support to the FAA by ensuring efficient flow of air traffic through the NAS. The TFMS provides benefits through the CATMT applications to improve capacity to minimize avoidable delays.

Modernizing and Improving TFMS contributes to maintaining overall operational availability within the National Airspace System (NAS), enabling the TFM system and CATMT capabilities that reside on it to continue providing benefits that include:

- Greater system reliability, dependability and availability, enabling TFMS to achieve and sustain its full benefits of avoiding NAS delay as well as retain TFMS users trust.
- Decrease maintenance and repair activities, thereby reducing time to repair which will reduce the impact of outages as well as avoid increased TFMS operational and support costs.
- Enable more efficient development for future improvements and reduce the time required to implement future capabilities that will also provide efficiencies to the NAS to minimize and avoid air traffic delay.

Detailed Justification for - 2A06 Air/Ground Communications Infrastructure

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Air/Ground Communications Infrastructure	$8,750	$9,750	$10,541

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Communications Facilities Enhancement (CFE) Expansion	10	$7,000.0
B. Radio Control Equipment (RCE) - Sustain	---	1,000.0
C. In-Service Engineering	---	750.0
D. Continued Maintenance For One Additional Year	---	1,791.0

What is this program and what does this funding level support?

The Air-to-Ground (A/G) Communications Infrastructure Sustainment programs enhance operational efficiency and effectiveness by replacing aging radio equipment, providing new, relocated or upgraded remote communications facilities, and providing equipment and support to detect and resolve radio frequency interference with FAA communications.

A. Communications Facilities Enhancement (CFE) Expansion

For FY 2019, $7,000,000 is requested to initiate the expansion/replacement/upgrade of 10 CFE sites, procure replacement radios, equipment racks, antennas, towers, and prepare sites for installations. These sites include: Duluth, MN; West Palm Beach, FL; Visalia, CA; La Crosse, WI; El Nido, CA; Nantucket, MA; Jacksonville, NC; Fairbanks, AK; Detroit, MI, and Pemberville, OH.

The Communications Facilities Enhancements (CFE) program provides new, relocated or upgraded Remote Communication Facilities (RCF's) to enhance the A/G communications between air traffic control and the aircraft when there are gaps in coverage or new routes are adopted. The program also provides various upgrades to RCFs, including building and tower grounding, lightning protection, and replacing the cables from the equipment to antennas whenever necessary to improve radio equipment performance in order to meet new capacity demands.

B. Radio Control Equipment (RCE) – Sustain

For FY 2019, $1,000,000 is requested for RCE obsolescence study and to install existing RCE units supporting 40 channels and support the construction and verification of the RCE test bed. The funding will also be used to procure 100 control type power supplies and 100 of redesigned modules to replace obsolete parts while providing longer term support for the operational Control Site RCEs.

The RCE program replaces obsolete radio signaling and control equipment which controllers use to select a remote radio channel. The RCE program improves reliability by replacing older non-supported tone control equipment providing more functionality and improving operational performance.

Also requested is $750,000 for in-service engineering activities.

What benefits will be provided to the American public through this request and why is this program necessary?

Air/Ground Communications Infrastructure will replace aging and increasingly unreliable equipment and communications facilities which will significantly improve safety. In addition, Air/Ground Communications Infrastructure will establish new communications facilities. New communications equipment will lower periodic and correctional maintenance costs associated with the old and technically obsolete equipment in the field and as a result will reduce costs for the FAA and taxpayers.

Detailed Justification for - 2A07 Air Traffic Control En Route Radar Facilities Improvements

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Air Traffic Control En Route Radar Facilities Improvements	$5,800	$5,400	$6,600

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Long Range Radar (LRR) Improvements Infrastructure Upgrades/Sustain	38	$5,600.0
B. In-Service Engineering	---	1,000.0

What is this program and what does this funding level support?

The Air Traffic Control En Route Radar Facilities Improvements Program is responsible for 157 Long Range Radar (LRR) surveillance facilities that provide aircraft position information to Federal Aviation Administration En Route control centers for air traffic control (ATC), and to the Department of Defense and Homeland Security for security monitoring of the National Airspace System (NAS).

About 80 percent of the LRR inventory is older than 30 years. Sixty-six of these sites were established in the early 1950's and have reached the end of their useful life. The ATC En Route LRR surveillance equipment will need to remain operational at least through year 2025. The NAS requires reliable and continuous operation of surveillance equipment. The repairs, improvements, and modernization to existing infrastructure will enable the facilities to continue to meet current operational, environmental, and safety needs. It will extend the service life of facilities, and most importantly, reduce the chance of outages that often cause air traffic delays and impact the requirement for continuous monitoring of the NAS.

The existing air surveillance infrastructure has shortfalls that must be addressed sequentially for the system to continuously meet the users' needs into the future. The immediate need is to ensure that current air surveillance capabilities do not further degrade while planning and implementing longer-term solutions.

For FY 2019, $6,600,000 is requested to sustain approximately 38 facilities that are in poor condition and have greatest impact to the NAS. The scope of the LRR infrastructure sustainment program includes upgrades and/or replacement of electrical, mechanical, lightning protection, fire detection, and facility security systems; buildings and structures; and facility access roads.

What benefits will be provided to the American public through this request and why is this program necessary?

Upon completion the infrastructure improvements will provide greater efficiency and reduce operating costs in En Route Air Traffic Control (ATC) and facility maintenance operations. Average Facility Condition Index of all 157 LRR facilities is currently at 83 percent which is below the minimum 90 percent required for such facilities. The goal of the LRR infrastructure sustainment program is to reach 90 percent FCI by 2025. Air Route Surveillance Radar (ARSR) equipment availability has continued in an upward trend (99 percent availability) as a direct result of the LRR Infrastructure Improvements made under this program and the American public benefits from reduced operating cost and system availability.

Detailed Justification for - 2A08 Voice Switch and Control System (VSCS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Voice Switch and Control System (VSCS)	$11,300	$12,800	$11,400

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Voice Switching and Control System (VSCS)	---	$11,400.0

What is this program and what does this funding level support?

Voice System and Control System (VSCS) and VSCS Training and Back-up System (VTABS) provide voice communication services to Air Traffic Controllers (ATCs) in the Air Route Traffic Control Centers (ARTCCs) throughout the National Airspace System (NAS). VSCS/VTABS allow the en route air traffic controllers to communicate with other Air Traffic Controllers, pilots, ground personnel and other locations while managing and directing air traffic. VSCS/VTABS will have to remain operational until the full deployment of the NextGen NAS Voice System (NVS), which is currently planned for 2025.

The VSCS technology refresh program sustains the operational availability and improves system reliability of VSCS/VTABS for both the current and future operations by replacing and upgrading obsolete components that are no longer supportable. The technology refresh program is required to ensure that the air-to-ground and ground-to-ground communications capabilities are reliable and available for separating aircraft, coordinating flight plans, and transferring information between air traffic control facilities in the En Route environment.

For FY 2019, $11,400,000 is requested for VSCS technology refresh activities including engineering analysis, logistics support analysis of Diminishing Manufacturing Sources and Material Shortages (DMSMS), storage array modernization and storage of equipment in support of FAA disaster recovery plan.

What benefits will be provided to the American public through this request and why is this program necessary?

The primary benefit of the VSCS program is cost avoidance by reducing obsolescence and maintaining availability. VSCS is an integral part of the FAA's air traffic control system. VSCS provides reliable access for many different ATC radios; the ability for ATC personnel to communicate with each other and coordinate work in the ARTCCs; and provides reliable and maintainable voice communications in the FAA's En Route ATC facilities.

Detailed Justification for - 2A09 Oceanic Automation System

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Oceanic Automation System	$24,000	$23,100	$17,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Advanced Technologies and Oceanic Procedures (ATOP) Technology Refresh	---	$9,500.0
B. Oceanic Service Enhancements	---	3,000.0
C. ATOP Enhancements	---	5,000.0

What is this program and what does this funding level support?

From 2005 to 2007, the ATOP program replaced the original oceanic air traffic control system, updated procedures, and modernized the Oakland, New York, and Anchorage Air Route Traffic Control Centers (ARTCCs), which house the oceanic automation systems. A support system was installed at the WJHTC. ATOP fully integrates flight and radar data processing, detects conflicts between aircraft, provides data link and surveillance capabilities, and automates the previous manual processes for oceanic air traffic control.

There are no viable alternatives in the near future (FY 2018 through 2028) other than the development of a new oceanic Air Traffic Control (ATC) system to replace the ATOP system. This would be both expensive and unnecessary since the current ATOP system with enhancements will be able to meet the future requirements of the FAA at considerably lower cost than a total system replacement.

A. ATOP Technology Refresh

The technology refresh of the ATOP system will provide compatible technology upgrades and replace the hardware at the three Oceanic Centers – New York (ZNY), Anchorage (ZAN) and Oakland (ZOA); the William J. Hughes Technical Center (WJHTC); and the labs at the prime contractor sites. The investment is a full system technology refresh that addresses issues of performance, software end of service, and data storage.

The ATOP Technology Refresh program will support maintaining the ATOP systems at the 99.7 percent availability or higher with the installation of refreshed equipment and an operating system starting in FY 2018. The ATOP technology refresh will be measured by ensuring the equipment is replaced on schedule in accordance with the program baseline and that the system replacement addresses the shortfalls listed below:

- Degraded system response times due to spike processing for system functions such as weather forecast updates and high traffic loads at New York Center (ZNY)
- Limited ability to process increased surveillance tracks from additional radar sources and Automatic Dependent Surveillance – Broadcast (ADS-B)
- Inability to store required amount of System Analysis and Recording (SAR), playback data, and security related events to meet required FAA standards/policy
- Lack of vendor support from IBM and Microsoft for obsolete operating systems (i.e., AIX 5.3 and Windows XP)
- Potential increased lifecycle costs to maintain proprietary system components

For FY 2019, $9,500,000 is requested to finalize and complete the hardware and operating system technology refresh deployment at the three Oceanic Centers – New York (ZNY), Anchorage (ZAN) and

Oakland (ZOA), and the second ATOP lab located at the WJHTC. The funding will also support development and delivery of the final technology refresh software build to support performance improvements to target 2028 system loads. The performance improvements are needed to support NextGen, Surveillance Broadcast Services (SBS), and other National Airspace System (NAS) improvements required in the oceanic domain.

B. Oceanic Service Enhancements

The Oceanic Service Enhancements support operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of oceanic domain services. The scope of these NAS enhancements is limited to operational changes that do not require significant capital investments. The identification, management, documentation, and overall governance of these NAS changes are coordinated with applicable stakeholders.

For FY 2019, $3,000,000 is requested for the Oceanic Service Enhancements. Supporting a category of requirements that address necessary and unplanned changes, these needs are the result of operational changes like deployment of new separation standards, and International Civil Aviation Organization (ICAO) mandates that are small in nature and must be addressed quickly. The funding will be directed for the operational analysis, engineering analysis, solution development, and solution implementation activities for ATOP system enhancements designed to improve the delivery of oceanic domain services.

C. ATOP Enhancements

The ATOP Enhancements program will provide necessary large-scale enhancements required to minimize the current systems operational shortfalls as the FAA moves forward with NextGen and other NAS upgrades. The initial investment for the ATOP Enhancements program, referred to as ATOP Work Package 1 (WP1), will address ATOP system shortfalls with enhancements currently being assessed and planned for implementation after a Final Investment Decision (FID) in the first quarter of FY 2019.

Current ATOP System Shortfalls:

- User interface and data processing limitations impacting controller coordination
- Lack of five nautical mile surveillance probe
- Lack of Air Traffic Services Inter-Facility Data Communications (AIDC) 3.0 support for coordination with international Air Navigation Service Providers (ANSPs)
- Lack of support for automatic re-probing of user requests
- Inability to access automated Special Activity Airspace (SAA) information
- Inability to access required external weather data

The program will address the continued evolution of the capabilities and services validated by the FAA's Oceanic/Offshore Standards and Procedures Group. The program will develop the following six planned enhancements:

- Enhanced Controller Coordination Interface
- Enhanced Conflict Probe in Surveillance Airspace
- Expanded Oceanic International Interfaces
- Approval of User Requests in Oceanic Airspace (Auto Re-Probe)
- Data Exchange via SWIM (New Services)
- Data Exchange via SWIM (Interface Rehost and Publish Services)

For FY 2019, $5,000,000 is requested for the ATOP Enhancements program to develop detailed requirements, complete design, and initiate coding for the initial subset of Enhanced Controller Coordination Interface and Enhanced Conflict Probe in Surveillance Airspace modifications to be deployed in FY 2021.

What benefits will be provided to the American public through this request and why is this program necessary?

A modernized Oceanic Automation System (OAS) will provide user benefits by improving stability and enhancing system performance to address traffic growth through 2028. This technology refresh will provide a foundation for new ATOP enhancements to be implemented that improve safety goals for the flying public by providing controllers with better coordination, conflict probe and surveillance tools. These new enhancements will also provide airlines and general aviation with reduced operating costs and system delays by delivering improved coordination and user request capabilities that support optimum flight profiles.

The technology refreshed OAS will also provide the FAA with improved performance and capacity to support integration of planned NAS and NextGen improvements. Replacing the current end-of-life operating systems and aging hardware with state-of-the-art components will reduce supportability risk and lifecycle support costs. Oceanic Service Enhancements will provide increased ATC efficiency and improved target levels of safety though the implementation of high priority ATOP functional enhancements that do not require significant capital investment. Improved communication and flight coordination through the ATOP Enhancements program will reduce controller workload, and enable controllers to provide more direct routings that will reduce fuel burn and carbon dioxide emissions.

Detailed Justification for - 2A10 Next Generation Very High Frequency Air/Ground Communications System (NEXCOM)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Next Generation Very High Frequency Air/Ground Communications System (NEXCOM)	$50,500	$54,000	$50,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
NextGen VHF/UHF A/G Comm System (NEXCOM) Segment 2 Phase 2	Various	$50,000.0

What is this program and what does this funding level support?

For FY 2019, the NEXCOM program is requesting $50,000,000 to replace and modernize the aging and obsolete National Airspace System (NAS) air-to-ground (A/G) analog radios that allow direct voice communication with pilots with new Very High Frequency (VHF) and Ultra High Frequency (UHF) radios at terminal and flight services facilities. The existing VHF analog controller-to-pilot communications system lacks the capacity and flexibility to accommodate future growth in air traffic. The continuous growth in air traffic and the introduction of new services has driven a proportional demand (approximately four percent per year) for air/ground communication frequency assignments. The system is beyond its estimated life-cycle and is increasingly expensive to maintain. Air/ground communication is the most fundamental and safety important element of the Air Traffic Control (ATC) system supporting all phases of flight for En Route, Terminal, and Flight Service operational environments.

In FY 2019, the NEXCOM program plans to use funding to deploy 3,000 new Terminal Air Traffic Control Radios (receivers and transmitters) at 140 terminal and flight services facilities, purchase VHF and UHF radios, procure 125 Emergency Transceivers, and fund related implementation and support activities. Segment 1a of the NEXCOM program finished replacing 25,000 en route radios in 1,200 En Route facilities in FY 2013. Ultimately 35,000 VHF and UHF radios will be deployed in the NAS under the NEXCOM Segment 2 program through 2026. Segment 2 is separated into two phases; Phase 1 was approved by the JRC in 2011; Phase 2 is scheduled for a Final Investment Decision in third quarter of quarter of FY 2017.

NEXCOM will meet the new and growing demands for air transportation services; provide the operational flexibility and Voice over Internet Protocol (VoIP) capability required for NextGen, utilize VHF spectrum required for voice communications more efficiently and have the ability to make recovered spectrum available for Data Communications should it be necessary.

What benefits will be provided to the American public through this request and why is this program necessary?

NEXCOM will improve reliability by reducing the number of unplanned outages by replacing existing communications equipment with modern Air to Ground Communications (A/G Comm) equipment. In addition, it will reduce the growth of maintenance costs by replacing A/G Comm equipment. An added performance benefit is the ability to increase capacity by expanding the number of communications channels within the spectrum assigned to the FAA. The Mean Time Between Failure performance metric, which is closely related to availability, will be increased from 11,000 hours to 50,000 hours at the

completion of NEXCOM Segment 2. This will both increase the safety of the NAS benefitting commercial airlines, general aviation and the flying public as well as reducing costs to taxpayers.

Detailed Justification for - 2A11 System-Wide Information Management (SWIM)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
System-Wide Information Management (SWIM)	$43,800	$50,050	$58,807

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. SWIM Segment 2B	---	$26,200.0
B. SWIM Segment 2C	---	12,000.0
C. Common Support Services-Weather (CSS-Wx)	---	16,700.0
D. Independent Operational Assessment (IOA)	---	400.0
E. Continued Maintenance For One Additional Year	---	3,507.0

What is this program and what does this funding level support?

The SWIM program is an information management and data sharing system for Next Generation Air Transportation System (NextGen). SWIM provides policies and standards to support data management, secure data integrity, and control data access and use.

A. SWIM Segment 2B

SWIM Segment 2B received the Joint Resource Council (JRC) Final Investment Decision (FID) approval in October 2015. SWIM Segment 2B continues to improve the FAA's ability to manage the efficient flow of information through the National Airspace System (NAS). Segment 2B includes additional capabilities to strengthen the overall security of NAS information systems and SWIM is using the NAS Integrated Systems Engineering Framework (ISEF) version 3.2 to specify SWIM capabilities and responsibilities consistent with an enterprise-level functional architecture. NAS Common Reference (NCR) will develop efficient Net-Centric Operations (NCO) for ATM situational awareness, geospatial awareness, data correlation, and support services. NAS enterprise Identity and Access Management (IAM) capability will enable the interoperability of security controls with NextGen partners. Swim Terminal Data Distribution Service (STDDS) is a NAS-EA Support Services system that has the capability to support various mission services in the terminal mission services area. Enterprise Service Monitoring (ESM) will provide situational awareness of Operations and Maintenance (O&M) status of NAS infrastructure and System Oriented Architecture (SOA) services, including service outages. For FY 2019, $26,200,000 Segment 2B funding is requested to:

- Complete STDDS Phase 2 Release 4 Initial Operational Capability
- Complete NCR Operational Testing at WJHTC
- Complete ESM Phase 3 Development Testing

B. SWIM Segment 2C

SWIM Segment 2C plans to continue improving the FAA's ability to manage the efficient flow of information through the NAS. Segment 2C's plan includes additional infrastructure and capabilities to strengthen the overall NAS information system security posture, and a tech refresh of existing hardware to improve performance capabilities on the hardware side resulting in better overall system performance. For FY 2019, $12,000,000 Segment 2C funding is requested to:

- Complete eight Internal DEX Messaging Nodes (DMNs) technology refresh

- Complete Internal DMNs and Internal DEX Access Nodes (DANs) technology refresh at SWIM Prototype Facility (SPF) and Research and Development (R&D) Domain
- Complete NAS Enterprise Security Gateway (NESG) DANs technology refresh

C. Common Support Services-Weather (CSS-Wx)

CSS-Wx will be the FAA's common support services capability for weather and establish an aviation weather publishing capability for the NAS. It will enable universal access and the standardization of weather information for dissemination to users by SWIM. CSS-Wx will filter weather information by location and time. Consumers of the information published by CSS-Wx will include air traffic controllers, traffic managers, commercial aviation, general aviation, and the flying public. CSS-Wx will be the FAA's single provider of aviation weather data, consolidating several legacy weather dissemination systems, and will provide weather information for integration into NextGen enhanced decision support tools (DSTs). CSS-Wx will also be scalable to facilitate the addition of new users and new systems. The CSS-Wx system is scheduled to achieve Initial Operating Capability (IOC) in FY 2019.

The CSS-Wx System will make improved weather products provided by the NextGen Weather Processor (NWP), the National Oceanic and Atmospheric Administration's (NOAA) NextGen IT Web Services, and other weather sources, available to FAA and NAS users for input into collaborative decision-making. A Final Investment Decision (FID) occurred on March 18, 2015 and a Prime Contract was awarded in April 2015. The CSS-Wx program is now in the FAA's Solution Implementation Phase.

CSS-Wx will resolve the issue of multiple interfaces, inflexible and inefficient information data management, unique data types and point-to-point information exchange. Implementation of this capability will provide cost savings, improvement of capacity, efficiency and safety in adverse weather. For 2019, $16,700,000 is requested for CSS-Wx WP1. Funding will be used to:

- Complete CSS-Wx WP1 Operational Testing (OT) (APB Milestone)
- Complete work towards achieving CSS-Wx WP1 Key Sites Initial Operational Capability (IOC) (APB Milestone)
- Complete work towards achieving CSS-Wx WP1 In-Service Decision (APB Milestone)

D. Independent Operational Assessment (IOA)

$400,000 is required to support IOA activities.

E. Maintenance

$3,507,000 to continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

What benefits will be provided to the American public through this request and why is this program necessary?

SWIM provides benefits to the FAA by reducing costs while providing better service in the following areas:

- Change system interfaces to support network messaging, reducing the cost of testing and maintaining each individual interface (currently a major cost driver and resource load for NAS systems)
- Provide the flexibility to provide information to new systems and locations without adding custom interfaces; this will significantly reduce the marginal cost of adding new system interfaces
- Provide common interfaces that facilitate spontaneously adding new users and applications for purposes of continuity of operations
- Enable the decommissioning of legacy weather data dissemination systems, which will reduce the rising operations and maintenance costs
- Develop/implement open international standards to format and exchange digital weather data to ensure harmonization and ease of future enhancement and implementation. The FAA is also leading the world with EUROCONTROL in developing the Weather Exchange Model (WXXM), which is the emerging

worldwide standard for the exchange of weather data. The goal is to provide access to weather data tailored to each user's needs. This enables access by all decision support tools. External consumers such as Airline Operations Centers will also be able to access the weather information in the new formats

SWIM reduces both the number and types of unique communication interfaces, reduces redundancy of information and better facilitates information-sharing, improves predictability and operational decision-making, and reduces cost of service. The improved coordination that SWIM provides allows for the transition from tactical conflict management of air traffic to strategic trajectory-based operations. SWIM provides the foundation for greatly enhanced information exchange and sharing with other agencies.

Detailed Justification for - 2A12 ADS-B NAS Wide Implementation

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
ADS-B NAS Wide Implementation	$154,800	$139,150	$123,748

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. ADS-B NAS Wide Implementation - Baseline Svc/App (Service Volume)	---	$116,600.0
B. ADS-B Sustain/Relocate (Gulf of Mexico Platform)	---	2,000.0
C. Independent Operational Assessment (IOA)	---	100.0
D. Continued Maintenance For One Additional Year	---	5,048.0

What is this program and what does this funding level support?

Automatic Dependent Surveillance-Broadcast (ADS-B) is a cornerstone technology for NextGen. It reduces delays and enhances safety by using an aircraft's broadcasted, instead of position information from traditional radar. ADS-B is an advanced surveillance technology that provides highly accurate and more comprehensive information. Aircraft position (longitude, latitude, altitude, and time) is determined using the Global Navigation Satellite System (GNSS), and/or an internal navigational reference system, or other navigation aids. The aircraft's ADS-B equipment processes this position information along with other flight parameters for a periodic broadcast transmission, typically once a second, to airborne and ground-based ADS-B receivers. The information is used to display aircraft position on En Route and Terminal Automation Systems.

The Gulf of Mexico (GOM) implementation of Air Traffic Control (ATC) services provides ADS-B surveillance data for aircraft operating in a large area without access to traditional radar coverage. Energy platforms in the GOM are utilized by the program to host surveillance, communications and weather facilities. These platforms have a temporary lifespan that are impacted by a number of economic and technical criteria. The shutdown of a platform requires that existing facilities be removed and replacement facilities installed on platforms that address any operational shortfall.

ADS-B has interdependencies with the following Programs:

- Airport Surface Surveillance Capability (ASSC)
- Advance Technologies and Oceanic Procedures (ATOP)
- En Route Automation Modernization (ERAM)
- Standard Terminal Automation Replacement System (STARS)
- Airport Surface Detection Equipment (ASDE-X)
- Time Based Flow Management (TBFM)
- Separation Management Portfolio Runway Status Lights (RWSL)

A. ADS-B NAS Wide Implementation - Baseline Services and Applications

For FY 2019, $116,600,000 is requested to provide for the continued implementation of the following baseline applications:

- ADS-B Separation Services

- Traffic Information Services - Broadcast (TIS-B), Flight Information Service - Broadcast (FIS-B), and Automated Dependent Surveillance Rebroadcast (ADS-R) Broadcast Pilot Advisory Services
- Traffic Situation Awareness with Alerts
- Airport Surface Traffic Situation Awareness
- Enhanced Visual Approach to support merging and spacing with Cockpit Display of Traffic Information (CDTI) Assisted Visual Separation (CAVS)
- Weather and NAS Situation Awareness

The funding will also allow for the continued implementation of Airport Surface Surveillance Capability (ASSC), a surface multilateration system that will receive inputs from cooperative and non-cooperative sensors. Additionally, continued operation of Wide Area Multilateration (WAM) surveillance services capability will occur. WAM provides aircraft location information to the automation system at Denver Air Route Traffic Control Center and Charlotte TRACON. This funding will also continue ADS-B Baseline Services, utilizing subscription fees for ADS-B infrastructure owned and operated by the prime contractor.

The anticipated FY 2019 accomplishments for ADS-B Baseline Applications include:

- Achieve Initial Operating Capability (IOC) of Terminal ATC Separation Services at 18 sites (154 cumulative)
- Complete IOC at four ASSC sites (seven cumulative)

B. ADS-B Sustain/Relocate (Gulf of Mexico Platform)

For FY 2019, $2,000,000 is requested to support the continuation of FAA Air Traffic Control services as agreed upon in the Memorandum of Agreement with the Gulf of Mexico helicopter operators and energy platform owners.

Specifically, the funding will be used to:

- Remove and refurbish facilities and equipment from active energy platforms when MOA partner energy platform owners make the decision to shut them down.
- Identify and evaluate an appropriate site to restore any lost services.
- Install equipment in new facilities on other strategically located MOA partner energy platforms.

C. Independent Operational Assessment (IOA)

For FY 2019, $100,000 is requested to support IOA activities.

D. Maintenance

Continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

What benefits will be provided to the American public through this request and why is this program necessary?

Benefits provided by ADS-B to the American public include more efficient use of airspace capacity, fewer flight delays, and more optimal routing for aircraft. Other efficiency benefits include reduced weather deviations and fewer cancellations resulting from increased access to some Alaskan regions and GOM oil platforms during inclement weather conditions. These efficiencies translate to savings in both aircraft direct operating costs and passenger value of time.

ADS-B meets a large performance gap in the capability of pilots and ATC to receive situational awareness information, thus providing for safety in ways legacy systems cannot by delivering services through cockpit avionics:

- Enhanced see-and-avoid capabilities which will assist pilots in preventing mid-air collisions

- Air Traffic Control services in non-radar airspace
- Weather information, helping to reduce incidences related to Instrument Flight Rule operations

Detailed Justification for - 2A13 Collaborative Air Traffic Management (CATM) Technologies

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Collaborative Air Traffic Management (CATM)	$13,820	$9,000	$17,700

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
CATMT Work Package 4	---	$17,700.0

What is this program and what does this funding level support?

CATMT Work Package 4 (WP4) will be the next enhancement package providing NextGen Midterm Traffic Flow Management (TFM)/CATM capabilities after receiving the Final Investment Decision (FID) in June 2017. Capabilities under analysis for CATMT WP4 include:

- Improving Demand Predictions (IDP) - Enhancements aimed at improving the Traffic Flow Management System (TFMS) predictions of demand for National Airspace System (NAS) resources; this will help reduce unnecessary delays
- Integrated Departure Route Planner (IDRP) - Provides strategic/tactical forecast of departure route and fix status affected by convective weather and volume for specific terminals; provides traffic managers with semi-automated resolution algorithm to solve departure constraints
- Traffic Flow Management System (TFMS) ingestion of Weather Data – TFMS will replace the legacy Corridor Integrated Weather System (CIWS) Data Distribution System (CDDS) prototype with the new System Wide Information System (SWIM) Common Support Services Weather (CSS-Wx) service

For FY 2019, $17,700,000 is requested to allow CATMT WP4 to:

- Complete Detailed Design Review and begin software development for the IDP capability
- Begin system engineering of TFMS Ingestion of Weather Data utilizing the Weather Information Exchange Model (WXXM)
- Begin system engineering for the IDRP capability

What benefits will be provided to the American public through this request and why is this program necessary?

The requested funding will allow CATMT WP4 to reduce erroneous alerts presented to En Route Supervisors and improve accuracy of demand predictions which yields better traffic management decisions. CATM WP4 will improve the overall availability and reliability of the TFMS tools by integrating data for departure management and making data readily available to traffic management unit users.

Detailed Justification for - 2A14 Time Based Flow Management (TBFM) Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Time Based Flow Management (TBFM) Portfolio	$50,600	$40,450	$21,150

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. TBFM – Work Package 3 (WP3)	---	$19,800.0
B. TBFM – Technology Refresh	---	1,000.0
C. Independent Operational Assessment (IOA)	---	350.0

What is this program and what does this funding level support?

The TBFM portfolio includes technology refresh and TBFM WP3 initiatives that support the National Airspace System (NAS). The capabilities enhance system efficiency by leveraging the TBFM decision-support tool, a system that is already deployed to all Continental United States (CONUS) Air Route Traffic Control Center (ARTCCs), Terminal Radar Approach Control (TRACON) facilities and Air Traffic Control Towers. Evaluating and maturing these concepts and capabilities include validation activities and demonstration and integration of operational capabilities. Improvements in TBFM's core Time-Based Metering (TBM) capability, an expansion of TBFM and its departure capabilities to additional locations will enhance efficiency and optimize demand and capacity.

The following two capabilities are the core of WP3 effort:

- Terminal Sequencing and Spacing (TSAS), which will provide efficient sequencing and runway assignment by extending time based metering to the runway
- Expansion of Integrated Departure/Arrival Capability (IDAC) to additional locations, which will increase efficiency of departure operations

For FY 2019, $21,150,000 is requested for the TBFM Portfolio to continue its efforts with the installation and deployment of the TBFM concepts which include TBFM WP3, TBFM Tech Refresh, and TBFM IOA task areas.

A. TBFM WP3 will use the $19,800,000 to:

- Complete IDAC deployments initiated in WP3 in FY 2018 to support the Performance Based Navigation (PBN) initiative; this includes the last IDAC deployment which is an Acquisition Program Baseline (APB) milestone.
- Complete the integration and test of TSAS at William J. Hughes Tech Center (WJHTC) and deploy TSAS to the first site in FY 2019 which are APB milestones.

B. TBFM Technology Refresh will use the $1,000,000 to:

- In FY 2018, it is anticipated that this program will complete all documents needed and achieve an Investment Analysis Readiness Decision (IARD). In FY 2019, the TBFM technology refresh will use the $1,000,000 to complete the documentation required for reaching a Final Investment Decision (FID); Final Requirements, Safety, EOSH, Implementation Strategy and Planning Document, APB, and Concept of Operations (ConOps).

C. TBFM IOA will use $350,000 to:

- For $350,000, the Independent Safety Assessment Team will conduct Independent Operational Assessments (IOAs) of designated systems or solutions before they are deployed throughout the NAS. For each IOA, a team of subject matter experts conduct a structured, system-level assessment of a system or solution in an operational environment. The team identifies safety hazards and operational concerns. The TBFM IOA will be conducted for TBFM Work Package 3 (WP3) in FY 2019.

What benefits will be provided to the American public through this request and why is this program necessary?

TBFM WP3 capabilities will enable an increase in arrivals and departures in areas where demand for runway capacity is high as well as areas in close proximity to airports with potential interference to airspace/approach. TBFM will also increase efficiency by allowing aircraft to fly PBN operations down to approach. The public will experience fewer delays, reduced carbon emissions, and less airport noise as the result of this TBFM WP3 Implementation.

TBFM technology refresh benefits will reduce maintenance costs of the existing hardware and continue sustainment of the TBFM system. It will ensure Operational Availability of 99.5 percent at the TBFM sites.

Detailed Justification for - 2A15 Next Generation Weather Processor (NWP) Work Package 1 (WP1)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Next Generation Weather Processor (NWP) (WP1)	$27,800	$35,450	$24,650

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Next Generation Weather Processor (NWP) Work Package 1	---	$24,300.0
B. Independent Operational Assessment (IOA)	---	350.0

What is this program and what does this funding level support?

The objective of the NWP program is to establish a common weather processing platform that will functionally replace the legacy FAA weather processor systems and host new capabilities. NWP Work Package 1 (WP1) uses data from the FAA and National Oceanic and Atmospheric Administration (NOAA) radar and sensors, and NOAA forecast models. NWP WP1 includes sophisticated algorithms to create aviation-specific current and predicted weather information. NWP WP1 creates enhanced weather products that will be available via the Common Support Services-Weather (CSS-Wx) system. It will perform the weather translation necessary to enable the use of weather information by automated decision-support tools (DSTs). NWP WP1 will also provide improved aviation safety related windshear and microburst products. Collectively these features will reduce operations and maintenance costs by consolidating the systems listed below which are funded under separate Budget Line Items (BLIs).

- Corridor Integrated Weather System (CIWS): Provides 0 - 2-hour aviation weather information to the Traffic Flow Management System (TFMS) and associated users
- Weather and Radar Processor (WARP): Provides weather information to en route air traffic controllers, supervisors, traffic management coordinators, and Center Weather Service Unit meteorologists
- Integrated Terminal Weather System (ITWS), which is funded under 2B19: Provides weather information to terminal air traffic supervisors and controllers

Air Traffic Management (ATM) and flight operations rely on weather information for decision making. Current aviation weather processing infrastructure and capabilities are inadequate and do not meet the real-time needs of Air Traffic Management (ATM) DSTs, operational decision-makers. Existing aviation weather products lack the spatial resolution and the timeliness necessary to assess the impact of weather phenomena on air traffic. Current legacy processing systems are built on closed architectural systems that are not compatible with one another. Legacy weather system infrastructure is limited and unable to ingest and process observation, forecast, and modeling data to create high-quality weather products with a longer time horizon then currently available.

For 2019, $24,650,000 is requested to continue development for the NWP WP1, complete Factory Acceptance Test (FAT), conduct System Testing and procure NWP WP1 Key Site equipment.

What benefits will be provided to the American public through this request and why is this program necessary?

The American public benefits from reduced airline operating costs (e.g. fuel) and passenger delays through NWP's delivery of aviation-relevant weather products that meet the needs of users and decision-support tools. Users will be able to identify the best routes to fly based on aircraft type, flight plan and flying preferences, using optimized weather observations, improved predictions, and translation of weather information into airspace constraints. Improved weather products will enable Traffic flow management to plan operations that optimize airspace capacity and reduce passenger delays. Additionally, the production of advanced aviation specific weather information improves safety for the American public.

Detailed Justification for - 2A16 Airborne Collision Avoidance System X (ACAS X)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Airborne Collision Avoidance System X (ACAS X)	$8,900	$7,700	$7,700

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Airborne Collision Avoidance System X (ACAS X)	---	$7,700.0

What is this program and what does this funding level support?

ACAS X is being developed to meet future collision avoidance requirements. The program will replace the existing Traffic Alert and Collision Avoidance Systems II (TCAS II) that is required in the U.S. airspace for all commercial aircraft with 30 or more seats and on all cargo aircrafts greater than 33,000 pounds. ACAS X will reduce the number of nuisance Resolution Advisories (RA) in U.S. airspace and better support future operations.

The ACAS X system will address shortfalls in the legacy TCAS II system. First, the system architecture will be designed so that threat detection and resolution logic changes can be made quickly using an automated process, which will be useful for future adaptations to Next Generation Air Transportation System (NextGen) operations. Second, ACAS X will have enough flexibility to be able to accommodate a variety of sensor types, including new generations of sensors where necessary. Third, ACAS X will reduce the number of "nuisance alerts" while simultaneously providing a reduced probability of near mid-air collision. The ACAS X systems have three variants in active development:

- ACAS Xa: Will use active interrogations and replies in concert with passive reception of ADS-B information to perform surveillance; ACAS Xa is the variant of ACAS X most similar to TCAS II in its form and function
- ACAS Xo: For use with NextGen operations where other variants of ACAS X would generate unacceptably high rates of RAs if used; an example of such an operation would be Closely-Spaced Parallel Operations (CSPO)
- ACAS Xu: For use with UAS, it is a complete Detect and Avoid (DAA) solution and designed to facilitate the integration of UAS into civil airspace by maintaining or improving current safety while meeting International Civil Aviation Organization (ICAO) requirements for global interoperability

For FY 2019, $7,700,000 is requested to support post Minimum Operational Performance Standards (MOPS) activities. The program office will update and publish Standards and Recommended Practices (SARPS) as well as initiate ground work for Technical Standard Order (TSO) and Advisory Circular (AC) documentation scheduled for FY 2020. Subject matter experts for the ACAS X program will continue their support with system development and maturity in areas of verification/validation efforts, safety, operational performance, requirements analysis, and participation in the RTCA SC-147 groups to align with the output goals.

What benefits will be provided to the American public through this request and why is this program necessary?

ACAS X will create fewer false warnings of potential midair collisions providing better performance than existing TCAS II logic. This improvement will promote the high level of aviation safety that is critical in terminal air traffic areas. Benefits include an increase in trust for ACAS X, reduction in workload for pilot and

Air Traffic Control, faster and less expensive implementation of updates to ACAS X in the field, conducting operations under Instrument Meteorological Conditions (IMC) and increased flexibility to modify airspace more frequently.

Detailed Justification for - 2A17 Data Communications in Support of NextGen

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Data Communications in Support of NextGen	$232,000	$178,100	$113,850

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Segment 1 Phase 2 (S1P2) Initial En Route Service	---	$89,900.0
B. Segment 1 Phase 1, Segment 1Phase 2 Data Comm Integrated	---	23,600.0
C. Independent Operational Assessment (IOA)	---	350.0

What is this program and what does this funding level support?

The Data Communications (Data Comm) program will provide data communications between Air Traffic Control (ATC) facilities and aircraft and will serve as an enabler for the NextGen operational improvements. Data Comm Segment 1 will deliver the initial set of Data Comm services integrated with automation support tools, which provides NAS benefits and lays the foundation for a data-driven NAS.

Data Comm is needed to bridge the gap between current voice-only ATC and the data-intensive NextGen. Data Comm will enable air traffic controller efficiency improvements and will permit capacity growth without requisite cost growth associated with equipment and maintenance. Data Comm is comprised of automation enhancements for ATC message generation and exchange (hardware and software) and the communications data link between ground and airborne users. Current analog voice communications contribute to operational errors due to miscommunications, stolen clearances, and delayed messages due to frequency congestion. In FY 2004 and FY 2005, approximately 20 percent of En Route operational errors were voice communication related and, 30 percent of the high severity En Route operational errors were deemed to be communications related. The results of this study were independently reconfirmed in July 2009 and again in 2017. Data Comm will significantly reduce communications related operational errors and improve the safety of air travel. Segment 1 will lay the foundation for a data-driven NAS.

The capacity and productivity of the NAS will be improved by Data Comm. Initially, Data Comm will be used in conjunction with the current traffic control strategies as well as planned strategies such as traffic flow management (TFM) re-routes. Data Comm will increase controller efficiency by automating routine exchanges. As controllers become more productive, tower and En Route capacity will grow without the need to assign additional resources. This increase in traffic handling ability has a direct correlation to reduced delays and increased efficiency. Recent benefits analysis suggests airline operations will benefit from reduced gate delay and taxi times, improved on-time performance and the opportunity to expand flight schedules. The busiest airport clearance delivery positions at Core 30 airports will see the most dramatic benefit.

Data Comm services will improve operations in the following manner:

- Improve flight efficiency due to improved controller and flight crew efficiency by providing automated information exchange
- Improve rerouting capabilities
- Provide more efficient routes for aircraft
- Decrease congestion on voice channels and provide an alternative communications capability

- Improve NAS capacity and reduced delays associated with congestion and weather
- Improve communication accuracy and safety with digital communication (i.e., reduced read/hear back errors, reduced loss of communications events)
- Reduce environmental impact due to less fuel burn and emissions
- Direct operating cost savings from increased throughput realized through reduced delays and improved communications

For FY 2019, $113,850,000 is requested for the Data Comm program. This funding supports the deployment of Segment 1 Phase 2 (S1P2) Initial En Route Services and funding for the network service.

The requested funding for S1P2 Initial En Route Services is intended to support RTCA Task Force 5 Recommendations 16, 17, 39, 44, and 42, as well as the September 2013 NextGen Advisory Committee (NAC) prioritization report, and the October 2014 NAC NextGen Integration Working Group (NIWG) Activity Prioritization report, and the 2016 NAC NIWG Rolling Plan.

A. Segment 1 Phase 2 (S1P2) Initial En Route Services

For FY 2019, Data Comm is requesting $89,900,000 for S1P2 Initial En Route Services, of which funding will be used to complete the operational evaluation, keysite implementation, keysite testing, keysite training and activities needed to achieve Initial Operating Capability (IOC) for Data Comm S1P2 Initial Services at keysites. The funding will also enable the start of testing, implementation and training at non-keysite ARTCCs. The funding will go towards ERAM prime vendor support of keysite testing and training and fixing any software issues found during testing. The funding will also pay for the continued ordering and installation of the Data Comm Air-to-Ground Network throughout the En Route domain.

Funding is also needed for program management, program control, operations and contract management support as well as second-level engineering test support. S1P2 Initial En Route Services milestones include:

- Complete developmental testing and evaluation (APB Milestone) - FY 2018
- Deliver ERAM software for system-level test and evaluation – FY 2018
- Order DCNS service volume for S1P2 Initial En Route service key site (APB Milestone) – FY 2018
- Complete Operational Evaluation – FY 2019
- Achieve First Site IOC for En Route Services (APB Milestone) – FY 2019

B. Segment 1 Phase 1 (S1P1) and Segment 1 Phase 2 (S1P2) DCIS Network Services

Data Comm is requesting $23,600,000 in FY 2019 for network services. This funding will provide the Very High Frequency (VHF) Data Link (VDL) Mode 2 air ground network service that provides connectivity between the controllers and the cockpit. Costs for the DCIS network service that are covered in other activities are being transitioned to this activity. The DCIS network services also include operations and maintenance, monitoring and control, and certification suite activities. This Data Communications Network Service supports both surface and en route operations.

C. Independent Operational Assessment (IOA)

$350,000 is for Independent Operational Assessment (IOA).

What benefits will be provided to the American public through this request and why is this program necessary?

Data Comm will reduce operational errors associated with communications, enhancing the safety and efficiency of the NAS. Data Comm will also reduce environmental impact due to less fuel burn and emissions. The program will improve NAS capacity and reduce delays resulting in estimated passenger value of time (PVT) savings of $11.3 billion for Tower and Initial En Route Services over the program life cycle.

Detailed Justification for - 2A18 Offshore Automation

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Offshore Automation	$3,000	$11,000	$14,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Offshore Automation	---	$14,000.0

What is this program and what does this funding level support?

Offshore Automation is the planned replacement and standardization of air traffic management (ATM) systems at the FAA's four offshore facilities (Anchorage ARTCC, Honolulu Control Facility, Guam CERAP, and San Juan CERAP). By replacing the existing legacy automation and flight data processing systems, these facilities will align with the NAS baseline of en route and terminal systems. This will provide greater workforce efficiency and flexibility as well as enable these facilities to adopt NextGen technologies and capabilities faster to deliver benefits to the flying public.

For FY 2019, $14,000,000 is requested to begin procurement, testing, and integration of the replacement ATM system for Anchorage ARTCC, AK. Pending a Final Investment Decision in 2018, the funding will be used to:

- Continue development of software baseline for Anchorage system
- Install test system at WJHTC laboratory to begin development test activities
- Begin development test activities for baseline system modules
- Continue engineering review for additional offshore site implementations

What benefits will be provided to the American public through this request and why is this program necessary?

Offshore Automation will migrate the ATM automation and flight data processing systems to the NAS baseline deployed in the CONUS. This will align the workforce to a single training, operations and maintenance baseline that ensures greater flexibility and efficiency. The implementation of NAS baseline software will also provide the offshore facilities faster deployment and adoption of NextGen technologies and benefits such as Data Communications and Performance Based Navigation. Automation tools in the newer systems allow for greater efficiency in airspace coordination with other providers as well as collaborative tools for users to negotiate route changes and operations with ATC.

Detailed Justification for - 2A19 En Route Service Improvements

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
En Route Service Improvements	$0	$3,000	$1,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
En Route Service Improvements	---	$1,000.0

What is this program and what does this funding level support?

This program supports a category of requirements that address necessary and unplanned changes in the en route domain. These sudden needs are the result of operational changes in the field, unanticipated changes from external organizations (e.g. International Civil Aviation Organization (ICAO), third party data providers, neighboring Air Navigation Service Providers (ANSP) or potential cost-savings initiatives. For FY 2019, $1,000,000 is requested for operational analysis, engineering analysis, solution development, and solution implementation activities to improve the delivery of en route domain services.

The scope of The En Route Improvements is limited to operational changes that do not require significant capital investments or involve significant systems complexity, interdependencies, and NAS operational changes. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an ATO domain service enhancement Standard Operating Procedure (SOP) and coordinated with applicable stakeholders.

This funding will be used to improve the presentation, access, and use of ERAM and other systems data by air traffic controllers and managers, resulting in more efficient, safer, and cost-effective delivery of en route services. These small but critical enhancements are identified by current operations, and support FAA and/or International Civil Aviation Organization (ICAO) changes.

What benefits will be provided to the American public through this request and why is this program necessary?

This program will provide increased Air Traffic Management (ATM) efficiency, improved target levels of safety, and enhanced productivity through the implementation of high priority en route functional enhancements. Improved interaction between the human and the systems, and increasing the accuracy and use of flight data will directly enhance the timeliness and fidelity of controller decisions. This will ultimately improve delivery of services. Advancing the interoperability between systems and facilities decreases manual coordination which directly enhances workforce productivity.

Detailed Justification for - 2A20 Commercial Space Integration

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Commercial Space Integration	$0	$4,500	$7,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Commercial Space Integration into the NAS	---	$7,000.0

What is this program and what does this funding level support?

The Commercial Space Integration into the NAS program will automate the FAA's ability to monitor and respond to launch and reentry operations in NAS through the acquisition and development of a Space Data Integrator (SDI). The SDI is a new integration capability that will automate the current manual process and is the first step towards integrating commercial space in the NAS. As the commercial space industry continues to grow, many of the planned missions will include new technologies that have never been undertaken such as reusable rockets, presenting an unprecedented level of complexity. Planning and execution challenges are making it increasingly difficult for the FAA to manage the growing volume of operations in the NAS without significant disruptions to both space and air operators. During a commercial space launch or reentry, the Commercial Space Transportation Organization (AST) and the Air Traffic Organization (ATO) rely on rudimentary tools such as pencil and paper, to monitor, manage, and respond to off-nominal events. Interfaces for the ingest of space vehicle data into existing NAS systems do not exist, so a small team transfers data across tools and networks verbally and on paper, enters the data by hand, completing multiple checks to minimize the potential for error.

AST, in collaboration with NextGen, ATO System Operations, and Mission Support, developed an SDI prototype that enables a "reduce, respond, release" approach to safely minimizing the effects of these operations on NAS efficiency and capacity without impeding industry progress. The prototype demonstrates the benefits of an integration system but is limited in capability. SDI will enable the FAA to safely reduce the amount of airspace that must be closed to other users, respond to off-nominal scenarios and during normal operations, and release airspace that is no longer at risk as the mission progresses. The program is currently planning for a Final Investment Decision (FID) in early FY 2019. For FY 2019, $7,000,000 is requested for a contract award to begin the design and development of a Space Data Integrator capability that will allow the FAA to keep pace with the growing industry.

What benefits will be provided to the American public through this request and why is this program necessary?

Commercial Space Integration into the NAS provides safety, flight efficiency, and cost saving benefits by enhancing the current level of safety through automating resource intensive processes and reducing the potential for human error during launch and reentry operations. It will allow NAS performance and capacity to keep pace with current and future demand, reducing delays and reroutes while increasing launch and reentry opportunities for each space flight. Additional benefits include the development of airspace management processes and procedures for transition from special operations to routine operations.

Detailed Justification for - 2B01 Terminal Doppler Weather Radar (TDWR) – Provide

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Doppler Weather Radar (TDWR) – Provide	$5,000	$3,800	$4,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Terminal Doppler Weather Radar (TDWR) – Provide	---	$4,500.0

What is this program and what does this funding level support?

The TDWR is a Doppler weather radar system used by Air Traffic Controllers (ATC) to increase the safety of the National Airspace System (NAS). TDWRs provide vital information and warnings regarding hazardous wind shear conditions to air traffic controllers managing arriving and departing flights in the terminal area. The current system is facing serious obsolescence issues and must be updated to preclude an adverse, potentially disastrous, impact to the current aviation weather safety initiatives.

The TDWR system has been in service since 1994. It is comprised of a substantial number of proprietary software and hardware components, many of which have become obsolete and present significant supportability problems that worsen with time. Without the Service Life Extension Program (SLEP), TDWR outages will become more numerous and lengthy, and support costs will continue to quickly rise.

This SLEP will address TDWR systems that have deteriorated due to aging, and have become obsolete or unsupportable. For FY 2019, $4,500,000 is requested for sustainment projects as follows:

- Antenna Servo Controller Replacement
- Direct Digital Controller Replacement
- Wind Shear Display Replacement
- Transmitter Microwave Assembly Replacement
- Grounding System Refurbishment

What benefits will be provided to the American public through this request and why is this program necessary?

Operational benefits of the system include the real-time detection of microbursts, gust fronts, wind shifts, and precipitation, as well as prediction of wind changes that allow improved airfield efficiency when making runway changes. In addition, weather-related delays have been reduced, allowing savings in aviation fuel consumption. The program will continue to deploy improvements that will lower TDWR operations costs and improve its reliability. Thus far, the SLEP has eliminated outages due to antenna gear failure and maintained service availability by replacing parts of the system that are difficult to maintain and support.

FAA has an agreement with the NWS to provide TDWR data. This information is further distributed to non-governmental organizations and companies such as Weather Underground (http://www.wunderground.com). This provides easy access by the public and other interested parties to TDWR information over the Internet.

Detailed Justification for - 2B02 Standard Terminal Automation Replacement System (STARS) (TAMR Phase 1)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Standard Terminal Automation Replacement System (STARS) (TAMT Phase 1)	$64,200	$86,700	$66,900

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Task	Locations/ Quantity	Estimated Cost ($000)
A. STARS Technology Refresh	9	$51,900.0
B. STARS Sustainment/Technology Refresh 2 Planning Engineering	---	15,000.0

What is this program and what does this funding level support?

A. Standard Terminal Automation Replacement System (STARS) Technology Refresh

For FY 2019, $51,900,000 is requested for the continuation of STARS technology refresh and software enhancements.

The STARS program is a joint Department of Defense (DoD) and Department of Transportation (DOT) FAA program to modernize terminal air traffic control automation systems. STARS is a digital processing and display system that replaces aging air traffic control equipment at FAA Terminal Radar Approach Control (TRACON) and Airport Traffic Control Tower (ATCT) facilities. Air traffic controllers use STARS automation and display systems to ensure the safe separation of both military and civilian aircraft within the nation's airspace.

TAMR Phase 1 is the technology refreshment of the STARS automated radar processing and display systems at 48 TRACONs and their associated ATCTs. The technology refresh provides hardware updates including new high-resolution Liquid Crystal Display (LCD) color displays, processors, storage devices and enhanced memory. The program also provides a software update with the hardware technology refresh to support NextGen initiatives and to maintain, correct, or improve system performance, efficiency, safety, and security vulnerabilities.

With this FY 2019 funding, the FAA plans to:

- Deliver Equipment at eight sites.
- Replace STARS G1 (SUN Ultra 5) processors with G4 processors.
- Deliver new functionality and upgrades to enhance performance and capacity in support of NextGen initiatives.
- Provide continuous data recording and improve safety and restorative analysis of operational incidents and system failures for critical end-of-life components, such as the system recording devices (Redundant Array of Independent Disks - RAIDS).
- Install processors and flat panel displays at the following: Pensacola, Rochester, Memphis, Boise, Des Moines, Norfolk, Lubbock and Corpus Christi.
- Complete Initial Operating Capability (IOC) at nine sites (41 of 48 sites, 85 percent) inclusive of IOC at the 39th site (APB Milestone).

The STARS program has overall system availability (software/hardware) of 99.9993 percent at all operational sites (Source: Web NAS Performance Analysis System). This program will modernize STARS equipment to allow it to continue to operate at this high level of availability. STARS uses Commercial-Off-The-Shelf (COTS) components that have a life expectancy of 10 to 15 years. Current STARS equipment has been in the NAS since 1999 and is in need of equipment upgrades. The STARS technology refresh effort will promote increased safety by providing an automation system with improved security features.

B. Standard Terminal Automation Replacement System (STARS) - Sustainment/Technology Refresh 2 Planning Engineering

For FY 2019, $15,000,000 is requested to fund STARS Technology Refresh Phase 2. This funding will provide engineering that will enable the FAA to replace key elements of STARS that have reached their end-of-life (EOL) and are no longer compatible with current commercial offerings. Two significant engineering activities include engineering required to upgrade the present Solaris Operating System that reaches EOL in FY 2018 and the end of vendor support in FY 2021, and qualifying the X3000 Processor/Digital Recording Device replacement. Technology Refresh of five STARS G1/G2 Local Integrated Tower Equipment (LITE) systems with new STARS G4 remote tower equipment will also be included.

With this FY 2019 funding, the program will:

- Complete STARS design study for compliance to FAA-G-2100 and FAA-STD-019
- Complete STARS consolidation study of documents required for FAA Second Level Engineering
- Deploy STARS to Sites 1 and 2 (Technology Refresh of G1/G2 LITE systems)

What benefits will be provided to the American public through this request and why is this program necessary?

STARS is a fully digital system that is capable of tracking all aircraft within the defined terminal airspace using available FAA and DoD surveillance or with system upgrades to global positioning satellite reports. It provides functions equivalent to or better than those accomplished by the existing terminal automation systems along with enhanced security. It is designed to incorporate new functionality more quickly and easily. STARS infrastructure can be expanded and extended to meet increased traffic demands and accommodate the introduction of new automation functions necessary for improved safety, efficiency, and capacity.

Detailed Justification for - 2B03 Terminal Automation Modernization/Replacement Program (TAMR Phase 3)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Automation Modernization/Replacement Program (TAMR Phase 3)	$108,900	$66,100	$9,012

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. TAMR/Replacement Program (TAMR Phase 3)	7	$8,000.0
B. Continued Maintenance For One Additional Year	---	1,012.0

What is this program and what does this funding level support?

For FY 2019, $9,012,000 is requested to employ a three-phased approach to modernizing the air traffic control systems that controllers use to control traffic approaching or leaving the nation's major airports. The first phase of the program, Terminal Automation Modernization and Replacement (TAMR) Phase 1, replaced the automated radar processing and display systems at Terminal Radar Approach Control (TRACON) facilities and their associated air traffic control towers. Phase 1 deployed the Standard Terminal Automation Replacement System (STARS) to 48 sites. TAMR Phase 2 replaced automation systems at five additional TRACONs and modernized air traffic controller displays and system processors at four large TRACONs including Denver and Chicago. The final phase of the program, Phase 3, will address the remaining 108 sites; 11 sites under Segment 1 and 97 sites under Segment 2.

TAMR Phase 3 Segment 2 will replace 91 Automated Radar Terminal System IIE systems at TRACONs and their associated Airport Traffic Control Towers (ATCTs), and six ARTS IE systems (stand-alone ATCT display systems) with STARS hardware, software, and displays. This Segment will deploy a scaled STARS system, known as STARS Enhanced Local Integrated Tower Equipment (ELITE) to the ARTS IIE facilities; and remote tower equipment to the ARTS IE facilities. The STARS automation system is a fully digital system capable of tracking all aircraft within the defined terminal airspace using available FAA and U.S. Department of Defense (DoD) surveillance systems.

In FY 2019, $9,012,000 is requested to:

- Deliver four additional operational systems. (Prior year funds)
- Achieve Initial Operational Capability (IOC) at seven sites (97 of 97, 100 percent).
- Complete IOC at last site, 91st (ARTS IIE). (Acquisition Program Baseline (APB) Milestone)
- Complete Operational Readiness Decision (ORD) at last site (Automated Radar Terminal System (ARTS IIE)). (APB Milestone)
- Complete ORD at last site (ARTS IE). (APB Milestone)
- Continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

The TAMR P3S2 program will replace 91 ARTS IIEs and associated Airport Traffic Control towers with STARS ELITE systems and six ARTS IEs with STARS Remote Towers and enable the convergence to a single Terminal Automation hardware and software platform by the end of FY 2019.

What benefits will be provided to the American public through this request and why is this program necessary?

The quantitative benefits include avoiding costs to maintain aging equipment, lifecycle benefits of common displays and processors, and common hardware for re-use and expansions. The FAA considers the existing ARTS hardware equipment beyond useful life and expensive to support. The ARTS processors and displays will not accommodate Automatic Dependent Surveillance-Broadcast (ADS-B) data input, are obsolete (end of life), and unavailable for purchase. The ARTS single sensor analog system will not accommodate ADS-B data input. STARS will enable ADS-B information to be used for surveillance applications and Air Traffic Services' displays in the terminal environment and will also complete the migration to a common terminal automation platform which will reduce development and support costs (over costs associated with dual platforms and a technologically old platform).

Replacing the current ARTS system with STARS will improve current critical terminal automation system performance parameters, including maximum number of unique tracked aircraft, displays, surveillance sensors, number of flight plans, and full service availability requirements.

The benefits to the public are expected to enhance controller's situational awareness, discerning weather and lessening risk through efficiency and commonality.

Detailed Justification for - 2B04 Terminal Automation Program

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Automation Program	$7,700	$8,493	$8,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Flight Data Input/Output (FDIO) Replacement	---	$2,000.0
B. Standard Terminal Automation Replacement System (STARS) Enhancement 2	---	5,000.0
C. Terminal Domain Service Enhancements	---	1,500.0

What is this program and what does this funding level support?

A. Flight Data Input/Output (FDIO) Replacement

The FDIO system provides standardized flight plan data, weather information, safety related data, and Wake Re-Categorization to air traffic controllers located at approximately 690 remote sites. This information assists controllers in tracking aircraft, providing departure clearances, and anticipating the arrival of aircrafts in the sector under their control. The FDIO Replacement program replaces end-of-life (EOL)/obsolete FDIO equipment with fully compatible commercial off the shelf (COTS) and modified COTS equipment. The program is based on a five-year replacement cycle for the various components in order to maintain system operational availability.

For FY 2019, $2,000,000 is requested to continue the procurement of hardware and software, to fund program management support, to procure and install replacement FDIO system components at Federal Aviation Administration (FAA) and Department of Defense (DOD) Air Traffic Control (ATC) facilities, and all related logistics. Replacement components consist of thermal printers, FDIO-Gateway equipment, Ethernet switches and related software updates that may be needed. Procurement and implementation of these items will decrease the maintenance costs of the system and ensure the FDIO system remains operational and able to adhere to the latest technology changes and security requirements.

FDIO is becoming a critical Flight Data interface component for several Terminal systems that require more modern interfaces. In addition to replacing components, this project will support a common Internet Protocol infrastructure to support future ERAM, NextGen architectures, and the Terminal Flight Data Manager System (TFDM).

B. STARS Enhancement 2

For FY 2019, $5,000,000 is requested to build upon previous investments to complete the investment and analysis and begin development. Standard Terminal Automation Replacement System (STARS) Enhancement 2 is the next useful segment for the Standard Terminal Automation Replacement System (STARS) platform by consolidating terminal automation onto a single platform as envisioned by NextGen. STARS Enhancement 2 will implement the capabilities necessary to enable trajectory-based operations in the terminal environment and identify and address outstanding operational needs.

The Terminal Radar Approach Control (TRACON) domain provides a key opportunity for increased efficiency and improved air traffic control operations as envisioned by the FAA's Strategic goals and NextGen plans. The current TRACON domain service is hindered during periods of adverse weather events and increased

traffic. Today's air traffic control and traffic management decision support tools have significant limitations in the efficient transfer of flight information and constraint information to other systems, facilities, certified professional controllers, pilots, and airport operators. The TRACON automation capabilities must evolve to support the mid-term concepts for NextGen.

STARS Enhancement 2 is the first of multiple work packages that contribute to TRACON evolution. The program will refine proposed concepts and validate them as viable additions to the NAS to support NextGen goals. Concept engineering activities include analysis, evaluation, and assessments to develop and mature concepts for changes to TRACON automation as well as identifying the associated procedure changes. STARS Enhancement 2 implements capabilities in the following areas:

- Separation assistance for the TRACON radar controller working arrivals, departures and overflights. Improved merging and separation management and conflict alerting for complex routes and separation requirements will be added.
- Information availability for the TRACON radar controller who frequently needs to coordinate flight status, control information manually, and communicate by voice with other controllers in the same facility or other facilities.

The program office will develop the investment documentation and requirements documents in support of a Final Investment Decision (FID) for STARS Enhancement 2. The program office supports the investment activities by providing system engineering and requirements analysis. The FID is planned for FY 2019, followed by contract award in third quarter of FY 2019.

C. Terminal Domain Service Enhancements

This program supports a category of requirements that address necessary and unplanned changes to various systems in the Terminal domain. These sudden needs are the result of operational changes in the field, unanticipated changes from external organizations (e.g. International Civil Aviation Organization (ICAO), third part data providers, neighboring ANSPs) or potential cost-savings initiatives. The funding request for FY 2019 is $1,500,000. The funds will be directed for the operational analysis, engineering analysis, solution development, and solution implementation activities to improve the delivery of terminal domain services.

The scope of these NAS enhancements is limited to operational changes that do not require significant capital investments or involve significant systems complexity, interdependencies, and NAS operational changes. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an ATO Standard Operating Procedure and coordinated with applicable stakeholders.

This funding will be used to improve the presentation, access, and use of STARS and other systems data by air traffic controllers and managers, resulting in more efficient, safer, and cost-effective delivery of terminal services. This program will conduct operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of terminal domain services. These small but critical enhancements are identified by current operations, and support FAA and/or ICAO changes.

What benefits will be provided to the American public through this request and why is this program necessary?

The projects under the Terminal Automation Program reduce the operating costs associated with maintaining aging hardware and software. The replacement of aging components also extends the service life of the systems and ensures the systems remain viable and operational components of the National Airspace System. In addition, these projects ensure smarter and more efficient security measures that better protect the FAA systems that operate in the Air Traffic Control environment. These outcomes benefit taxpayers and the flying public.

Detailed Justification for - 2B05 Terminal Air Traffic Control Facilities – Replace

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Air Traffic Control Facilities – Replace	$58,800	$58,118	$19,200

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Terminal Air Traffic Control Facilities – Replace	---	$19,200.0

What is this program and what does this funding level support?

Terminal Air Traffic Control Facilities–Replace is one of the programs included in the Air Traffic Control (ATC) Facilities Sustainment Strategic Plan (SSP). Funding the programs in this strategy will improve and maintain the facility condition index (FCI) ratings at FAA facilities that provide the backbone for the National Airspace System (NAS). The FAA is seeking funding for design starts at three sites, and the purchase of long-lead equipment and utility installation at one site.

The FAA provides air traffic control services from more than 500 Air Traffic Control Towers (ATCT) and Terminal Radar Approach Control (TRACON) facilities. Under this program, the FAA evaluates which buildings need to be replaced, sustained, or modernized (especially relative to other facilities across the country) to ensure an acceptable level of building conditions and to meet current and future operational requirements. The average age of ATCTs in the FAA portfolio is 33 years, and the average age of a TRACON is 26 years. There are facilities that are 65 years old. In some cases, ATCTs and TRACONs built 20 years ago do not meet today's Occupational Safety and Health Administration, operational, and building requirements. The facilities also may not have been built to meet today's technological needs and, while some facilities can be modernized or sustained, replacement may be the most efficient method for the FAA to meet operational needs and conform to current building codes and design standards.

The ATCT and TRACON replacements are large capital investments. Given constrained resources, the FAA is focusing on risk-based analyses to ensure that those facilities in greatest need are replaced first. The FAA has a prioritized listing of all NAS terminal sites and conducts ongoing studies that determine if and when the FAA needs to replace an ATCT due to its siting, size, and physical conditions. From that list, the FAA then initiates siting and design studies and ultimately, construction of the facilities with the greatest need.

Segment 1 funding in the amount of $8,500,000 is requested in FY 2019 to support advance requirements definition and program management costs for planning and overseeing the program. Activities supported under Segment 1 include the evaluation of unique operational and maintenance requirements that impact ATCT/TRACON facilities, the development of business cases, mock-ups of the Airport Facilities Terminal Integration Laboratory (AFTIL) to assist with the evaluation of the attributes of proposed airport sites, actual site selection, and other advance engineering considerations.

Segment 2 funding, which encompasses the design phase of an ATCT/TRACON replacement project, is requested in the amount of $5,400,000 in FY 2019 for three sites. The design starts are scheduled for Greenville/Spartanburg, SC (GSP) at $1,800,000; Anchorage, AK (ANC) at $1,800,000, and Grand Forks, ND (GSK) at $1,800,000.
Segment 5 funding in the amount of $5,300,000 is requested in FY 2019 for one facility. This segment funds the disposition, demolishment, and decommissioning of the facility that has been replaced. The facility included in this request is Charlotte, NC (CLT).

What benefits will be provided to the American public through this request and why is this program necessary?

The benefits provided by the Terminal Air Traffic Control Facilities – Replace program include:

- Eliminating line-of-sight issues, thus increasing efficiency and safety
- Providing adequate space for all approved operational and support positions to enhance efficiency at the ATCT/TRACON
- Providing adequate space and infrastructure for new modern equipment and systems to facilitate the transition to NextGen
- Reducing the high cost of maintaining old and outdated buildings
- Increasing the overall FCI of terminal facilities by providing new buildings that meet current codes

These benefits are instrumental in providing efficiency and effectiveness, which in turn will produce cost savings for taxpayers.

Detailed Justification for - 2B06 ATCT/Terminal Radar Approach Control (TRACON) Facilities - Improve

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
ATCT/Terminal Radar Approach Control (TRACON) Facilities – Improve	$47,720	$61,800	$95,850

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. ATCT/TRACON Modernization	---	$83,400.0
B. Facilities Realignment Implementation	---	10,000.0
C. In-Service Engineering	---	2,450.0

What is this program and what does this funding level support?

ATCT/TRACON Terminal Facilities Improvement is one of the programs included in the FAA's Air Traffic Control (ATC) Facilities Sustainment Strategic Plan. For FY 2019, $95,850,000 is requested for the following:

A. ATCT/TRACON Modernization - $83,400,000 is requested to initiate modifications, improvements, sustainment and repairs to Airport Traffic Control Tower (ATCT)/TRACON facilities, to include New York TRACON (N90) and Portland TRACON (P80). Funding will also support system engineering activities, configuration management, facility planning, facility condition assessments and program support services.

The ATCT/TRACON Terminal Facilities Improvement program includes projects that will enable facilities to maintain current operational, environmental, and safety needs in lieu of replacing or relocating the entire facility. This effort will result in a smooth and orderly transition of new equipment into the FAA's terminal facilities. It will also improve the operational efficiency and environment of equipment within ATCT/TRACON facilities. The upgrades and improvements to terminal facilities support the National Airspace System (NAS) modernization strategy to achieve efficient aerospace systems and operations.

Facility improvements must incorporate new requirements for relocated or replaced equipment with minimal impact to existing operations. The power and heating, ventilation, and air conditioning (HVAC) systems at many terminal facilities must be upgraded to handle both the new and old equipment during the in-service change-out. A successful transition of improvement projects is vital in many towers. There is no room for additional equipment. Therefore, base buildings must be temporarily expanded.

The program funds an average of 50 sustainment projects each year. Sustainment is defined as activities to continue the NAS/terminal service mission critical capability by modifying, repairing, replacing, and reconfiguring. Routine and ongoing maintenance activities are not funded from this program. The sustainment projects include many sites throughout the NAS and will consist of efforts such as mechanical, electrical, elevators and plumbing.

B. Facility Realignment Implementation - $10,000,000 is requested for conducting transition planning, initiating and completing facility modifications, installing necessary equipment, supporting realignment-related training, and preparing workforce, facilities, and equipment for the transition. This project will fund the implementation of realignment recommendations submitted by the FAA Administrator to Congress.

C. In Service Engineering - Also requested is in-service engineering funding in the amount of $2,450,000 to promote the improvements and allow for immediate response and tactical distribution in response to emerging solutions.

What benefits will be provided to the American public through this request and why is this program necessary?

The benefits of the ATCT/TRACON Terminal Facilities Improve program are that repairs will be made to critical infrastructure that facilitates the movement of air traffic. These repairs will increase the overall Facility Condition Index (FCI) of those facilities and reduce the risk of air traffic control outages by providing safe, secure, resilient, and efficient buildings that meet modern codes. These improvements reduce the ongoing cost of operational maintenance at these facilities.

Facility realignments are expected to deliver cost savings, cost avoidance, and staffing and operational efficiencies upon implementation and may continue to accrue overtime.

Detailed Justification for - 2B07 Terminal Voice Switch Replacement (TVSR)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Voice Switch Replacement (TVSR)	$6,000	$6,000	$9,574

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Terminal Voice Switch Replacement (TVSR) II	---	$9,574.0

What is this program and what does this funding level support?

The ongoing Terminal Voice Switch Replacement (TVSR) program involves replacing the aging, obsolete voice switches in Air Traffic Control Tower (ATCT) and Terminal Radar Approach Control (TRACON) facilities. Terminal voice switches provide voice communication services to Air Traffic Controllers in the airport towers and TRACONs. This allows the terminal air traffic controllers to communicate with other Air Traffic Controllers, pilots, ground personnel and other locations while managing and directing air traffic.

The TVSR program ensures that controllers continue to have reliable voice communications in the terminal environment. The program consisted of several multiyear equipment contracts for voice switches, including: Small Tower Voice Switches (STVS), Enhanced Terminal Voice Switches (ETVS), Rapid Deployment Voice Switches (RDVS) model IIA, Voice Switch By-Pass System (VSBP), Interim Voice Switch Replacement (IVSR), and the Conference Control System (CCS-W) in the Air Traffic Control Command Center in Warrenton, VA. Of these contracts, IVSR is the only voice switch currently in production and is the only contract vehicle available to the FAA to procure voice switch equipment for new or modernized terminal facilities. Replaced voice switches are recovered for refurbishment or cannibalized for spare parts to restock the logistics depot to support sustainment efforts.

For FY 2019, $9,574,000 is requested to procure, test, deliver and install up to seven Terminal voice switch systems, refurbish and/or cannibalize associated legacy systems for spare parts, and to conduct technical refresh to mitigate supportability risk of Terminal legacy voice switches.

What benefits will be provided to the American public through this request and why is this program necessary?

TVSR provides voice switches to terminal facilities throughout the National Airspace System (NAS) and provides reliable voice communications in support of air traffic terminal operations. The reliability of communications from controller to controller and controllers and pilots is vital to a safe air traffic control system and promotes safety. The TVSR program reduces operational costs by reducing the current annual maintenance cost for legacy switches and promotes operational availability that reduces delays.

Detailed Justification for - 2B08 NAS Facilities Occupational Safety and Health Administration (OSHA) and Environmental Standards Compliance

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
NAS Facilities OSHA and Environmental Standards Compliance	$42,700	$46,700	$41,900

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
NAS Facilities OSHA and Environmental Standards Compliance	---	$41,900.0

What is this program and what does this funding level support?

The Air Traffic Organization (ATO) National Airspace System (NAS) Facilities Occupational Safety and Health Administration (OSHA) and Environmental Standards Compliance Program provide occupational safety and environmental risk management technical expertise to support compliance with applicable safety and environmental protection standards and mitigate identifiable hazards in the ATO workplace.

ATO acquisitions, installations, modifications, and operations must comply with a wide variety of safety and environmental protection standards governing areas ranging from fire and life safety for our facilities through the storage and disposition of hazardous wastes and materials.

The Environmental and Occupational Safety and Health (EOSH) Services provides safety and environmental protection and risk management support management expertise through the life cycle of ATO operations. EOSH professionals consult in the planning phases of retrofitted and new construction efforts to mitigate risks and even completely engineer out hazards at the earliest possible point. EOSH professionals devise, develop, and publish orders, policies, procedures, and practices that promote cultural risk management. EOSH professionals conduct job hazard analyses and facility inspections to identify actual and potential risks. Risk mitigation plans are developed and enacted. Risk mitigation methodologies range from educational opportunities focused on safety and environmental risks and how to apply risk awareness and mitigation techniques through modification of existing ATO assets.

The EOSH program performs data analyses to identify, track, and mitigate emerging or recurrent risk concerns. EOSH program risk management efforts:

- Protect employees and the environment
- Prevent damage and loss of FAA resources
- Promote a culture of safety and environmental responsibility

For FY 2019, $41,900,000 is requested to provide technical compliance expertise to address Federal, State, and local environmental and safety regulations and binding commitments.

- Employee Health/Industrial Hygiene
- Tower Fire Life Safety
- Environmental Compliance
- Occupational Safety
- Service Area Technical Implementation
- Arc Flash Hazard Analysis

Non-compliance with Federal, State, and local environmental, safety, health, legal, and other requirements imposes significant liabilities on the FAA in the form of personnel injury or loss, interruptions to National Airspace System (NAS) operations, violations of bargaining unit agreements, post-incident response actions (such as costly cleanups), and a decrease in employee morale. Failing to effectively manage safety and environmental risks also incurs short- and long-term financial impacts for the agency. Employee injuries directly impact not only the injured worker (lost time and productivity) but also require the cost and time commitments associated with first- and second-level responders, generate unplanned workload for post-incident investigatory and administrative personnel, and create personnel backfill requirements to achieve the continuing mission.

What benefits will be provided to the American public through this request and why is this program necessary?

The goal of these activities is to identify and reduce or eliminate occupational hazards and environmental liabilities present in FAA operations through a combination of compliance policies and procedures, continuous hazard identification and monitoring, targeted training, deployment of protective measures, and hazard abatement activities. Through these efforts, occupational safety and environmental risks are reduced, resulting in a safer, healthier workforce, reduced employee injuries and associated costs, a strong agency compliance posture, and reduced impacts to FAA operations. These efforts also put the FAA in compliance with several Federal and State compliance regulations.

Detailed Justification for – 2B09 Airport Surveillance Radar (ASR-9)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Airport Surveillance Radar (ASR-9)	$4,500	$11,400	$12,800

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. ASR-9 Service Life Extension Phase 3	---	$11,900.0
B. In Service Engineering	---	900.0

What is this program and what does this funding level support?

The ASR-9 SLEP Phase 3 program continues the phased strategy to extend the service life of the ASR-9 systems. The ASR-9 SLEP Phase 3 program will implement modifications to the ASR-9 system to sustain primary radar surveillance in terminal airspace. The ASR-9 uses hardware and software architectures that are becoming obsolete. Without modifications, the ASR-9 system will experience decreasing reliability, lowering availability and increasing supportability risks due to the limited commercial availability of some critical components. The ASR-9 was procured in the mid-1980s, fielded between 1989 and 1994, and is intended to remain operational through the 2035, well beyond the original 20-year lifecycle. The ASR-9 SLEP program ensures availability of critical terminal surveillance services until a replacement system is deployed.

The ASR-9 provides aircraft position and weather information to air traffic controllers. An accurate depiction of this information is a key element in reducing delays and improving safety at high activity airports. The ASR-9 tracks all aircraft within its range and provides those tracks, as well as, six-level weather intensity information to terminal automation systems so it can be displayed on the controller's screen. The ASR-9 also provides data to the Airport Movement Area Safety System (AMASS) and to the Airport Surface Detection Equipment model X (ASDE-X) to aid in the prevention of accidents resulting from runway incursions. The sustainment of the ASR-9 aligns with the NAS Enterprise Architecture Surveillance Roadmap, and the Surveillance and Broadcast Services (SBS) Automatic Dependent Surveillance Broadcast (ADS-B) backup strategy.

ASR-9 SLEP Phase 3 anticipates a Final Investment Decision (FID) in March 2018. The ASR-9 SLEP Phase 3 will mitigate issues of obsolescence, reliability and maintainability, and lifecycle costs for:

- ASR-9 Communications Infrastructure: Replace the legacy Racal Milgo Omnimode 96 Modems and the Analog to Digital (A/D) Converter Circuit Card Assembly (CCA)
- ASR-9 Control and Monitoring Infrastructure: Replace the legacy Modulator Pulse Assembly (MPA) Monitoring and Control CCA and the Maintenance Display Unit (MDU)
- ASR-9 Depot Replenishment: Replenish the FAA Logistics Center inventory spares of Clutter Map Memory (CMM) CCA, Receiver Protector, and Hardline Cables and Connectors

For FY 2019, $12,800,000 is requested: $11,900,000 for Phase 3 activities and $900,000 for In-Service Engineering activities to allow for immediate response to emerging technology solutions.

The FY 2019 funding for Phase 3 includes the following activities:

- Racal Milgo Omnimode 96 Modem Replacement: Continue Data Communications Equipment (DCE) procurement activities and site preparation for new communications lines
- Analog to Digital Converter CCA Replacement: Continue testing and begin site preparation and installation activities
- Modulator Pulse Assembly CCA Replacement: Complete prototype development and procure First Article
- Receiver Protector Replacement: Procure initial spares
- Clutter Map Memory CCA Replacement: Procure First Article
- Maintenance Display Unit Replacement: Begin software development and pre-production hardware procurement
- Hardline Cables and Connectors: Procure First Article and start development and system testing

What benefits will be provided to the American public through this request and why is this program necessary?

ASR-9 outages are a significant contributor to aircraft arrival and departure delays at major airports throughout the United States. The ASR-9 service life extension will increase equipment and service availability and reduce delays that cost airlines and the flying public money and time.

Detailed Justification for – 2B10 Terminal Digital Radar (ASR-11) Technology Refresh and Mobile Airport Surveillance Radar (MASR)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Digital Radar (ASR-11) Technology Refresh and Mobile Airport Surveillance Radar (MASR)	$6,100	$3,200	$1,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Terminal Digital Radar (ASR-11) Technology Refresh	---	$1,000.0

What is this program and what does this funding level support?

The ASR-11 Technology Refresh Segment 3 (TR3) program continues the phased strategy to extend the service life of the ASR-11 systems, providing terminal surveillance of aircraft in support of Federal Aviation Administration (FAA) and Department of Defense (DoD) air traffic control (ATC) operational needs. The ASR-11 was procured via Interagency Agreement with the Department of Defense (DOD) United States Air Force. The FAA procured 66 systems and fielded the last system in 2013. The ASR-11 is intended to remain operational through the 2035, well beyond the original 20-year lifecycle. The ASR-11 Technical Refresh programs ensure availability of critical terminal surveillance services until a replacement system is deployed.

ASR-11 TR3 will address parts obsolescence; diminishing manufacturing supply (DMS), operational performance deficiencies or other areas requiring technology refresh to ensure continued reliable and cost effective operation of ASR-11 systems. The program plans to procure form fit and function replacements and/or redesign replacements, as required.

ASR-11 TR3 Initial Acquisition Readiness Decision (IARD) is planned for September 2019 and the Final Investment Decision (FID) is planned for September 2020. For FY 2019, $1,000,000 is requested for ASR-11 TR3 investment analysis activities in support of IARD planned for September 2019.

What benefits will be provided to the American public through this request and why is this program necessary?

The ASR-11 Technology Refresh program ensures the continued safe and cost effective operation of terminal radar service for the flying public by addressing the most urgent obsolescence issues.

Detailed Justification for – 2B11 Runway Status Lights (RWSL)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Runway Status Lights (RWSL)	$4,800	$2,800	$2,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Runway Status Lights Technology Refresh	---	$2,000.0

What is this program and what does this funding level support?

RWSL integrates airport lighting equipment with approach and surface surveillance systems to provide a visual signal to pilots and vehicle operators indicating that it is unsafe to enter/cross or begin takeoff on the runway. The system is fully automated with inputs from surface and terminal surveillance systems that are processed through light control logic that commands in-pavement lights to illuminate red when there is traffic on or approaching the runway. There are 20 baseline production RWSL Airports:

- Fifteen are commissioned: Orlando (August 2013), Phoenix (March 2014), Houston (April 2014), Washington-Dulles (July 2013), Seattle (August 2014), Las Vegas (October 2014) Charlotte (March 2015), Ft. Lauderdale (May 2015), New York-LaGuardia (July 2015), Minneapolis (August 2015), Los Angeles (October 2015) Newark (April 2016), Detroit (April 2016), New York-Kennedy (June 2016) and Chicago 10L/28R Phase 1 (April 2017)
- Two have achieved Initial Operating Capability (IOC): San Francisco (November 2016) and Baltimore-Washington (March 2017) and will commission this fiscal year
- Two are under construction: Dallas/Ft. Worth and Boston Logan
- One will begin construction in November 2017: San Diego

The RWSL technology refresh program will address Information Systems Security (ISS) deficiencies as described in the RWSL ISS Plan of Action and Milestones (POA&M). In addition, the program will assess the need to upgrade and replace obsolete Commercial Off-the-Shelf (COTS) hardware and software to ensure the continued reliable and cost effective operation of the system through its designated lifecycle. The RWSL was procured in late 2008, fielded between 2009 and 2018, and is intended to remain operational until replacement begins in 2026. The program is on track for an Investment Analysis Readiness Decision (IARD) by the first quarter of FY 2019 and the Final Investment Decision (FID) by the first quarter of FY 2020.

For FY 2019, $2,000,000 is requested to proceed toward Final Investment Decision by FY 2020 and produce the necessary Investment Analysis (IA) artifacts.

What benefits will be provided to the American public through this request and why is this program necessary?

A top priority of the FAA is maintaining safety in the national airspace system. The safe and expeditious flow of air traffic at an airport is the product of a complex, disciplined interaction of people, aircraft, and vehicles, all supported by increasingly sophisticated processes, communications and control technologies, and regulatory oversight. Maintaining this safe flow of airport traffic defines the runway safety mission of the FAA.

Unfortunately, aircraft, vehicles and people may sometimes be inappropriately present on the protected area of a surface designated for the landing and take-off of aircraft. Such an occurrence is known as a runway incursion. Runway incursions can cause catastrophic accidents. RWSL is a system being deployed to provide alerts directly to pilots and vehicle operators that it is unsafe to enter a runway or to begin take-off. This has been a long standing National Transportation Safety Board recommendation.

Detailed Justification for - 2B12 National Airspace System Voice System (NVS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
National Airspace System Voice System (NVS)	$48,400	$68,750	$43,150

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Demonstration and Qualification	---	$26,800.0
B. Deployment	---	16,000.0
C. Independent Operational Assessment (IOA)	---	350.0

What is this program and what does this funding level support?

NVS is the next generation voice communication equipment that allows Air Traffic Controllers to talk to pilots, other controllers, ground personnel and other facilities while managing and directing air traffic. The NVS Program will replace all the voice switches currently installed at the Air Route Traffic Control Centers (ARTCCs) and a limited number of voice switches located at the large Terminal Radar Approach Control (TRACON) facilities and Airport Towers throughout the NAS. NVS will replace decades old voice switch equipment with a secure, digital Voice over Intranet Protocol technology. NVS will provide a nationwide capability for routing, monitoring, and sharing voice communication assets throughout the NAS and support NextGen features such as off-loading during non-peak operations.

The current switch technology continues to age and faces parts obsolescence and diminishing manufacturing sources; it is also limited by geography. NVS will provide flexible, scalable, and digital voice communications throughout the NAS. NVS will support current and future air traffic control operations as envisioned by both government and industry forecasters.

For FY 2019, $43,150,000 is requested for both the Qualification and Deployment segments under the NVS program. Under the Qualification segment, the FAA will continue NVS development, testing and installation activities in order to complete Key Site Operational Testing and Evaluation by May 2019 and achieve Initial Operating Capability at Key Site by September 2019. Under the Deployment segment, the FAA will implement necessary hardware and software updates and training revisions to ensure system deployability and supportability throughout the NAS. The FY 2019 request also includes $350,000 for Independent Operational Assessment (IOA) activities in support of the NAS.

What benefits will be provided to the American public through this request and why is this program necessary?

NVS will replace decades-old analog systems with secure, digital Voice over Intranet Protocol technology. Current voice switch equipment only allows controllers to speak to others within the range of their nearby radio site. NVS works over a secure FAA digital network and is not limited by geography. NVS is instrumental in supporting NextGen's objective to build a more dynamic, scalable, networked and fully digital aviation system.

- NVS is replacing custom/expensive legacy systems with scalable, enterprise-managed platform that reduces acquisition costs

- NVS is supporting reconfiguration of controller positions and facility alignment
- NVS will enable more capacity via efficient use of resources and services

Detailed Justification for - 2B13 Integrated Display System (IDS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Integrated Display System (IDS)	$7,700	$5,000	$19,459

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Enterprise Information Display System (E-IDS) Program	---	$18,000.0
B. Continued Maintenance For One Additional Year	---	1,459.0

What is this program and what does this funding level support?

The IDS legacy systems (particularly the IDS-4s) are facing part shortages and technology obsolescence that puts operational use at risk. The lack of repair parts has also put system sustainment at risk. The cost of maintenance support also increases as the equipment ages. Essential hardware components needed to support these systems and software (particularly the DOS-based software from IDS-4) are not available from the industry and proprietary software is no longer supported by the vendor.

The Enterprise Information Display System (E-IDS) Program will replace multiple programs responsible for sustaining seven different legacy IDS systems operating in Air Traffic Control (ATC) facilities. Deployment will extend beyond the Terminal domain, consisting of the Terminal Radar Approach Control (TRACONs) and the Airport Traffic Control Towers (ATCTs). It will also include the En Route domain, consisting of Air Route Traffic Control Centers (ARTCCs), the Combined Center/Radar Approach Control (CERAPs) domain and the Alaska Automated Flight Service Station (AFSSs). Finally, E-IDS will also provide an IDS system for the oceanic domain.

This enterprise system will collect data through System Wide Information Management (SWIM) and distribute the information for display to client users in all domains. By utilizing authorized information sources in conjunction with an enterprise infrastructure that shares the information, users will be assured common system operational awareness across all domains. E-IDS will reduce manual entry, facilitate interfacility coordination, and integrate information.

E-IDS will support contingency operations if a catastrophic event occurs by migrating and restoring position functionality to a different facility for the restoration of operations. The basis for this resiliency capability is the creation of a centralized enterprise database that stores the functions, data requirements, and presentation design that are unique to each specific position in the enterprise.

The E-IDS Program achieved a successful Investment Analysis Readiness Decision (IARD) in June 2016, and is currently in the Initial Investment Analysis (IIA) phase. An Initial Investment Decision (IID) is anticipated in the second quarter of FY 2018. Efforts during this phase include:

- Initial Requirements Development
- Alternative Analysis
- Cost Estimating
- Business Case Determination
- Market Surveys

FY 2019 funding will be needed to complete program management, systems engineering, tests, logistics, human factors, investment analysis and acquisition planning efforts required to achieve a successful Final

Investment Decision (FID) which is anticipated for second quarter of FY 2019. Funds will be placed on a new contract to a prime vendor to start system development and will be used to continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

E-IDS will align its acquisition with service delivery schedules of other FAA interfacing programs, including Aeronautical Information Management Modernization (AIMM), Common Support Services – Weather (CSS-Wx)/NextGen Weather Processor (NWP), and SWIM.

What benefits will be provided to the American public through this request and why is this program necessary?

E-IDS will:

- Enable interoperability among systems by establishing a service-oriented architecture (SWIM), along with defining standards for data exchange (AIXM, WXXM, FIXM).
- Increase the efficiency of data sharing throughout the NAS by consuming data from common sources, thus ensuring uniformity of data among facilities.
- Address common Human Factors across Air Traffic environments and users, as well as reduce training costs.
- Reduce the cost of maintaining disparate systems by requiring identical skill sets for hardware and software maintenance across Air Traffic environments.

Detailed Justification for - 2B14 Remote Monitoring and Logging System (RMLS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Remote Monitoring and Logging System (RMLS)	$9,900	$7,400	$18,100

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Automated Maintenance Management System (AMMS)	1	$5,000.0
B. Remote Monitoring and Logging System (RMLS) Technology Refresh	28	13,100.0

What is this program and what does this funding level support?

A. Automated Maintenance Management System (AMMS)

AMMS will deliver benefits through technology and infrastructure by interfacing dispersed maintenance system within the currently existing (SWIM) Service Oriented Architecture environment. System interfaces will be standardized, and governance will be applied to data exchanges. Data will be cleansed, and authoritative data sources will be documented. Data exchange services will be utilized to provide common services for maintenance systems, and enhanced, modernized maintenance tools will be implemented, as to promote more efficient maintenance practices.

For FY 2019, $5,000,000 is requested to support the System Engineering/Project Management activities currently underway. The components to be addressed utilizing this funding will be to; refine requirements definition, support the continued development of a data exchange standard, perform proof of concept activities for solution implementation of commercially available products, and initiate a proof of concept environment for program risk reduction.

The specific initiatives to be supported by this funding are as follows:

- $1,500,000 is required to perform requirements engineering and acquisition process activities to achieve the Final Investment Decision program milestones
- $1,500,000 is required to perform the continued development of a platform-independent maintenance data standard. This includes the following activities:
  - Integration of data exchange requirements for maintenance scheduling/coordination, flight check scheduling/coordination, and automated NOTAM generation/cancellation
  - Requirements defining and initial development of common data services
  - Integration and testing of common services within the AMMS proof of concept environment
- $2,000,000 is required to perform software engineering activities to complete development of the AMMS Proof of Concept environment. The Proof of Concept environment will be used for demonstrating technical risk reduction for the following:
  - Implementation of program requirements in the areas of:
    - The Maintenance Automation Tool (event coordination, scheduling, and maintenance logging)
    - System to System Interoperability - The integration of system interfaces via the System Wide Information Management (SWIM) infrastructure
  - Business Case analysis development
  - Integration of SWIM services
  - The exchange of data using a maintenance data standard
  - User acceptance of the Maintenance Automation Tool

B. Remote Monitoring and Logging System (RMLS) Technology Refresh (TR)

RMLS Technology Refresh will replace aging legacy RMLS core hardware components to accommodate National Airspace System (NAS) growth and ensure that the legacy Remote Maintenance and Monitoring (RMM) infrastructure supports the agency's storage, bandwidth, and security needs. This program is necessary because the hardware upgrade will allow the RMLS infrastructure to comply with the FAA's mandated security requirements.

For FY 2019, $13,100,000 is requested to perform the following for Remote Monitoring and Logging System (RMLS) Technology Refresh (TR):

- Procure and implement hardware for lab at William J. Hughes Technical Center (WJHTC) Integration Testing/Operational Testing (IT/OT)
- Procure hardware for implementation at WJHTC (OT2), National Operations Control Center (NOCC) for the Data Repository (DR/OPS), Oklahoma City (OKC Training), Southern California TRACON (SCT), Albuquerque ARTCC (ZAB), Anchorage ARTCC (ZAN), Boston ARTCC (ZBW), Chicago ARTCC (ZAU) Honolulu (ZHN), Salt Lake ARTCC (ZLC), Oakland ARTCC (ZOA), Denver ARTCC (ZDV), Washington ARTCC (ZDC), Fort Worth (ZFW), Houston (ZHU), Indianapolis (ZID), Jacksonville (ZJX), Kansas City (ZKC), Los Angeles (ZLA), Salt Lake City (ZLC), Miami (ZMA), Memphis (ZME), Minneapolis (ZMP), New York (ZNY), Oakland (ZOA), Cleveland (ZOB), Seattle (ZSE), Atlanta (ZTL)
- FAA and contractor support for program, management activities
- FAA and contractor support to acquire Remote Monitoring System Engineering Team (RMSET) Technical data
- Technical Documentation such as System Support Modifications (SSM), the RMLS Handbook and Technical Instruction Manuals will be modified as well to reflect the new equipment

What benefits will be provided to the American public through this request and why is this program necessary?

The Benefits to be derived from the Remote Monitoring and Logging System (RMLS) benefits the American Public by; cost savings and reduction in flight delays for the American Public and airline industry, streamlined maintenance practices, increased availability of equipment and services, and enhanced flight check scheduling for the restoration of NAS equipment and services. Also, increased safety by; proper certification of NAS equipment and services, more timely issuance/cancellation of Notices to Airmen (NOTAMs), increase situational awareness of maintenance data, promote more efficient maintenance practices, and reduce maintenance outages within the NAS.

Detailed Justification for – 2B15 Mode S Service Life Extension Program (SLEP)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Mode S Service Life Extension Program (SLEP)	$37,900	$20,900	$15,400

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Mode S Service Life Extension Program	---	$14,100.0
B. In Service Engineering	---	1,300.0

What is this program and what does this funding level support?

The Mode S system provides secondary aircraft surveillance in terminal and En Route airspace. Mode S uses selective beacon detection technology to provide target data as digital formatted messages and analog video tailored for automation and display systems. The Mode S is co-located with Airport Surveillance Radar Model 9 (ASR-9) and ASR-8, and Common Air Route Surveillance Radar (CARSR). The Mode S system and the co-located primary radars are capable of providing correlated radar and beacon reports to the National Airspace System (NAS) En Route and Terminal automation systems at Terminal Radar Approach Control (TRACON), Air Route Traffic Control Center (ARTCC) facilities, the U.S. Department of Defense (DoD), and other users.

Terminal Mode S systems support aircraft separation standards, reduces delays, and improves safety at congested airports. Currently, there are 148 operational Mode S radar systems in the NAS and have been in operation since 1989. The Mode S System has exceeded the expected 20-year life cycle. As the systems continue to age, sustainment has become more difficult because of obsolete parts and diminishing manufacturing sources and material shortages. These challenges have caused the operational availability of the Mode S systems to drop below the FAA Performance Metric 2 requirement of 99.7 percent. The sustainment of Mode S secondary radar systems is essential to sustaining the NAS as the Agency progresses to 2035 and begin development of Spectrum Efficient National Surveillance Radar (SENSR) in 2025.

FAA Logistic Center Mode S Radar Products Division conducted a Diminishing Manufacturing Sources and Material Shortages (DMSMS) Study in April 5, 2014. The study identified 11 critical Lowest Replaceable Units (LRUs) with major obsolescence issues, End of Service life, and Diminishing Manufacturing Sources. In addition to these LRUs, an additional 28 LRUs would require replacement or modification due to dependencies.

The FAA will transition to Automatic Dependent Surveillance – Broadcast (ADS-B) as the preferred means of surveillance on January 1, 2020. As part of the transition, the FAA defined a backup strategy to mitigate the potential loss of ADS-B during a Global Positioning System (GPS) interference or jamming event. The result of that study selected a reduced set of Mode S systems to provide this backup capability. These remaining Mode S systems included all En Route Mode S radars and a subset of approximately 42 Terminal Mode S radars. Currently, the number of radars to be part of the backup capability is being revalidated and should determine the number of Mode S systems as part of the SLEP.

A Final Investment Decision is currently planned for third quarter of FY 2018. The competitive procurement is anticipated to be awarded in fourth quarter of FY 2018.

For FY 2019, $14,100,000 is requested for site surveys; procure production units, key site installation, second level engineering, ATS Test and Evaluation (T&E) Services and program management. Also, $1,300,000 is requested for in-service engineering activities to allow for immediate response to emerging technology solutions.

The Mode S Programs interdependencies include providing beacon aircraft tracks to Standard Terminal Automation Replacement System (STARS), Enhanced En Route Automation Modernization (ERAM), and Advanced Technologies and Oceanic Procedures (ATOP) automation systems for processing and presentation to the air traffic controllers. Mode S provides the ASR-9 and CARSR with beacon target data for beacon correlation and primary beacon target merge processing to automation. Mode S also provides beacon surveillance data to Airport Surface Surveillance Capability (ASSC) and Airport Surface Detection Equipment Model X (ASDE-X) for the function of safety logic in the detection of runway incursions.

The Mode S system supports other Federal Agencies by providing correlated radar and beacon reports and weather map reports to NAS En Route and Terminal Automation, U.S. Department of Defense (DoD) and Department of Homeland Security (DHS) through the Defense Radar Program and to the Department of Treasury and National Weather Service (NWS) through separate agreements.

The expected outcomes that result from funding the program are:

- Extend the Service Life of the System Capability
- Decreased System Maintenance
- Reduced Outages
- Increase Equipment and Service Availability
- Decreased Operating Cost

What benefits will be provided to the American public through this request and why is this program necessary?

The extended service life of the Mode S system will reduce outages due to performance deterioration and parts obsolescence. Furthermore, the Mode S SLEP will increase equipment and service availability. The success of the program will be measured by analysis of Mode S outages attributable to system components affected by this modification, air traffic delays due to these outages, and related demand for spare parts.

SLEP Phase 3 will build upon previous successes by ensuring that proven Commercial-Off-The-Shelf (COTS) technologies are utilized to the fullest degree possible.

Detailed Justification for - 2B16 Terminal Flight Data Manager (TFDM)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Terminal Flight Data Manager (TFDM)	$42,200	$90,350	$119,250

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Terminal Flight Data Manager (TFDM)	---	$119,000.0
B. Independent Operational Assessment (IOA)	---	250.0

What is this program and what does this funding level support?

The Terminal Flight Data Manager (TFDM) program will deliver to tower Air Traffic Controllers (ATC) and FAA traffic managers NextGen decision support capabilities that integrate flight, surface surveillance, and traffic management information. TFDM will provide the equipment for the collection, distribution, and update of flight data information in the terminal area, and to improve access to information for the safe and efficient control of air traffic. TFDM decision support capabilities will promote safe and efficient airport operations in managing airport surface traffic sequencing and scheduling. TFDM will automate manual flight data processes to enable enhanced data sharing between the Tower, En Route, Approach Control, Traffic Flow Management (TFM) and Flight/Airline Operations Centers (FOC/AOC).

A key component of the TFDM system is the transition from paper flight strips to electronic flight data representation and exchange. This will facilitate enhanced flight data exchange between controllers within the tower, those in other ATC facilities, and those overseeing Traffic Flow Management Systems. This will also facilitate data exchange with aviation partners such as the airlines' flight operations centers and airport operators to support Collaborative Decision Making (CDM). Providing flight data in electronic format eliminates the necessity of the physical exchange of flight data, reduces telephone call volume between facilities and reduces the manual re-entry of data among multiple ATC systems. Air traffic controllers will have more heads up time, looking out the window, to focus on the surface traffic, therefore, increasing safety.

Another key component of the TFDM system is the introduction of a surface scheduler/metering capability.TFDM will provide the basis for efficient management of traffic flows on the surface at U.S. airports by transitioning the performance of airport surface operations from a "first come, first served" model to a more strategic model that allocates taxi clearances to minimize taxi distance and time, thus reducing fuel burn and CO2 emissions.

The Final Investment Decision was approved and the prime contract was also awarded in June 2016. The program's implementation plan is based on a two software build approach (Build 1 and Build 2) and deployment to 89 airports from FY 2020 to FY 2028. TFDM is currently in the system design phase and has completed the following key milestones:

- Build 1 System Requirements Review (SRR)
- Contractor Integrated Baseline Review (IBR)
- Early User Involvement Events (Air Traffic and Technical Operations)
- Program Level Integrated Baseline Review (IBR)
- Build 1 Critical Design Review (CDR)

TFDM will be integrated into the NAS and will have program interdependencies for data exchanges with numerous other systems. The costs associated with other system interfaces and modifications required to deliver TFDM capabilities is included in the TFDM cost baseline. In FY2018, TFDM will start incremental funding for the development of the modifications required for Flight Data Input Output (FDIO) System, Tower Data Link Service (TDLS), Remote Monitoring and Logging System (RMLS), and Traffic Flow Management System (TFMS) to support the TFDM implementation.

In FY 2019, $119,000,000 is requested for the continued System Development and Implementation of TFDM Build 1 and TFDM Build 2. The Prime Contract costs for FY 2019 will cover the completion of the Build 1 Formal System Acceptance Testing, support for the FAAs Operational Test (OT), and the completion of Build 1 Key Site Implementation. FY 2019 Prime Contractor costs continue for TFDM Build 2 with the Code Development, System Integration, and the start of Build 2 Formal System Test. Additionally, FY 2019 Prime Contractor costs cover the Hardware procurement for sites#2-12 and some of the early implementation activities for those sites. The remaining FY 2019 funds will provide the Program Management and Technical Support resources to support the Program Office and the Surface Operations Office. This funding will be used in the planning, oversight and management of the prime contractors' effort to develop the TFDM system, the Test resources required to oversee and witness the Formal System Test activities, conduct of the Operational Test (OT), and the further preparation for the implementation of the TFDM system.

Anticipated key milestones for FY 2019 are:

- Complete Build 1 Development Test (DT)
- Start Build 1 Operational Test (OT)
- Complete WJHTC Systems 1-5 Integration and Test
- Start Site Acceptance Test (SAT) Preparation and Conduct for WJHTC Systems 1-5
- Conduct FAA Academy Technical Operations (FAAAC TO) Systems Site Survey, Site Preparation and Design, and Integration and Test
- Conduct Site Acceptance Test for FAAAC TO Systems
- Conduct Production Acceptance Test (PAT) for FAAAC TSS Systems
- Complete Build 2 Early User Involvement Events (EUIEs)
- Start Build 2 Development Test (DT)
- Continue development of the modifications that will support TFDM implementation:
    - Flight Data Input Output (FDIO) System
    - Tower Data Link Service (TDLS)
    - Remote Monitoring and Logging System (RMLS)
    - Traffic Flow Management System (TFMS)

Also requested is $250,000 for IOA activities.

What benefits will be provided to the American public through this request and why is this program necessary?

This program focuses on gaining efficient flow and management of aircraft on the surface at selected metroplex airports and the complex terminal airspaces within the NAS. High density airports typically see higher demand for runway capacity, operate multiple runways, and have complex airspace and ground interactions in the arrival and departure phases of flight. The surface capabilities being implemented in this program are expected to improve both the efficiency of individual flights while optimizing runway throughput. This work will make travel safer for the traveling public, help reduce passenger delays leading to a better traveling experience, and contribute to less pollution.

TFDM will enhance airport capacity utilization during severe weather and other off-nominal conditions, improve usability, and situational awareness.

These benefits are derived through:

- **System consolidation and elimination of paper flight strips** - Consolidating Air Traffic Control Tower (ATCT) systems, panels, displays to reduce costs and allow more real estate in the tower and removing paper strips and supporting infrastructure to reduce costs.
- **Reduced accidents on the surface** - Providing electronic flight data to reduce accidents caused by controller miscommunication and overlooked flights.
- **Reduced fuel burn through Departure queue management** - Providing tools to improve pushback planning thereby shifting taxi delay from the taxi phase to the gate or non-movement area leading to reduced fuel burn and operating costs.
- **Increased opportunity for flight prioritization** - Improving coordination and data sharing between the Air Traffic Control (ATC) system and flight operators to give airlines more flexibility in prioritizing flights based on business needs; allows substitution during Surface Metering.
- **Improved off-time compliance related to controlled departure times** - Providing more accurate predictions of event and taxi times to allow better compliance with the current controlled departure times.
- **Increased opportunity to take Call for Release (CFR) delay at gate** - Improving coordination and data sharing between the ATC system and flight operators to shift CFR delay from the taxi phase to the gate
- **Improved runway load balancing (strategic)** - Providing strategic airport configuration and runway load tools in the ATCT to better coordinate runway use.
- **Improved runway load balancing (tactical)** - Providing tactical runway balancing tools in the ATCT to better coordinate runway use.

Detailed Justification for - 2B17 National Air Space (NAS) Voice Recorder Program (NVRP)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
NAS Voice Recorder Program (NVRP)	$2,000	$5,000	$14,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
National Air Space (NAS) Voice Recorder Program (NVRP)	---	$14,000.0

What is this program and what does this funding level support?

The NAS Voice Recorder Program (NVRP) will replace the legacy Digital Audio Legal Recorders (DALRs) and provide enhanced digital voice recording functionality to meet new requirements. The replacement of aging voice recorders will reduce operational costs and address the increasing demand for more expeditious audio access and capabilities such as increased recording capacity, recording of Voice Over Intranet Protocol (VoIP) telephones, connection to FAA Telecommunications Infrastructure (FTI)'s enterprise Network Time Protocol (NTP).

As the voice recorder technology and voice recorder requirements have evolved, earlier digital voice recorders are experiencing obsolescence and supportability issues. There are currently over 460 recorders in operation today which were deployed between 2007 and 2015; they began to reach their end of service life starting in 2017. Full implementation of this program will result in the replacement of the legacy voice recorders, Digital Audio Legal Recorders (DALRs) that do not meet current Safety Requirements. Additionally, it will decrease the risk of Diminishing Manufacturing Sources and Material Shortages (DMSMS) issues in order to maintain Operational Availability.

For FY 2019, $14,000,000 is requested to procure equipment for up to 18 operational sites and four support sites. It will also provide for the installation of the Operational Test and Evaluation system and Key Site system as well as system spares, depot level support and spares, training and design engineering activities for Application Programming Interface (API) software to enable remote access for retrieving recordings.

What benefits will be provided to the American public through this request and why is this program necessary?

NVRP supports the FAA's Strategic Initiative to Make Aviation Safer and Smarter through Risk-Based Decision Making. Voice recorders are used by the FAA for recording voice conversations between Air Traffic Controllers, pilots, and ground-based personnel. Recorded conversations are used in the investigation of accidents, incidents, and in the routine evaluation of air traffic operations. NVRP provides the FAA's Aviation Safety organization another source of safety data which support the FAA's initiative to better integrate safety risk into decision-making processes.

The primary FAA benefit is cost avoidance in the reduction of technical refresh costs associated with current voice recorder models to support obsolescence and supportability concerns.

Detailed Justification for - 2B18 Integrated Terminal Weather System (ITWS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Integrated Terminal Weather System (ITWS)	$1,000	$1,000	$2,100

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Integrated Terminal Weather System (ITWS)	Various	$2,100.0

What is this program and what does this funding level support?

The Integrated Terminal Weather System (ITWS) provides automated weather information for use by air traffic controllers, supervisors, pilots and airline dispatch. The ITWS integrates data and information from FAA and National Weather Service (NWS) sensors such as the Terminal Doppler Weather Radar (TDWR), the Next Generation Weather Radar (NEXRAD), Airport Surveillance Radar (ASR), Low Level Windshear Alert System (LLWAS), Automated Weather and Surface Observing Systems (AWOS/ASOS), lightning detection systems, NWS weather models and aircraft via the Meteorological Data Collection and Reporting System (MDCRS).

Automated weather products produced by the ITWS include essential safety, windshear and microburst detection and predictions, storm cell intensity and direction of motion, lightning information, detailed winds in the terminal area and a one-hour storm forecast. The graphical, full-color display provides an easy-to-use interface that does not require meteorological interpretation. ITWS weather information is available to air traffic managers, controllers and airlines via dedicated situation displays at FAA Air Traffic facilities, the web or an ITWS data feed. There are no other FAA weather programs that provide the type of airport-specific weather products that are generated by ITWS.

Interdependencies include NextGen Weather Processor (NWP) and Common Support Services – Weather (CSS-Wx). NWP and CSS-Wx are subsuming ITWS beginning in 2021. FY 2016 - FY 2018 funding enables the ITWS Program Office to port ITWS software to new hardware to sustain the system until it is replaced by NWP and CSS-Wx. For FY 2019, $2,100,000 is requested for software and hardware sustainment activities and this request allows the FAA to buy enough hardware to deploy the solution.

What benefits will be provided to the American public through this request and why is this program necessary?

The ITWS program supports terminal requirements. Program beneficiaries range from commercial aviation and general aviation to the flying public and the benefits to them are safety, flight efficiency and delay reduction. National Transportation Safety Board (NTSB) statistics indicate weather-related delays cost the aviation industry and the traveling public approximately $4.1 billion per year, of which $1.7 billion per year is considered avoidable. Through improved integration of weather data into timely, accurate aviation weather information, FAA can reduce delays and improve NAS capacity utilization while enhancing aviation safety. The ITWS sustainment will extend the life of the commissioned ITWS systems, preventing system outages to ensure these benefits and savings continue to be realized.

Detailed Justification for - 2B19 NextGen – Performance Based Navigation (PBN) and Metroplex Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Performance Based Navigation (PBN) and Metroplex Portfolio	$20,000	$20,000	$20,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. NextGen Performance Base Navigation (PBN) Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP)	5	$15,000.0
B. NextGen DME Support for PBN Strategy	---	5,000.0

What is this program and what does this funding level support?

PBN uses Area Navigation (RNAV) and Required Navigation Performance (RNP) to improve access and flexibility in the National Airspace System (NAS) with the goal of providing the most efficient aircraft routes possible from departure runway to arrival runway while also enabling right-sizing of conventional procedures and navigation infrastructure. PBN defines the requirements for routes and procedures that enable aircraft to navigate with greater precision and accuracy. It provides a basis for designing and implementing new flight paths, redesigning airspace, and providing safe obstacle clearance. In support of PBN, the objective of NextGen DME is to provide a resilient network to continue PBN operations during a Global Navigation Satellite System (GNSS) disruption. Appropriately equipped aircraft will be able to continue PBN operations during both wider space-based and localized GNSS interference events.

A. NextGen Performance Base Navigation (PBN) Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP)

The Metroplex program designs and implements new PBN flight procedures and airways to optimize flight and air traffic operations at high priority Metroplex sites. These procedures achieve NAS-wide benefits in fuels savings, reduced carbon emissions, and reduction in aircraft delays, while also supporting the implementation of new traffic flow management initiatives and technologies, resulting in improvements in streamlining NAS operations at the Metroplex program sites. Each Metroplex site follows a standard five-phase process. All phases include industry representation. The details of the work accomplished during these phases are as follows:

Study and Scoping: The Study Phase is conducted by study teams that identify issues and propose potential solutions through facility and industry interface meetings. The result of this phase is a set of conceptual designs, with a high-level assessment of benefits, costs, and risks.

- Design and Procedure Development: The Design Phase is where the detailed Integrated Airspace and Procedures design work is conducted. When appropriate and justified, Human-in-the-Loop simulations and other design analyses are performed.
- Evaluation: This phase includes all necessary operational modeling, Safety Management System analyses, and environmental assessment.
- Implementation and Training: This phase includes all steps required for implementation of the Metroplex project including flight inspections, publishing procedures, planning, training and execution.
- Post Implementation Review and Modifications: The Post-Implementation Phase includes a review of the implemented airspace and procedures changes to determine if they have delivered desired benefits

and/or caused other impacts. Modifications or refinements may be made to better achieve the desired benefits or address unforeseen impacts.

For FY 2019, $15,000,000 is requested for the funding of the technical contract support work that includes program management and financial support, PBN route and procedures designs, environmental assessments, airspace optimization and redesigns, Safety Management System analysis and documentation production, Human in the Loop Simulations, Community Involvement technical support, and the development, coordination, collection, and submission, and archiving documentation for the following:

- Complete the Evaluation Phase at three Metroplex locations (e.g., Florida, Denver, and Las Vegas)
- Complete the Implementation Phase at four Metroplex locations (e.g., Denver, Cleveland/Detroit, Florida, and Las Vegas)
- Completion of Post-Implementation Phase at four Metroplex location (e.g., Cleveland/Detroit, Denver, Florida, and Las Vegas)

B. Next Gen DME Support for PBN Strategy

The objective of the NextGen DME program is to provide a resilient navigation service to enable commercial aircraft to seamlessly continue PBN operations during Global Navigation Satellite System (GNSS) disruptions. The program will add DMEs to the existing network to eliminate single points of failure (critical DMEs) and fill coverage gaps to enable DME Area Navigation (RNAV) aircraft, without Inertial Reference Unit (IRU), to continue PBN operations during GNSS disruptions.

For FY 2019, the NextGen DME Program requests $5,000,000 to procure three new DME systems, acquire real property, continue site preparation and installation for DMEs procured in FY 2018, and commission five new DME sites.

What benefits will be provided to the American Public through this request and why is this program necessary?

Performance Based Navigation (PBN) and Metroplex Portfolio funding will allow for expedited design, publication, and implementation of PBN procedures. The NextGen Metroplex projects were jointly prioritized by the FAA and Industry. This program has been identified by Congress and the Government Accountability Office (GAO) as essential for the modernization of the NAS.

The Metroplex program allows more efficient use of airspace and optimized arrivals and departures. Metroplex solutions may include changes to airspace structure to support the optimized procedures. Specific operational changes include removing level-offs on arrivals, de-conflicting traffic flows, adding new high-altitude PBN routes, and realigning airspace to support the new procedures. When complete, Metroplex optimization benefits are projected to reduce aircraft CO2 emissions by about 225 thousand metric tons and fuel consumption by about 26 million gallons per year. These benefits are expected to generate about $77 million per year in savings for aircraft operators, the traveling public, and the FAA.

These resources benefit the American public by allowing pilots flying aircraft equipped with RNAV to continue PBN operations in the event of a GNSS outage; significantly maintaining flight efficiency, reducing delays and reducing carbon emissions and noise, thereby providing an environmental benefit. DME/DME RNAV service will be available to the 30 percent of commercial aircraft that are not equipped with Inertial Reference Unit (IRU), significantly reducing the impact on pilot/controller workload during GNSS disruptions, thereby improving safety. The NextGen DME program will eliminate existing DME facilities that are not needed for RNAV, thereby reducing maintenance costs for equipment, facilities, and instrument flight procedures.

Detailed Justification for - 2C01 Aviation Surface Observation System (ASOS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aviation Surface Observation System (ASOS)	$10,000	$10,000	$10,976

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Aviation Surface Observation System (ASOS)	---	$10,000.0
B. Continued Maintenance For One Additional Year	---	976.0

What is this program and what does this funding level support?

The Aviation Surface Observation System, also known as the Aviation Surface Weather Observation Network (ASWON), is a portfolio program that consists of the various facilities, equipment, and subsystems in the National Airspace System (NAS) that detect and report surface weather conditions required to conduct aircraft operations under 14 CFR parts 91 subpart K (part 91K), 121, and 135. The ASWON Technology Refresh program continues to address obsolescence of FAA-owned surface weather equipment at approximately 1,100 airports.

For FY 2019, $10,976,000 is requested to continue the technology refresh upgrades of FAA-owned surface weather equipment deployed at the approximately 1,100 airports. $9,000,000 will be used to procure and install hardware/software upgrades for 571 FAA owned ASOS systems as part of the Interagency ASOS Service Life Extension Program (SLEP) with the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS). $1,000,000 will be used in FY 2019 to complete the technology refresh of the F-420 Wind System and Digital Altimeter Setting Indicator (DASI) at 226 airports (APB Milestone). The remaining funding will continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.
The following systems, agencies, and users depend on the data provided by ASWON:

- Air Traffic Control (ATC), Part 91, 121, and 135 Operators, and National Weather Service (NWS)
- Automatic Terminal Information Service (ATIS)
- Surveillance Broadcast Services (SBS) - Flight Information Service Broadcast (FIS-B)
- Standard Terminal Automation Replacement System (STARS)
- NAS Information Display System (NIDS)
- Weather System Processor (WSP)
- NEXTGEN Weather Processor (NWP)
- Common Support Services – Weather (CSS Wx)
- Integrated Terminal Weather System (ITWS)
- Weather and Radar Processor (WARP)
- Corridor Integrated Weather System (CIWS)

What benefits will be provided to the American public through this request and why is this program necessary?

The ASOS/ASWON program serves as the nation's primary surface weather observing network and benefits the flying public by ensuring the continued availability of weather reports that are required to conduct safe and efficient aircraft operations under 14 CFR parts 91 subpart K (part 91K), 121, and 135.

ASOS/ASWON information increases the accuracy and timeliness of forecast and warning products that are provided by the National Weather Service (NWS) for protection of life and property and enhancement of the national economy.

Detailed Justification for - 2C02 Future Flight Services Program (FFSP)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Future Flight Services Program (FFSP)	$3,000	$14,039	$10,100

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Future Flight Services Program	---	$10,100.0

What is this program and what does this funding level support?

Currently, a combination of entities and platforms provide Flight Services to the General Aviation (GA) community. These services include but are not limited to: pre-flight and in-flight flight planning, advisory services, weather briefings, pilot weather report (PIREP) processing, and Search and Rescue (SAR) coordination. These services are provided within the Continental United States (CONUS), Puerto Rico, and Hawaii. Flight Services also provides Visual Flight Rules (VFR) coordination, orientation support to lost aircraft, helps maintain continuous weather broadcasts on selected Navigational Aids (NAVAID), and issues Notices to Airman (NOTAM). GA pilots may access flight service information directly through web portals, thus eliminating much of the need for pilots to talk to a flight service specialist.

FFSP will expand the web portion of flight services, and reduce or eliminate human delivery of flight services as much as possible. The timeframe associated with the transformation is dependent on the technologies responsible for enabling the new capabilities, availability of the interdependent programs to perform their essential functions, and involvement from industry stakeholders such as Aircraft Owners and Pilots Association (AOPA), National Business Aviation Association (NBAA), etc. FFSP will also leverage Next Generation Air Transportation System (NextGen) solutions in order to increase operational efficiency, and improve aeronautical data acquisition and utilization in the support of flight services. For example, prospective service providers will use weather data from Common Support Services - Weather (CSS-Wx) and aeronautical information from the Aeronautical Common Service (AIMM Segment 2) and leverage FAA enterprise infrastructure including SWIM, FAA Cloud Services, and other planned infrastructure enhancements to the extent possible. The primary objective of FFSP is to realign the Flight Services mission by modernizing services and delivery methodologies.

FFSP will focus on aligning Core Safety Functions. Some of these functions will remain within Flight Services and FFSP while others will be integrated or reengineered into other service areas of the Air Traffic Organization (ATO). The Core Safety Functions were defined by Flight Service as functions that need to be provided by the FAA for the safety of the NAS and include:

- Visual Flight Rules (VFR) search and rescue operations
- Emergency services to aircraft in distress
- Weather Observation Entry (METAR Entry)
- NOTAM Coordination, Entry and Dissemination
- Security related to Special Flight Rules Area (SFRA)/Air Defense Identification Zone (ADIZ)/Flight Restricted Zone (FRZ) Flight Plans
- Instrument Flight Rules (IFR) clearance relay
- Pilot weather report (PIREP) entry
- Instrument Flight Plans (IFR) and Services provided to DOD

The Automated Flight Service Stations (AFSS) contract with Leidos currently provides flight services in the CONUS. A 42-month single source contract extension has been executed to ensure the continuity of services until the new FFSP contract is awarded.

The Direct User Access Terminal Service (DUATS) contracts that allow pilots direct access to flight service information expired in March 2015. The follow-on DUATS effort, DUATS II, was awarded to two Vendors (Lockheed Martin and Computer Science Corporation (CSC)) and will provide continued delivery of these services until the new FFSP contract is awarded. When the new FFSP contact is awarded, it will include those services provided via the DUATS II contracts.

The FFSP intends to leverage advances in technology and automation to enhance flight service capabilities, garnering efficiencies for long-term cost reductions. FFSP is a proposed single integrated service-based solution that will replace the existing Flight Service automation systems and services for CONUS, Hawaii, and Puerto Rico more cost effectively. FFSP will maximize technologies and procedures in use today to enhance automation, communications, navigation, and the way pilots manage information to generate cost savings, capture operational efficiencies, and consolidate services.

For FY 2019, $10,100,000 is requested for communications infrastructure/hardware costs. FFSP will deploy Air-to-Ground Media gateways to support the transition to a new service provider. The Air-to-Group Media gateways will be deployed in each service area allowing the FFSP service provider connectivity to the FAA Radio Communications Outlets (RCO) for the delivery of inflight flight services. These gateways will allow for Internet Protocol (IP) connectivity to the service provider thus allowing service providers to propose commercially available IP capable voice switches. FFSP will also develop a centralized web-based flight plan filing service which will provide a single authoritative source of flight plans and status utilizing the SWIM infrastructure. FFSP Program Management Office will continue to conduct stakeholder outreach activities critical to achieving the objective of migrating users away from costly human assisted services.

What benefits will be provided to the American public through this request and why is this program necessary?

The American Public, as well as the GA community, will benefit from technology enhancements and cost savings gained by elimination/reduction of services which are redundant, obsolete and/or do not align with Flight Service Core Services.

FFSP will realize cost savings and achieve efficiencies in the delivery of flight services by modernizing services and delivery methodologies. FFSP will discontinue obsolete services and activities as well as redundant activities provided by other FAA service organizations based on collaboration with user groups and outcomes of Safety Risk Management panels.

Detailed Justification for - 2C03 Alaska Flight Service Facility Modernization (AFSFM)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Alaska Flight Service Facility Modernization (AFSFM)	$2,650	$2,650	$2,650

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Alaska Flight Service Facility Modernization (AFSFM)	---	$2,000.0
B. In-Service Engineering	---	650.0

What is this program and what does this funding level support?

The Alaska Flight Service Facility Modernization (AFSFM) program is a multi-year facility modernization and sustainment program that addresses FAA Flight Service Stations (FSS) in Alaska. Thirty-three percent of the Alaska Flight Service facilities were constructed in the 1970's require extensive renovations to meet current building codes, fire life safety, electrical standards and generally do not meet the American's with Disabilities Act accessibility requirements, as defined and imposed by the Uniform Federal Accessibility Standards (UFAS) and the Architectural Barriers Act Accessibility Standard (ABAAS). These conditions endanger FAA personnel health and safety and increase the risk of service outages.

Specifically, 17 FSS facilities will be updated to meet environmental, safety and accessibility requirements and the electrical and safety systems will be upgraded to ensure they meet current standards. The program identifies and corrects deficiencies such as substandard lightning, grounding and bonding protection, electrical systems, and/or heating and cooling systems that could disrupt flight service operations by reducing the reliability of flight service automation systems.

For FY 2019, $2,000,000 is requested to support the following:

- Roof replacements/upgrades at Nome and Kotzebue FSSs
- Building interior upgrades (equipment room, break room, pilot briefing room, restrooms, etc.) at Barrow, McGrath and Palmer FSSs
- Heating, Ventilation, and Air Conditioning (HVAC) System upgrade at Nome FSS

Also requested is $650,000 for in service engineering activities. The AFSFM spend plan is revised based on seasonal and logistical limitations associated with material transportation and other inherent schedule risks due to the Alaska environment and transportation infrastructure limitations.

What benefits will be provided to the American public through this request and why is this program necessary?

This program efficiently uses funds to correct deficiencies in older FSS facilities to bring them up to date with current building and safety codes. Project schedules are developed at least two years in advance, which allows opportunities to reduce costs through efficient use of engineering and technical resources. Additionally, this program allows the FAA to avoid hefty expenses and costs associated with unscheduled and emergency upgrades to flight service facilities. Effectively managing this program to ensure costs for upgrades are within project scope provides cost savings to the American public.

Detailed Justification for - 2C04 Weather Camera Program

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Weather Camera Program	$2,200	$1,300	$1,100

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Weather Camera Program – Future Segments	---	$1,100.0

What is this program and what does this funding level support?

The primary goal of the FAA Weather Camera Program is to improve aviation safety and efficiencies by providing current visual weather information in the form of real-time video camera images to pilots and aviation users. The camera images are designated as an FAA Advisory weather product used for enhanced situational awareness and the images are made available free on the public website http://avcams.faa.gov. FAA currently owns and maintains 230 camera facilities in the state of Alaska and provides those images to pilots and the aviation industry on its managed website.

The camera images provide pilots, dispatchers and Flight Service Station Specialists with up-to-date weather conditions at airports, mountain passes, and strategic Visual Flight Rules (VFR) locations. The weather camera service enables pilots to make better informed decisions about whether or not it is safe to fly before becoming airborne and during a given flight via en route briefings. When combined with other available weather information products, such as Meteorological Aerodrome Reports (METARs), weather camera images become a powerful "go or no-go" aeronautical flight decision tool. The weather cameras in Alaska are also beneficial to the National Weather Service (NWS) Forecast Offices. The NWS uses the images from every camera site in Alaska to assist in formulating current weather reports and forecasts.

For FY 2019, $1,100,000 is requested to fund the FAA Weather Camera security and sustainment activities to ensure continuity and reliability of the current infrastructure in Alaska.

What benefits will be provided to the American public through this request and why is this program necessary?

The Weather Camera Program and its service continue to facilitate measurable reductions in weather-related aviation accidents and fatalities in Alaska and provide measurable reductions in weather-related flight interruptions and aviation fuel consumption. With the expansion of camera services to Hawaii and the CONUS it is expected that the aviation community will obtain similar increases in safety and efficiency. The actual accident statistics associated with this program were reduced from .28 accidents per 100,000 operations in 2007 to only .04 accidents per 100,000 operations in 2014, the last year that the metrics were calculated.

Detailed Justification for - 2C05 Juneau Airport Wind System (JAWS) Technology Refresh

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Juneau Airport Wind System (JAWS) Technology Refresh	$0	$0	$1,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Juneau Airport Wind System (JAWS) Technology Refresh	---	$1,000.0

What is this program and what does this funding level support?

Juneau Airport Wind System (JAWS) measures and transmits wind information to the Juneau Automated Flight Service Station (AFSS), Alaska Airlines, and the National Weather Service for weather forecasting. Other Alaska aviation users access JAWS data via the Internet. JAWS provides terrain induced wind and turbulence data that addresses safety of flight and decreases the probability of experiencing unnecessary weather related delays in and out of the Juneau International Airport (JNU), Alaska. Although JAWS data is advisory, it is essential for pilots to be aware of wind conditions that affect approach and departure paths because of the restrictive geographical features on both sides of the corridor in and out of the Juneau Airport.

Periodic replacement of commercial off-the-shelf (COTS) system components is necessary because of the weather condition on the mountains where the wind sensors are located. Updating these sensors assures continued supportability of the system through an indefinite service life. The technology refresh business case for JAWS is planned to begin in FY 2019. The technology refresh will include replacement of computers and controllers, radios, firmware and software, anemometers, profilers, and may include National Center for Atmospheric Research (NCAR) consulting support. The Final Investment Decision (FID) is planned in FY 2020.

For FY 2019, $1,000,000 is requested to conduct the Investment Analysis Readiness Decision (IARD) and produce the Investment Analysis (IA) artifacts

What benefits will be provided to the American public through this request and why is this program necessary?

During the JAWS Post Implementation Review (PIR), the system has achieved the baseline expectation for increased capacity with actual Required Navigation Procedures (RNP). The system has achieved 91 percent detection of all alert messages. JAWS has improved the commercial flight operations with a 52 percent improvement in flights diverted and 9.51 minutes of improvement in average arrival delays while improving arrivals on-time. JAWS system provides the safe operation of aircraft that is going in and out at Juneau Airport, and has received positive feedback from Alaska Airline.

Detailed Justification for - 2D01 VHF Omnidirectional Radio Range (VOR) Minimum Operating Network (MON)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
VHF Omnidirectional Radio Range (VOR) Minimum Operating Network (MON)	$9,000	$11,000	$15,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
VOR Minimum Operational Network (MON) Implementation Program	---	$15,000.0

What is this Program and what does the funding level support?

VOR Minimum Operational Network (MON) Implementation Program

The VHF Omni-Directional Range (VOR) Minimum Operational Network (MON) Implementation Program will prepare the analysis, amend/cancel/replace procedures, flight check, relocate any services/equipment collocated with the VORs, develop documentation and implementation plans for downsizing the VOR network to the minimum required as a backup navigation system for VOR equipped aircraft. Additionally, the program will begin investment analysis activities in preparation for Phase 2 (FY 2021 to FY 2025) of the program. The VOR MON Implementation program will transition the legacy network of approximately 957 VORs to a MON of approximately 650 VORs with a target date of 2025. Downsizing the VOR network to the minimum required as a backup navigation system provides an opportunity for cost avoidance and supports the National Airspace System (NAS) Efficient Streamlined Services (NESS) Initiative. It would allow aircraft to navigate and land safely under Instrument Flight Rules (IFR) in the event of disruption in a Global Navigation Satellite System (GNSS) signal; however, the planned backup capability will be less than the current VOR network.

As the need for VOR based procedures and routes decreases due to the transition to Precision Based Navigation (PBN), resources that are currently being spent in sustaining and operating the current legacy VOR facilities, many of which are beyond their service life, can be shifted for more efficient use. The legacy VOR routes and procedures will be cancelled, amended, or replaced, as necessary prior to a particular VOR being discontinued. Removing the VOR infrastructure occurs as new PBN routes and procedures are added to support NextGen.

For FY 2019, $15,000,000 is requested to meet the Phase 1 goals of the VOR MON Program and to continue Phase 2 investment analysis activities. The program will work with the appropriate groups to discontinue 25 VORs. This group includes Flight Procedures Teams (FPTs), Aeronautical Information Services (AJV-5) resources, and Planning and Requirements Leads. The program will fund approximately 655 procedures to discontinue at least 36 VORs in FY 2020, since procedures are typically funded prior to the fiscal year of the Navigational Aid's (NAVAIDs) discontinuance. This work will require substantial engineering; cancellation, amendment and/or replacement of routes and approach procedures; program management and safety risk management (SRM) analysis.

What benefits will be provided to the American public through this request and why is this program necessary?

The FAA is transitioning the NAS to more efficient PBN routes and procedures, so fewer VORs are needed. VORs do not enable PBN and few aircraft are actually using the VORs, electing to use their PBN equipment to fly the conventional Victor Airways and Jet Routes. The benefits of reducing the VOR facilities include opportunities for reduced operations and maintenance cost for facilities, instrument flight procedures, flight inspection, and opportunities to avoid potential recapitalization costs. This program will result in a more optimized NAS, where the more efficient PBN operations will be primary and a MON of VORs will be retained to serve as a back-up in the event of a GNSS outage or interference.

Detailed Justification for - 2D02 Wide Area Augmentation System (WAAS) for GPS

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Wide Area Augmentation System (WAAS) for GPS	$111,600	$104,300	$96,320

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Wide Area Augmentation System (WAAS)	---	$96,320.0

What is this program and what does this funding level support?

WAAS supports the FAA mission need of providing a satellite navigation capability across the National Airspace System (NAS). WAAS provides both horizontal and vertical navigation for precision approach-like operations for all WAAS equipped users at all qualified runway ends in the NAS. WAAS consists of a network of 38 precisely located ground reference stations distributed across the United States, Canada and Mexico that monitor the GPS satellite signals. Three master stations collect reference station data and calculate corrections and integrity messages for each GPS satellite. The WAAS messages are broadcast to user receivers via leased navigation transponders on three commercial geostationary (GEO) satellites. The receiver on the aircraft applies the corrections and uses the integrity information from the WAAS message to ensure the validity and obtains a precise navigation position.

For FY 2019, $96,320,000 is requested to execute planned tasks.

GEO Satellite Acquisition, $22,680,000

- Complete integration and testing of GEO 6 into WAAS and initiate operational lease
- Complete GEO 7 Preliminary Design Review and Critical Design Review
- GEO Sustainment lease services will continue, leases for CRE and GEO-5 will continue

Technology Refresh, $15,640,000

- DFO Segment 1 Release 4 (Safety Computer Upgrade) will complete integration into the fielded WAAS
- Segment 1 Release 5 (GEO 6 Operational) will complete integration and cut-over into the fielded WAAS
- National Airways Systems Engineering (NASE) will complete testing and modifications outside the scope of the DFO Segment 1 Contractor's work scope.

NAS Implementation, $1,980,000

- Development, modification, and release of 160 WAAS procedures, to include necessary numbers of flight inspections.

Technology Evolution, $4,110,000

- Development activities to support current WAAS capability (threat model assessments, ionospheric effects analysis) and research future capabilities to extend WAAS and GNSS supported operations
- Current emphasis is on global LPV-200 capability, building on GNSS Evolutionary Architecture Study work with the development and validation of Dual-Frequency Multiple Constellation (DFMC) SBAS standards and development and validation of Advanced Receiver Autonomous Integrity Monitoring (ARAIM) standards
- Continued development of the ARAIM safety case, and support to RTCA for completion of the draft DFMC SBAS Minimum Operational Performance Standards (MOPS) and completion of validation and

review of DFMC SBAS standards for International Civil Aviation Organization Annex 10 at the Navigation Systems Panel

Technical Engineering/Program Support, $18,990,000

- Provide systems, software, safety, reliability-maintainability-availability (RMA), test and evaluation, human factors, logistics and hardware engineering support
- Provide specialty engineering support for Hazardously Misleading Information (HMI) analysis efforts, Radio Frequency Interference (RFI) investigation and mitigation, system security assessments, and system performance assessments
- Provide program management support in areas of finance; quality assurance (QA); Earned Value Management (EVM); project planning, execution, and monitoring
- Develop documentation in support of FAA Acquisition Management System (AMS) Final Investment Decision (FID) for WAAS Phase IV Segment 2

Wide Area Augmentation System (WAAS) Sustain Leased Services, $32,920,000

- Provide lease payments and manage leases for the 3rd, 4th, Gap Filler, and 5th GEO operational lease services
- Support resolution of any system anomalies, interference events or other issues to ensure compliance with WAAS performance requirements. Review GEO lease performance reports as well as review and approve GEO Ground Uplink Site design changes.

What benefits will be provided to the American public through this request and why is this program necessary?

WAAS is capable of supporting all ADS-B enhanced operations. WAAS has been used as the ADS-B on-board position sensor in all demonstrations to date, because it meets the requirements to achieve levels of accuracy, integrity, and availability required by an ADS-B position sensor for all enhanced surveillance operations and will enable ADS-B to fully implement all capabilities (reduced separation). The development of a common WAAS/ADS-B avionics suite using the same WAAS-based position sensor will reduce the overall cost to the user and will facilitate the widespread, rapid, and cost-effective deployment of both WAAS and ADS-B. WAAS accuracy, integrity and availability have led to the integration of a WAAS capability into most commercial GPS chips and receivers supporting numerous applications (marine, automobile, agriculture, surveying and recreation). Other investments that WAAS interfaces with include Continuously Operating Reference Stations (CORS) operated by the National Geodetic Survey under the National Oceanic and Atmospheric Agency and Mobile E911.

In terminal area and approach operations, a Flight Safety Foundation Report found that there is nearly an eight-fold reduction in approach accident rates (53 per million for non-precision approaches vs. seven per million for precision approaches) when precision vs. non-precision approaches were used. Specifically, 141 accidents could be prevented over a 20-year period and save over 250 lives when using WAAS for vertically guided approaches at airports where stable vertical guidance is not available or not used today. WAAS provides vertical and horizontal guidance with an aviation safety component enabling pilots to make stable, vertically guided approaches to all qualified runway ends in the continental United States and most of Alaska. Presently precision vertically guided approaches using CAT I ILS are only available at 1,550 of the nation's 19,000 runway ends.

Cargo aircraft have shown increased cargo capacity, reduced fuel loads, reduced divert rates (inability to land at planned destinations), and operational cost savings of approximately $200,000 per year. Regional airlines have shown fuel and time savings by utilizing satellite-based waypoints that facilitate straight-line, shortest-distance routes as compared to legacy (zigzag) routes that fly a series of straight line route segments connecting ground based navigation aids. Commuter airlines have demonstrated cost avoidances attributable to lower minimum descent altitudes at airports through the installation of LPV approach procedures. This savings, along with very short return on investment timelines, has translated into commitments to fully equip airline fleets with WAAS avionics. Business jet operators in FAA Government Industry Partnerships (GIPs) have been able to decrease in-flight conflicts with major airport traffic while on approach at feeder airports. This has allowed increased frequency of operations and reduction of in-flight and ground clearance delays.

EMS helicopter operators have been able to create IFR LPV approaches to medical center helipads, eliminating the requirement to land at distant airports necessitating ground transportation and consequent delays in patient care. WAAS-based helicopter routes have allowed elimination of Air Traffic Control delays by assuring de-confliction with airline traffic at major metroplex airports. WAAS based helicopter routes and LPV approaches have been developed that reduce ground delays for executive transport in extremely complex and congested airspace such as the New York metropolitan area, allowing significant increases in flight operations during poor visibility. In 2010, an independent Post Implementation Review (PIR) found that WAAS was successfully delivering the expected performance and benefits while maintaining the program cost and schedule baseline.

The FAA is required by law to establish, operate, and maintain navigation capability for all phases of flight. The FAA determined that the safest, most efficient and cost-effective means of providing precision approaches at the maximum number of runway ends possible within the NAS and the highest availability enroute capability, is via a satellite-based navigation capability, specifically WAAS. WAAS increases the accuracy, continuity, availability, and integrity of GPS data, with associated improvements to air traffic system capacity and safety.

By increasing procedures and expanding WAAS coverage, users will equip with WAAS receivers and increase the total benefit realized by WAAS. WAAS enables reduction or avoidance of expensive and high maintenance cost of ground based navigation aids. Reductions in the number of ground based navigation aids and the associated cost savings have started. A minimum operating network of ground based navigation aids will be retained through the Very High Frequency Omnidirectional Radar (VOR) minimum operating network (VOR MON). Plans are currently being developed to rationalize the number of Category I Instrument Landing System (Cat I ILS) in the NAS.

WAAS performance has met or exceeded its performance requirements since commissioning in 2003, and is documented quarterly. Real time data and plots, daily plots, performance videos and performance analysis is available for WAAS at the following website: http://www.nstb.tc.faa.gov/.

Detailed Justification for - 2D03 Instrument Flight Procedures Automation (IFPA)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Instrument Flight Procedures Automation (IFPA)	$9,400	$8,500	$1,400

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Instrument Flight Procedures Automation (IFPA)	---	$1,400.0

What is this program and what does this funding level support?

IFPA is a suite of advanced Information Technology (IT) tools. These tools create products using fully integrated solutions for visual and instrument flight procedures. IFPA consists of the Terminal Area Route Generation, Evaluation and Traffic Simulation (TARGETS) design tool, Instrument Flight Procedures (IFP) database application, Airports and Navigations Aids database (AirNav) application, Obstacle Evaluation (OE) system, and the Aeronautical Information Services Production Workflow System (APWS).

For FY 2019, $1,400,000 is requested to continue technology refresh activities for the second segment of IFPA technology refresh efforts and upgrade the server hardware that houses the IFPA suite of technology and applications. This activity will be accomplished with Commercial off the Shelf (COTS) hardware and will accompany work to integrate the new components with the applicable National Airspace Systems.

In FY 2018 COTS Personal Computer hardware will have been refreshed. Development and testing of TARGETS capabilities will be underway in FY 2019. For APWS, system configuration and development continues with development and testing in FY 2018, and finishes with system delivery in FY 2019.

- The TARGETS tool provides space-based navigation (RNAV and RNP) procedure design capability, as well as ground-based navigation procedure design capability
- The APWS tool provides business process workflow automation for the Aeronautical Information Services organization so that collaboration occurs systematically and progress is monitored until publication of the new navigation procedure

What benefits will be provided to the American public through this request and why is this program necessary?

The IFPA tool suite provided productivity gains for all Aeronautical Information Services' major work products. Since the program's inception, the development time required for new and amended Instrument Flight Procedures, flight procedure Notice to Airmen (NOTAM) generation time, and obstacle evaluation time have all been reduced. These efficiency gains are multiplied by the hundreds and thousands of these products produced on an annual basis and they reduce the costs for these activities to the American public

In addition, IFPA increases the airport arrival capacity for eight major metropolitan areas and at the nation's busiest airports when visibility is restricted. IFPA increases automated capabilities for all types of precision and non-precision flight procedures including conventional (ground-based navigation aids) and performance-based (satellite-based navigation).

Detailed Justification for - 2D04 Runway Safety Areas (RSA) – Navigational Mitigation

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Runway Safety Areas (RSA) – Navigational Mitigation	$14,000	$1,600	$2,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Runway Safety Areas (RSA) Phase 2 – Navigational Mitigation	---	$2,000.0

What is this program and what does this funding level support?

For FY 2019, $2,000,000 is requested to supply the initial funds for the RSA Phase II program and to conform with FAA-owned equipment to RSA standards contained in AC 150/5300-13 Airport Design. RSA compliance provides a measure of safety in the event of an aircraft's excursion from the runway by significantly reducing the extent of personal injury and aircraft damage during overruns, undershoots and veer-offs. The funding request of will be used to initiate the correction of 25 RSA violations that were not part of the original effort.

The RSA Phase II initiative will correct FAA-Owned facilities and equipment (F&E) that are not in compliance with the RSA standards. The scope of the work, to satisfy the language of Title 14 Code of Federal Regulations (CFR) Part 139 (Certification of Airports), will range from the installation of frangible connections on identified structures to the relocation of facilities within and outside the RSA. These facilities or structures are classified as: 1) fixed by function and 2) not fixed by function. Objects that are fixed by function are permitted within the RSA as long as it meets the frangibility requirements. The RSA must be free of all objects that are three inches above the grade and are not frangible. Objects that are not considered fixed by function will be moved outside the RSA to extent practical. Below is a listing of objects by classification:

Objects fixed by function:
- Runway End Identifier Lights (REIL)
- Precision Approach Path Indicator (PAPI)
- Visual Approach Slope Indicator (VASI)
- Inner Marker (IM)
- Approach Lighting System (ALS)
- Runway Visual Range (RVR)
- Access Roads
- Radar Reflectors
- Power Panels (case by case)
- Individual Control Cabinets (ICC)
- Engineered Materials Arresting System (EMAS)

Objects not fixed by function:
- Localizer (most cases when not possible to relocate)
- NavAid Buildings (power sheds)
- Transformers
- Power Panels (case by case)

The activities associated with this effort will be prioritized according to the major airport hubs, their supporting reliever airports and then other airports with reported NavAids violations. Interdependencies will be with the FAA Airports Organization (ARP) to provide access to the airports and runways to complete the necessary improvements. The expected outcome from funding the RSA Phase II program is that previously undiscovered violations are corrected in a timely manner.

What benefits will be provided to the American public through this request and why is this program necessary?

Compliance with the RSA standards provide a measure of safety in the event of an aircraft's excursion from the runway by significantly reducing the extent of personal injury or aircraft damage during overruns, undershoots and veer-offs. Thus, the primary benefit of the RSA Phase II program is the prevention of loss of life from aircraft striking non-compliant NavAids located in designated RSAs.

Under the previous RSA Phase I effort, between Fiscal Year (FY) 2010 and FY 2016, the FAA successfully executed 1,174 projects to correct violations at 499 RSAs and plans to complete a total of 1,394 projects at 614 RSAs by no later than December 31, 2018. Although significant progress has been made to mitigate all known RSA violations, it is expected that additional RSA violations will be found during routine ATO and Office of Airports (ARP) inspections; decreasing in number each successive year.

Detailed Justification for - 2D05 NAVAIDS Monitoring Equipment

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
NAVAIDS Monitoring Equipment	$2,000	$2,000	$3,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
NAVAIDS Monitoring Equipment (NME)	---	$3,000.0

What is this program and what does this funding level support?

There are currently two different types of consolidated Air Traffic control and monitoring systems operating in the National Airspace System (NAS) that replace multiple legacy control and monitoring panels used by Air Transportation System Specialists (ATSSs) for monitoring and controlling navigational aids (Navaids) equipment at an airport. These two systems are the Integrated Control and Monitoring System (ICMS) and the Universal Interlock Controller (UIC). These systems, which are typically located in the air traffic control tower cab and equipment room, are used by Air Traffic Control Specialists (ATCS) and ATSSs to monitor and control predefined sets of Navaids from one or more user interfaces located in the airport facility. Instrument Landing Systems (ILS), Runway Visual Range (RVR) equipment, Runway End Identifier Lights (REIL), Precision Approach Path Indicator (PAPI) light arrays, and other airport Navaids are monitored and controlled by these control and monitoring systems.

For FY 2019, $3,000,000 is requested to support the development of Investment Analysis (IA) artifacts to achieve Final Investment Decision (FID) in FY 2019, and for the development and evaluation of the Screening Information Request (SIR) which precedes procurement of the NME system.

What benefits will be provided to the American public through this request and why is this program necessary?

The NME system development and deployment will maintain the safety and efficiency benefits of the legacy control and monitoring systems that are deployed in the NAS. This will be achieved by either replacing or upgrading the existing ICMS and UIC systems that exist today. The NME system will support the situational awareness of ATSSs by providing a status and the ability to control the states of the many Navaids that are used for arriving and departing aircraft. The NME system will provide the technological updates necessary to maintain the current levels of system availability and reliability for control and monitoring systems deployed today.

The NME program is necessary to address challenges in maintaining multiple software versions of the ICMS and UIC system deployments, technological differences in system functionality, system performance issues partly due to aging system technology, and challenges associated with FAA depot and second-level engineering supportability. The NME Program will address these challenges by either replacing or upgrading the ICMS and UIC systems that currently exist today.

Preparation and approval of business case artifacts are essential to ensure stakeholder acceptance and to justify FAA investment for the NME Program.

Detailed Justification for - 2D06 Landing and Lighting Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Legacy Navigation Aids Portfolio	*$32,500	*$29,000	$42,372

*Indicates a comparability adjustment to prior budget structure. Capital Investment Plan (CIP) projects for the navigation projects noted below have been combined into a legacy navigation aids sustainment/portfolio rather than the previous structure that spanned eight individual BLIs.

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. VOR Collocated with Tactical Air Navigation (VORTAC)	2	$3,500.0
B. Instrument Landing Systems (ILS)	11	6,000.0
C. Distance Measuring Equipment (DME)	60	5,500.0
D. Navigation and Landing Aids SLEP	16	5,000.0
E. Visual NAVAIDS – Establish/Expand	10	1,000.0
F. Runway Visual Range (RVR) Replacement/Establishment	24	7,000.0
G. Approach Lighting System Improvement Program (ALSIP)	11	5,000.0
H. VASI Replacement – Replace with Precision Approach Path Indicator	75	7,000.0
I. In Service Engineering	---	900.0
J. Continued Maintenance For One Additional Year	---	1,472.0

What is this Program and what does the funding level support?

A. VOR Collocated with Tactical Air Navigation (VORTAC)

For FY 2019, $3,500,000 is requested for engineering and technical services/support and funding to dopplerize one on-going VOR project, to initiate one new Doppler VOR (DVOR) project, and to support the preliminary business case analysis for a future VOR contract. This program relocates, refreshes technology at VOR and VORTAC facilities and improves VOR operational performance by procuring and installing DVOR electronic kits and DVOR antenna hardware kits to upgrade the conventional systems. Numerous VORs have radial restrictions because of encroachment by obstacles that block the transmission of VOR signals. Dopplerizing a VOR eliminates the signal reflection restrictions caused by most obstacles that include newly constructed tall buildings, nearby industrial parks with a high concentration of metallic buildings, overhead transmission lines, radio, television and cellphone towers, and, more recently, wind farm stations.

The VOR and VORTAC (a combination of VOR and Tactical Air Navigation (TACAN) system) provide navigational guidance for civilian and military aircraft in both the en-route and terminal areas. As the FAA transitions gradually to performance based navigation (PBN), a VOR Minimum Operational Network (MON) will be retained to serve as a backup to satellite navigation and define VOR routes and procedures for legacy users. These components will continue reliable, safe, and efficient ground based VOR and VOR/DME systems until the use of Global Positioning System is widespread.

B. Instrument Landing Systems (ILS)

For FY 2019, $6,000,000 is requested for engineering and technical services/support, completion of one on-going ALSF-2 establishment project, attain service availability at three ILS locations, procurement of three ILS systems, and initiate three sustain ILS projects. This program supports the installation of ILS and/or High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) for the establishment of Category II/III precision approach procedures. An ILS precision approach system is comprised of a grouping of electronic devices: Localizer, Glide Slope and marker beacons) and, in some cases, ancillary aids

(Distance Measuring Equipment, Approach Lighting System, Runway Visual Range, etc.) that provide landing aircraft with both electronic guidance and visual landing aids. These systems allow properly equipped aircraft to land safely in adverse weather conditions.

The ILS provides both vertical and lateral guidance information for the pilot to allow safe landing to touchdown and rollout. The ILS sends information to instruments in the cockpit so that the pilot can maintain a predetermined flight path to the runway even in low visibility. The ILS also provides a backup landing capability in the event of a loss of Global Navigation Satellite System (GNSS) service. The ALSF-2 is a lighting system installed along the extended centerline extending a distance of 2,400 feet outward into the approach zone and ending at the runway threshold to provide visual cues to help the pilot see the runway. This program supports ILS sustainment activities at large hub and medium hub non-military airports.

C. Distance Measuring Equipment (DME)

For FY 2019, $5,500,000 is requested for engineering and technical services/support, procurement of 20 DME systems, attain service availability for 20 establish/sustainment DME projects, and to initiate funding for 20 DME installations. DME is a radio navigation aid used by pilots to determine the aircraft slant distance from the DME location. The program is procuring and installing state-of-the-art DME systems to: support replacement of DMEs that have exceeded their service life expectancy, establish new DMEs at qualifying airports, to relocate DME facilities, and establish DMEs in lieu of Instrument Landing System marker beacons. DMEs reduce the need for less desirable step-down non-precision approach procedures in which a pilot descends to the minimum allowable altitude to visually locate the runway. DMEs lead to better specification and control over the vertical descent profile and reduces controlled-flight-into-terrain (CFIT) risk.

D. Navigation and Landing Aids SLEP

For FY 2019, $5,000,000 is requested for engineering and technical services/support, completion of two MALSR replacement projects, completion of four ILS replacement projects, procure five ALSF-2 RLMS kits, and completion of five RLMS installations. This program renovates or replaces airport approach lighting systems at sites where there is a high risk for failure and where that failure would result in loss of the primary precision approach. NavAids include: Medium Intensity Approach Lighting Systems with Runway Alignment Indicator Lights (MALSR) for Category I approaches, and ALSF-2 at Category II/III approaches. This program also supports Instrument Landing Systems (ILS) sustain and replace efforts at airports that provide less than 0.25 percent of total US enplanements and at airports with less than 0.50 percent of total US non-military itinerant operations.

E. Visual NAVAIDS – Establish/Expand

For FY 2019, $1,000,000 is requested for engineering and technical services/support; completion of five site surveys at PAPI installation sites and completion of approximately five PAPI establishment projects. Visual NavAids are necessary to assist pilots in visually acquiring the runway environment. These lighting systems facilitate the transition from cockpit instruments to external visual references during the final landing phase. Different categories and types of approaches require different visual NavAids equipment.

This program supports the procurement, installation, and commissioning of PAPI systems and Runway End Identifier Lights (REIL) systems. The PAPI provides visual approach glide slope information to pilots and enables them to make a stabilized descent with a safe margin of approach clearance over obstructions. PAPI consists of four lamp housing assemblies arranged perpendicular to the edge of the runway. PAPI projects a pattern of red and white lights along the desired glide slope so a pilot can tell whether they are on the glide slope and how to correct their glide slope if they are above or below it. A REIL is a visual aid that provides the pilot with a rapid and positive identification of the runway end in use during approach. The REIL system consists of two simultaneously flashing white lights, one on each side of the runway landing threshold.

781 runway ends that require implementation of a visual glide slope indicator approach capability have been identified by CAST and will reduce the number of the controlled flight into terrain accidents during approach and landing. These include runways affected by Land and Hold Short Operations (LAHSO) requirements that increase airport capacity by allowing coordinated approaches on intersecting runways.

F. Runway Visual Range (RVR) Replacement/Establishment

For FY 2019, $7,000,000 is requested for engineering and technical services/support, procurement of approximately 12 RVR systems and ancillary equipment, and to establish/sustain RVRs at approximately 12 locations. This program is required per the Code of Federal Regulations §91.175, Takeoff and Landing under Instrument Flight Rules. This program allows airports to conduct takeoff and landing operations during conditions of low visibility.

This program replaces older RVR equipment with Personal Computer (PC) Based RVR equipment as well as equipment for sites that have qualified for an upgrade from a Category I to a Category II/III precision approach. RVR provides air traffic controllers with a measurement of the visibility at key points along a runway that is used to decide whether it is safe to take off or land during limited visibility conditions. During reduced visibility weather conditions, RVR system measurements are used by Air Traffic to establish airport operating categories; thus, properly equipped aircraft with a trained crew may continue operations under reduced visibility Category I, Category II and Category III conditions. The RVR decreases diversions and delays at an airport by providing an accurate measure of the runway visibility. The RVR information affects airline scheduling decisions and air traffic management decisions regarding whether flight plans should be approved for an aircraft to fly to or take off from an airport with low visibility. There are 280 airports in the National Airspace System (NAS) that have RVR systems.

G. Approach Lighting System Improvement Program (ALSIP)

For FY 2019, $5,000,000 is requested for engineering and technical services/support; procurement of ten Remote Radio Control System (RRCS) ancillary equipment for Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR), completion of MALSR replacement project at approximately one location.

The Approach Lighting System Improvement Program (ALSIP) upgrades approach lighting systems built before 1975. It upgrades the equipment to current standards and reduces the potential severity of take-off and landing accidents by replacing rigid structures with lightweight and low-impact resistant structures that collapse or break apart upon impact. The entire approach lighting system is replaced when rigid structures are replaced. The High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) provides visual information on whether the pilot is aligned with the runway centerline, the aircraft's height above the runway plane, roll guidance, and horizontal reference for Category II and III Precision Approaches. The MALSR provides visual information on runway alignment, height perception, roll guidance, horizontal references for Category I Precision, and Special Authorization Category II Approaches.

H. VASI Replacement – Replace with Precision Approach Path Indicator

For FY 2019, $7,000,000 is requested for engineering and technical services/support; procurement of approximately 25 PAPI ancillary systems; initiate approximately 25 new Visual Approach Slope Indicator (VASI) system with PAPI projects, and completion of approximately 25 VASI replace with PAPI projects. The International Civil Aviation Organization (ICAO) has recommended that all international airports replace the VASI lights with PAPI lights. This standardizes the equipment used to allow pilots to determine visually that they are on the proper glideslope for landing. The program supports the procurement, installation, and commissioning of PAPI systems in order to comply with this ICAO recommendation.

I. In Service Engineering

$900,000 is requested for In-service engineering activities that allow for immediate response and tactical distribution of resources to emerging technology solutions across this entire navigation portfolio.

J. Continued Maintenance For One Additional Year

Continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

What benefits will be provided to the American Public through this request and why is the program necessary?

The FAA is transitioning the NAS to more efficient PBN routes and procedures that rely on GNSS. To achieve the transition, FAA is aggressively pursuing the implementation of satellite navigation and the sustainment of the ground based navigation infrastructure. Ground Based Navigational Aids will continue to provide a backup function, as required, in the event of a GPS outage to ensure consistent and reliable landing operations and provide resiliency in the navigation domain.

Visual Navigation Aids must continue to identify runway parameters, provide visual landing ques, and identify visibility constraints to commercial and general aviation pilots. These visual systems provide enhanced safety of operations for landing aircraft. VORs, DMEs, and ILSs will remain in the NAS for the foreseeable future to provide resiliency during GNSS disruptions. A substantial portion of these ground based navigation aids and runway lighting/visual systems have exceeded the planned service life for those assets. This portfolio provides for the systematic replacement and sustainment of those systems. The result of this work reduces operational costs for FAA and enhances the reliability of the assets.

Detailed Justification for - 2E01 Fuel Storage Tank Replacement and Management

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Fuel Storage Tank Replacement and Management	$22,700	$28,100	$25,700

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Fuel Storage Tank Replacement and Management	135	$25,700.0

What is this program and what does this funding level support?

The Air Traffic Organization (ATO) active tank system inventory includes over 3,700 units that support communication, navigation, weather, and surveillance missions. Fuel storage tank (FST) systems store and supply electrical generator fuel, lubricating oil, building heater and boiler system fuel, service vehicle fuel, liquid waste, and similar bulk liquids.

FST system manufacture, installation, operation, and disposal is regulated under Federal, State and local statutes, including the Clean Water Act (CWA), the Oil Pollution Act (OPA), and the Resource Conservation and Recovery Act (RCRA), among others, with significant penalties for compliance failures. The FST program received a final investment decision in June 2013. The FST program operates to attain three primary objectives:

- Sustain NAS operational readiness — A loss of integrity on any storage tank component can negatively affect the operational capacity of the supported systems and may ultimately result in a total Air Traffic Control (ATC) facility outage.
- Mitigate environmental damage and regulatory non-compliance — Non-compliance incurs short-term ATC operational impacts (use prohibitions result in inability to support the mission) and longer-term fiscal impacts, including costly cleanup activities, fines, and unplanned retrofit costs.
- Conduct effective in-service management and lifecycle replacement — As fuel tanks age beyond their service life, there is an escalating risk of failure and associated leakage with attendant operational impacts and environmental damage.

For FY 2019, $25,700,000 is requested to fund tank unit replacements, modernization, and upgrades at approximately 135 locations across the National Airspace System (NAS).

What benefits will be provided to the American public through this request and why is this program necessary?

Executing an FST lifecycle sustainment program achieves the cost benefit of sustaining availability of the systems for NAS operations, reducing the risk of leaking FST systems, minimizing adverse impact to personal and environmental safety, and preventing regulatory fines of up to $32,500 per day per unit for failing to comply with regulatory standards.

Monthly tracking confirms fuel systems continually achieve the goal of 99.7 percent sustained operational availability. Operating modern equipment, sustainable, and regulatory-compliant fuel systems mitigate damage and associated costs resulting from incidental release of hazardous, toxic, or dangerous materials and assures the travelling public and aviation stakeholders a reliable and safe transit experience.

Detailed Justification for- 2E02 Unstaffed Infrastructure Sustainment (UIS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Unstaffed Infrastructure Sustainment	$40,490	$35,700	$51,050

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Unstaffed Infrastructure Sustainment	344	$48,000.0
B. Employee Housing and Life Safety Shelter System Service	---	600.0
C. In-Service Engineering	---	2,450.0

What is this program and what does this funding level support?

For FY 2019, $51,050,000 is requested to sustain to support 344 critical infrastructure sustainment projects of unstaffed FAA facilities as well as the mechanical systems for FAA employee housing in Alaska. The FAA owns more than 12,000 buildings, broadcast towers, and poles whose sole purpose is to protect and support National Airspace System (NAS) communications, surveillance, weather, and navigation aids. These structures are failing. They suffer from leaking roofs, deteriorated foundations, inadequate air conditioning and electrical systems, and severely corroded guy wires and anchors. A majority of these sites are operating beyond their design service lives. In addition, in remote locations or overseas the FAA owns or leases, approximately 150 dwelling units that are used as permanent housing for FAA employees in remote locations, temporary quarters for FAA employees at remote locations (for example islands in the Bering Sea), and a system of life-safety emergency shelters in harsh environments (i.e., remote arctic and mountaintop locations). Employees who use these facilities provide air traffic control services and/or National Airspace System (NAS) facilities maintenance services.

The UIS program sustains NAS-supporting infrastructure, which enables the reliable and continuous operations of surveillance, navigation, communication, and weather equipment. Unstaffed infrastructure protects electronic equipment from weather hazards and unauthorized entry. NAS sustainment includes major repairs to and replacement of real property assets and structures that are normally not staffed, such as:

- Major repair, refurbishment, and replacement of NAS antenna and equipment towers
- Major repair, refurbishment, and replacement of buildings; shelters; roofs; heating, ventilation, and air conditioning (HVAC) equipment; electrical panels and distribution wiring; locks and alarm sensors; lighting; access roads; grounds; and fencing
- NAS equipment shelter replacements at several locations
- Communication tower replacements and repairs at several locations
- HVAC replacements at airport surveillance radar (ASR) facilities

What benefits will be provided to the American public through this request and why is this program necessary?

The American Public will benefit from a stable NAS infrastructure. This program will improve availability and reliability of air traffic control (ATC) services as a direct result of building improvements (e.g., HVAC replacement and electrical system upgrades) that provide a safe and functional operating environment for electronic systems. It will extend the operational service life of NAS remote facilities that house and protect valuable systems, equipment, and staff. A safer and more secure work environment provided for Air Traffic Organization (ATO) technical operations personnel is the result of well sustained assets.

Detailed Justification for - 2E03 Aircraft Related Equipment Program (ARE)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aircraft Related Equipment Program (ARE)	$13,000	$12,500	$13,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Flight Inspection (FI) Flight Program	---	$9,000.0
B. Flight Simulation Testing and Research Technologies (START)	---	4,000.0

What is this program and what does this funding level support?

A. Aircraft Related Equipment (ARE) Program:

Following consolidation of the legacy flight programs into a single FAA Flight Program under the governance of ATO Flight Program Operations (October 2016), the Aircraft Related Equipment (ARE) program provides the funding to meet regulatory, sustainment, and obsolescence requirements for the Flight Program Operations flight inspection aircraft. The Flight Program Operations flight inspection mission ensures FAA navigational systems, facilities, and tools are sound and operating according to specifications. The Agency is also responsible for Department of Defense (DOD) worldwide flight inspection requirements. The flight inspection mission requires aircraft equipped with specialized test equipment and systems.

ARE program funding provides for the physical and technical updates to 28 agency-owned Flight Program Operations flight inspection aircraft, avionics, and specialized mission equipment. The program not only provides for regulatory requirements, but also provides for expanded capability and extended useful life of the aircraft, avionics, and mission equipment for 20 to 30 years. ARE projects fall under one of three categories:

- Aircraft Modernization: Projects support avionics technology refresh and new or changing regulatory requirements for operating aircraft in domestic and international airspace.
- Mission Sustainment: Projects support mission equipment technology refresh and new or changing regulatory requirements necessary to continue flight inspection of legacy NAS systems.
- Flight Inspection System Modernization: Projects support new mission equipment requirements and new or changing regulatory requirements necessary to provide flight inspection of Performance Based Navigation (PBN) and implementation of evolving NextGen systems.

For FY 2019, $9,000,000 is requested for ongoing modifications/upgrades to FAA Flight Program Operations flight inspection aircraft, avionics, and mission equipment as follows:

- Challenger 601 Modernization - Acquire and install avionics upgrades and ADS-B out systems
- Sustain the current Automatic Flight Inspection System (AFIS)
- Challenger 605 Modernization - Acquire and install navigation and surveillance avionics upgrades
- Communications systems

B. Flight START:

The project integrates requirements for life cycle sustainment of the existing Flight Simulators for the effective development, design, testing and implementation of future NextGen technologies. The Boeing 737 Simulator and Airbus wide-body FBW Simulator require continual sustainment and technology refresh to meet the needs of the Safety Organization. The Flight START Program will enable the continued technology refresh of the Airbus 320 Flight Package, existing A330/A340 simulator, and Boeing 737. These simulators assist in performing realistic, high fidelity operational evaluation activities and supporting vital research and development projects such as Closely Spaced Parallel Operations, Required Navigation Performance, and Human-in-the-Loop (HITL) pilot/controller/aircraft terminal operations performance. These evaluations are necessary for the introduction of new NextGen technology initiatives, NAS modernization, and National Transportation Safety Board (NTSB) safety initiatives. For FY 2019, $4,000,000 is required for technology refresh enhancements of FAA simulators.

What benefits will be provided to the American public through this request and why is this program necessary?

Safe, efficient, and regulatory compliant aircraft are necessary for the continued successful performance of the Flight Program Operations flight inspection mission and Flight Simulators. ARE funds are required to meet this end.

The Flight Program Operations flight inspection mission is a key component of FAA safety and increased capacity initiatives, which support evolving the NAS into a performance-based system. A performance-based NAS allows civil aircraft to navigate airspace more safely and with greater flexibility than the current ground-based system. To meet these safety and greater capacity objectives the, the Flight Program Operations flight inspection fleet must be updated to continue to certify an expanding number of landing systems at the lowest possible cost. The Flight Program Operations flight inspection mission serves as the quality assurance program to verify that NAVAIDS and instrument flight procedures (IFP) conform to prescribed standards and provide accurate guidance for all NAS users. Flight inspection identifies discrepancies that are repaired before they cause delays and diversion of aircraft. The safety impact of this work benefits the agency, as well as end users of the airspace.

Flight START will integrate requirements for life cycle sustainment of the existing Flight Simulators and includes the development, design, and implementation of future technologies that will improve aviation safety. The FAA has regulatory authority for approving special instrument approach procedures and the introduction of new concepts and technologies for aircraft navigation. The upgrade of the simulators will enable FAA to analyze and test the viability of these new concepts and procedures for use in the NAS and develop the appropriate regulations regarding their use.

Detailed Justification for - 2E04 Airport Cable Loop Systems – Sustained Support

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Airport Cable Loop Systems – Sustained Support	$8,000	$8,000	$10,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Airport Cable Loop Systems Sustained Support	14	$10,000.0

What is this program and what does this funding level support?

For FY 2019, $10,000,000 is requested for advanced engineering, construction activities, and Fiber Optic Transmission Systems (FOTS) equipment installations for the initiation of three large scale Airport Cable Loop (ACL) projects, and continuation/completion of five large scale ACL projects. In addition, funding will allow the program to start and complete four smaller scale projects (regionals) that will be determined at the Air Ground Integrated Requirements Team (AGIRT) meeting in FY 2019.

The program replaces existing on-airport, copper-based, signal/control cable lines that have deteriorated and obsolete underground telecommunications cable infrastructure systems are vulnerable to failure and have caused flight delays related to these cable outages. The primary focus will be on projects at airports with high traffic counts and enplanements. These lines feed airport surveillance radar, air/ground communications, landing systems data and information to the Air Traffic Control Tower, and operational and maintenance information to FAA-staffed facilities. Where cost effective, the program will install fiber optic cable in a ring configuration to provide communications diversity.

The ACL program reduces the number of unplanned outages due to deteriorated copper lines, and improves signaling and communications, which allows for increased operational availability of infrastructure systems. There have been 1,498 delays and outages associated with on airport cable loop from 2004 to 2015 for airports in the NAS which the ACL program aims to reduce over time.

The Airport Cable Loop program, along with multiple other programs, has mutual dependencies on the telecommunications infrastructure. More than 15 FAA programs rely on Airport Cable Loop to provide connectivity to and from control facilities and is linked with NextGen.

What benefits will be provided to the American public through this request and why is this program necessary

ACL is presently reducing on-airport telecommunication infrastructure related delays of core airports by three percent on an average annually. System reliability and safety are enhanced due to increased system performance from redundant or diverse pathways provided by the cable loop system. Standardizing requirements will simplify and reduce operation requirements for logistics, configuration management, training, procurement, and depot support which save taxpayer dollars.

Detailed Justification for - 2E05 Alaskan Satellite Telecommunications Infrastructure (ASTI)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Alaskan Satellite Telecommunications Infrastructure (ASTI)	$6,000	$20,900	$16,300

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Alaskan Satellite Telecommunications Infrastructure (ASTI)	---	$11,900.0
B. Alaskan Satellite Telecommunications Infrastructure (ASTI) Enhancements	---	4,400.0

What is this program and what does this funding level support?

ASTI is a FAA-owned satellite based network that provides 90 percent of the inter-facility communications required by the FAA in Alaska to support air traffic control operations. The ASTI network topology consists of hub earth stations, remote earth stations, leased transponder space segment, and a Network Operations Control Center (NOCC). ASTI uses primary and alternate satellites to provide service diversity. The remote earth stations are linked to their respective hubs and the NOCC through leased transponders providing Alaska with critical, essential and routine air traffic control telecommunications services such as:

- Remote Control Air-to-Ground (RCAG) facility and Remote Communications Outlets (RCOs) for voice communication with pilots
- En Route and Flight Service Station Radio Voice Communications
- En Route and Terminal Radar Surveillance Data; Digitized Radar Data and Digitized Beacon Data
- Flight Service Station Flight Service Data processing system and the Digital Aviation Weather Network
- Weather Advisories, Briefings, and Products supporting Automatic Surface Observation System (ASOS), Automated Weather Observation System (AWOS), and AWOS Data Acquisition System (ADAS)
- Wide Area Augmentation System (WAAS) Reference Station
- Automatic Dependent Surveillance-Broadcast (ADS-B)

The ASTI Technology Modernization is an ongoing program that replaces/upgrades system components originally deployed in the 1990s as part of the Alaskan NAS Inter-facility Communications System (ANICS). The ASTI Technology Modernization program will improve system availability, reduce the frequency of system alarms and outages, reduce the level of FAA maintenance, provide satellite bandwidth savings, and improve life cycle support including training, second level engineering support, radome maintenance, and depot level supply support.

For FY 2019, $11,900,000 is requested to successfully complete the Alaskan Satellite Telecommunication Infrastructure (ASTI) modernization efforts and achieve system-wide component replacements/upgrades at 62 locations (including four hubs). An ASTI program Baseline Change Decision (BCD) was approved May 2017. The revised schedule plans the majority of the implementation in FY 2018 with final implementation efforts projected to be completed by April 2019.

The ASTI Technology Modernization program provides for the replacement and upgrade of vital system components due to aging, obsolescence, and implements improved Support Services. ASTI is needed to address the current system deficiencies:

- Availability has fallen significantly below 0.9999 (for critical services) and 0.999 (for essential and routine services) and continues to decline

- Critical system components are no longer supportable for required system operations
- Environmental destruction of system components
- Lack of support infrastructure for training, second level engineering support, radome maintenance, and logistics

For FY 2019, $4,400,000 is requested for sustainment of the ASTI system. Sustainment efforts will ensure the fielded system remains operational by addressing end-of-life products, evolving security requirements, and ensuring the system architecture is able to meet IP bandwidth and maintainability requirements and will reduce future operations and maintenance costs. The ASTI Sustainment project was established in conjunction with the BCD to address underestimated system sustainment efforts from the original ASTI program baseline. ASTI sustainment will:

- Ensure System Availability continues to meet 0.9999 (for critical services) and 0.999 (for essential and routine services)
- Ensure critical system components required for system operations remain supportable
- Maintain a modern and flexible system to support emerging NAS requirements
- Address Information Systems Security (ISS) requirements

What benefits will be provided to the American public through this request and why is this program necessary?

The ASTI network is an integral part of the communications infrastructure in Alaska and ensures vital communication operations are available to controllers and pilots. Modernization and continued sustainment is critical to continue the availability of a safe and reliable Air Traffic Control System in Alaska. It will improve the reliability of the network that connects air traffic controllers to the radios and sensors that provide the ability to see and communicate with all aircraft within the Alaska Air Space.

Detailed Justification for - 2E06 Facilities Decommissioning

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Facilities Decommissioning	$6,200	$13,900	$9,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Facility Disposition	100	$9,000.0

What is this program and what does this funding level support?

Facilities Decommissioning funds the final disposition of decommissioned infrastructures and associated property restorations, environmental due diligence audits (EDDAs), and required work investigation as listed below:

- Final disposition of decommissioned infrastructure and property restoration to meet all applicable laws, including the appropriate removal and disposal of hazardous materials; appropriate disposal of debris; evaluation of impact upon cultural and historic preservation; and wetlands and natural resource protection issues
- Conducting Phase I EDDA and developing reports for government-owned properties, as required by the General Services Administration (GSA) and other applicable laws
- Investigating and documenting the structure to be removed at each site and associated restoration

For FY 2019, $9,000,000 is requested to fund the final disposition of decommissioned infrastructures and associated property restorations, EDDAs, and investigations of other required work. This funding level will support approximately 100 projects. The current inventory backlog is projected to increase every year due to the discontinuance of ground-based NAS facilities.

What benefits will be provided to the American public through this request and why is this program necessary?

The June 2005 Government Accountability Office (GAO) report, "Air Traffic Operations: The Federal Aviation Administration Needs to Address Major Air Traffic Operating Cost Control Challenges", states that the FAA needs to expand its efforts to cut operational costs to address an expected gap between budget forecasts and expenses. The report recommends accelerating decommissioning of ground-based navigational aids.

In recent years, the FAA has decommissioned many redundant or underused facilities. Funding was identified in FY 2007 to begin the divestiture (including environmental testing, infrastructure demolition, and property restoration) of these facilities. In addition, under the NextGen program, the FAA plans to decommission entire classes of facilities such as non-directional beacons and remote communications facilities.

This program has experienced great success since FY 2005. Funded work results in the release of decommissioned real property from FAA inventory and associated cost avoidance of property lease fees, property maintenance fees (e.g., grass cutting, snow removal), utility fees, and communications frequency fees. There are also monetary gains for the U.S. government in the sale of FAA property no longer needed. Between FY 2008 and FY 2016, the Facility Decommissioning Program disposed of 1,285 sites at a 10-year

cost avoidance of $60,200,000. The program has met or exceeded the FAA performance metrics since 2011.

Detailed Justification for - 2E07 Electrical Power System – Sustain/Support

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Electrical Power System – Sustain/Support	$105,000	$105,000	$140,834

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Electrical Power System – Sustain/Support	---	$140,700.0
B. Continued Maintenance For One Additional Year	---	134.0

What is this program and what does this funding level support?

For FY 2019, $140,834,000 is requested by the Electrical Power Systems – Sustain/Support (PS3) program to sustain NAS power system infrastructure components to provide quality power to its facilities and meet performance requirements by supporting the task activities listed above. PS3 is the Power Services Group (PSG) program that addresses sustainment and support of 11 electrical power system program tasks. The PS3 program provides high quality electrical power that is reliable, maintainable, and available by sustaining and supporting components of existing prime power, power conditioning, power regulator, backup power, grounding, monitoring, and electrical power cable infrastructure as identified in the activity tasks. The funding will reduce a large backlog and address systemic problems by replacing obsolete equipment with state-of-the-art engine generators, power cables, and ACEPS equipment within the NAS.

The PS3 program also supports the Department of Defense's collocated Air Route Surveillance Radar (ARSR) equipment as well as the Department of Commerce's Non-CONUS National Weather Service (NWS) WSR-88D weather radar. PS3 also provides power support to other government agencies with collocate equipment such as the U.S. Coast Guard and the Drug Enforcement Administration (DEA). PS3 NAS interdependencies include providing highly reliable power to Automation, Communication, Navigation, Surveillance, Weather, and HVAC systems.

PSG systems have formal written NAS performance requirements, Reliability, Maintainability and Availability (RMA), and have daily National Airspace Performance Reporting System (NAPRS) requirements. The PS3 primary role is to assume responsibility for sustaining, replacing, and refurbishing components of the power system infrastructure after it has been funded, installed, and commissioned by the NAS implementation offices/programs. The secondary role is, to provide additional equipment such as PCS/UPS, EG, CPDS and DC BUS equipment on a limited, case-by-case basis for locations with poor electrical power quality to ensure meeting overall NAS RMA service goals and requirements.

The FAA PS3 program sustains 11 electrical power systems:

a. National Airspace System (NAS) Batteries: supply DC power either directly to NAS service equipment, such as Very High Frequency Omni-directional Range (VOR) installations, or indirectly to NAS equipment via the ACEPS, PCS/UPS, and DC BUS equipment. Depending on the NAS requirements, batteries can support anywhere from 15 minutes to 72 hours. The Battery Program periodically replaces batteries and monitoring components at En Route, Terminal, and GNAS facilities to ensure NAS service reliability. The periods of replacement range from five years to seven years for Valve Regulated Lead Acid (VRLA)-type battery cells, and in some cases up to 20 years for flooded-type battery cells depending on the type of battery technology used and reliability assessment to support the NAS service.

b. Power Conditioning System (PCS)/Uninterruptible Power Supply (UPS): is a power quality and backup system that conditions commercial power and provides a short-duration power source to prevent power disruptions and surges from adversely affecting electronic system performance and critical NAS infrastructure. The PS3 program currently sustains PCS/UPS systems that have an expected useful life of up to 15 years, with the exception of batteries.

c. Direct Current Backup System (DC BUS): converts commercial AC power to high quality reliable DC power, providing a low-cost, short-term power source at facilities with limited power needs. NAS system availability is increased by preventing commercial power-related outages from disrupting air traffic operations. PS3 sustains DC BUS systems with a useful life of up to 15 years, with the exception of batteries.

d. Air Route Traffic Control Center (ARTCC) Critical and Essential Power System (ACEPS): provides high quality and highly reliable power to the En Route and large Terminal Control Centers. FAA operates ACEPS at 21 ARTCCs and three large Terminal Radar Approach Control (TRACON) facilities. ACEPS is comprised of engine generators, switchgear, and UPS systems. The legacy ACEPS EGs are obsolete with an average age of greater than 50 years old. These EGs are well beyond their expected useful life of 20 years. To address this obsolescence, the PS3 program has developed ACEPS II, Phase I and II. Phase I involves replacing the Critical bus system, and Phase II replaces the Essential bus system.

e. Lightning Protection, Grounding, Bonding, and Shielding (LPGBS): sustains and optimizes components of LPGBS systems to minimize electrical hazards to personnel, facilities, and electronic equipment caused by lightning, voltage surges, electrostatic discharge (ESD), and power faults at NAS facilities. Sites are hardened to prevent NAS delay or loss of service, minimize or preclude outages, and enhance personnel safety.

f. Electrical Line Distribution (ELD): comprises FAA infrastructure at airports and ancillary facilities that distributes electrical power to NAS facilities—primarily 5kV-15kV distribution cables, transformers, and switchgear. Approximately 60 percent of the cable is beyond its useful life. The operational risk to the NAS is rising since the number of ELD-related incidents is increasing at a rate of about five percent per year. At airports, ELD supports the dedicated, long runs of underground power cables that are within the runway's Visual Navigational Aids (NavAids) systems. These systems, such as the ALSF and MALSR, are a required element for instrument landing approaches.

g. Engine Generators (EG): provide backup power when commercial power is unavailable or becomes unreliable. EG projects include installing and sustaining transfer switches. An EG has a 20-year useful life. When EG requirements impact Fuel Storage Tank (FST) programs, PS3 may need to perform some fuel line modifications on a case-by-case basis.

h. Critical Power Distribution System (CPDS): is a set of standardized power system configurations for the FAA's large facilities that include Combined Control Facilities (CCF), large TRACONs, and large airport traffic control towers. Components include electrical distribution equipment, transfer switches, engine generators, UPS, and batteries. The CPDS types have different RMA requirements optimally matched to the criticality and activity level of the NAS facility it serves.

i. Alternative Energy Systems (AES): activities integrate a broad range of clean energy technologies to meet NAS operational demands. Using AES technologies reduces the FAA's carbon footprint and helps to achieve the goals of Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," for reduction of fossil fuel dependencies. Alternative energy generation systems used within the FAA include solar energy, wind energy, fuel cell, and geothermal. PS3 sustains AES installations connected to NAS equipment.

j. Environmental Remote Monitoring System (ERMS): provides power system sensors and interfaces to the ERMS network, which reports power system status to the operations control centers. The information provides the FAA with real-time data on the status of the systems, which allows a response to system-related issues.

k. Program Management and System Engineering: provides system engineering to define and document customer requirements for power systems. It administers requirements through the design phase, system

validation, quality assurance, safety improvement, and useful life. This effort includes identifying options, preparing drawings and administering training, and establishing test facilities. It also includes support for long-lead-time equipment purchases outside of standard project installation schedules.

What benefits will be provided to the American public through this request and why is this program necessary?

The PS3 program achieves its goal of using responsible program management techniques to comply with requirements from Environmental and Occupational Safety and Health (EOSH) and the Environmental Protection Agency (EPA) by reducing arc flash hazards to employees and replacing EGs with new technologies to aid in the reduction of the FAA's carbon footprint. The PS3 program ensures the reliability and availability of electrical power systems to prevent costly delays, and enhances safety for NAS operations to provide reliable world-class air traffic control that is safe and reliable. PS3 sustainment improves the power service technology, assuring that the Next Generation Air Transportation System (NextGen) Program reliably meets its service goals to NAS operations, the global aviation community, and to the American public.

The PS3 program funds the replacement, refurbishment, purchase, and installation of components to sustain NAS electrical power infrastructure valued at several billion dollars. The PS3 program is vital to both maintaining and increasing NAS capacity, reliability, and availability through sustainment of NAS equipment. Without reliable NAS power systems, electronics cannot deliver their required availability. Commercial power disruption results in flights being kept on the ground, placed in airborne holding patterns, or being re-routed to other airports. The PS3 program also prevents expensive damage to ATC electronic equipment. Sustainment prevents system and equipment failures that result in costly delays. The FAA's independent Investment Planning and Analysis (IP&A) Office determined that a single ACEPS outage results in an economic impact to NAS users of approximately $2 million per hour in terms of Aircraft Direct Operating Costs (ADOC) and Passenger Value of Time savings (PVT). (This estimate is based on an August 15, 2016 En Route Automation Modernization [ERAM] outage event at the Washington ARTCC).

To ensure a well-run program, PS3 partnered with the University of California, Berkeley, and the University of Maryland under the auspices of The National Center of Excellence for Aviation Operations Research (NEXTOR), to evaluate performance impacts of power systems to NAS operations.

Detailed Justification for - 2E08 Energy Management and Compliance (EMC)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Energy Management and Compliance (EMC)	$2,000	$2,400	$2,400

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Energy Management and Compliance (EMC)	---	$2,400.0

What is this program and what does this funding level support?

The Energy Management and Compliance (EMC) program orchestrates cost-effective reductions of energy and water use at ATO facilities by coordinating policies, technical support, targeted infrastructure investments, and data analysis and reporting. By upgrading older facility infrastructure, such as mechanical and electrical systems, the EMC program will not only reduce operational costs but also increase reliability of the National Airspace System (NAS) by reducing the likelihood of facility outages and disruptions that can be caused by out-of-service building systems. The EMC program promotes energy and water-use efficiency and the use of off-grid power and non-polluting energy sources for all activities and acquisitions.

For FY 2019, $2,400,000 is requested to support the following projects:

- Perform energy and water improvements at five high energy using facilities
- Develop and implement performance-based contracts to maximize third party investments in ATO infrastructure
- Provide required quarterly and annual reports on progress against legislative and executive order mandates to the Department of Transportation (DOT), the Department of Energy (DOE), and the Office of Management and Budget (OMB)

The EMC program has identified 592 facilities that comprise 75 percent of the ATO's energy usage. The mandates of the Energy Independence and Security Act (EISA) and the Energy Policy Act (EPAct) require the agency to identify and implement recommended energy and water improvements to reduce utility usage and associated costs at these facilities. The EMC program has already identified more than $220,000,000 in recommended improvements to lower energy usage at ATO facilities, many of which would pay back in fewer than 10 years.

What benefits will be provided to the American public through this request and why is this program necessary?

The EMC program is necessary to provide a coordinated approach for identifying and implementing cost-effective investments in the FAA infrastructure to reduce ongoing utility expenses. The American public benefits from reduced energy consumption at FAA facilities as well as cost savings that are the result of those efforts.

Detailed Justification for - 2E09 Child Care Center Sustainment

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Child Care Center Sustainment	$1,000	$1,000	$1,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Child Care Center Sustainment	11	$1,000.0

What is this program and what does this funding level support?

The FAA owned centers are reaching a facility age of 20 - 25 years; many are in need of roof replacements, HVAC system upgrades, and modernization to meet safety and building code requirements. This program has been established as a multi-year sustainment program that will address facility requirements for the 11 FAA Operated Child Care Centers. The Child Care Centers were established to provide FAA personnel with priority enrollment and flexibility to meet the unique schedule needs of air traffic personnel. FAA is responsible for maintaining the safety of the buildings.

The program is necessary to ensure that the Centers are properly maintained, up to local building codes and regulations, and are safe and secure. The lack of a consistent sustainment plan for these facilities has increased the risk to building occupants from failure of critical building components such as roofs, fire life safety and plumbing systems. Centers continue to be funded if/when funds are available. Repairs are prioritized by level of risk. The current level of risk assessment does not take into account that young children occupy the buildings and many "low" risk repairs are higher because of the ages and sizes of the occupants. A sustainment plan would ensure that these facilities are evaluated and repairs are addressed to avoid deterioration.

For FY 2019, $1,000,000 is requested to improve the condition of Child Care Centers (Centers) that are located at FAA facilities. This funding will be used to modernize the 11 FAA Operated Centers that are in need of major projects and other expenses unique to a child care center (e.g. kitchen, children size restrooms). Playground equipment located at FAA Child Care Centers is considered real property, permanent structures, and an integral part of the child care center facility. The fund would not be used to procure daycare supplies (e.g. crayons, paint, toys).

What benefits will be provided to the American public through this request and why is this program necessary?

The required funding specifically allocated to these Centers will decrease deferred maintenance – which is the cost of rebuilding or replacing components whose service life has exceeded their scheduled lifetime. It will remove the risk to building occupants from the potential failure of critical building components and it will increase the employee retention rate, employee satisfaction, loyalty, and decreases job vacancies[1]. Employee satisfaction leads to more productive employees which in turn benefit the American Public by making government more efficient. Additionally, these Centers have a 100 percent accreditation rate compared to only seven percent nationwide rate.

[1] (Source: http://www.childrenschoice.com/benefits-of-employer-sponsored-child-care, http://www.businessweek.com/debateroom/archives/2007/04/day_care_an_office_affair.html)

Detailed Justification for - 2E10 FAA Telecommunications Infrastructure 2 (FTI-2)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
FAA Telecommunications Infrastructure 2 (FTI-2)	$10,360	$2,000	$6,700

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
FAA Telecommunications Infrastructure 2 (FTI-2)	---	$6,700.0

What is this program and what does this funding level support?

The FTI-2 program is the successor to the existing FTI program which provides the majority of the telecommunications services required by the FAA. Telecommunications services are essential to the operations of the National Airspace System (NAS) and the FAA. As the FTI program comes to an end, FTI-2 is necessary to ensure there is no interruption to the NAS and FAA operations. The current FAA Telecommunications Infrastructure (FTI) program is providing services today with its contract ending in 2017 and an extension contract through 2022. FTI-2 will provide high-availability, low latency telecommunications services for NAS systems and a separate Mission Support network that serves as the FAA's Intranet for secure connectivity to FAA internal administrative applications as well as the public Internet.

FTI-2 will be responsible for establishing a modern infrastructure that is capable of meeting the FAA's future demands for telecommunications services through 2035. FTI-2 will provide a robust competitive environment for meeting the FAA's future telecommunications needs. For example, FTI-2 will implement modern Internet Protocol (IP)-based infrastructure to replace legacy Time Division Multiplex (TDM)-based infrastructure that will no longer be supported in the commercial marketplace. The FTI-2 network infrastructure will support the connectivity requirements of NextGen-enabling programs such as the NAS Voice System (NVS) and Data Communications (Data Comm).

For FY 2019, $6,700,000 is requested for engineering, implementation, planning, and market research activities. These activities will define requirements and develop acquisition work products for an Initial Investment Decision (IID) in FY 2019 and begin acquisition activities related to Final Investment Decision (FID). Additionally, the funding will cover necessary resources, program and contract support, for development of the RFP to be released in 2020.

What benefits will be provided to the American public through this request and why is this program necessary?

The FTI-2 program will benefit the American Public directly and indirectly upon implementation:

- Ensure continuity of the telecommunications services required for the operation of the United States Air Traffic Control system as the existing telecommunications services contract reaches the end of its period of performance
- Reduce telecommunications service delivery timeframes so that new capabilities can be put into operation more quickly to support the flying public and air carriers
- Provide enhanced network service monitoring, control, and security capabilities that improve visibility in outage impacts and reduce restoration times

- Provide the enhanced security capabilities needed to ensure secure communications with internal and external stakeholders that depend upon the FAA's wide area networks and SWIM enterprise messaging services

Detailed Justification for - 2E11 Data Visualization, Analysis and Reporting System (DVARS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Data Visualization, Analysis and Reporting System (DVARS)	$6,500	$5,500	$4,500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Data Visualization, Analysis and Reporting System	---	$4,500.0

What is this program and what does this funding level support?

The Data, Visualization, Analysis and Reporting System (DVARS) program will provide data and analyses on NAS operations to FAA executives, Air Traffic Managers, and Air Traffic Operations personnel to help them identify deficiencies and develop proposals to improve NAS performance. DVARS is a replacement for the Performance Data, Analysis and Reporting System (PDARS) which currently provides a means for field facility personnel and FAA offices to develop recommendations for improving the NAS through identification of capacity and system efficiency improvements to reduce delays. PDARS provides data, tools, and analysis to operational facilities.

- DVARS will serve as a replacement to PDARS utilizing a modernized platform. DVARS will provide the same capabilities as PDARS through integrated visualization and reporting tools that allow users to access quality NAS data and perform modeling, analysis, and trending. DVARS will provide added benefits to the FAA that include a centralized NAS Database, streamlined system updates with no required field facility technology refresh, the ability to expand user access, and less overall dependency on contract support. In FY 2018 the final Design Review for DVARS will be completed and work will begin on the development of the DVARS data and processing system to meet program requirements

For FY 2019, $4,500,000 is requested to complete implementation of DVARS data and processing system capabilities as the foundation of the PDARS modernization. Critical enhancements and transition support to the PDARS system will also be funded from this program.

What benefits will be provided to the American public through this request and why is this program necessary?

Planning for facility and system enhancements requires the ability to track, monitor, and analyze the daily NAS operations. The modernization of PDARS planned through the implementation of DVARS will provide a modernized enterprise solution inclusive of data processing, visualization, and reporting. DVARS will provide the same functionality and products as the legacy system on a modernized platform. Users will gain access to ad hoc reporting capabilities and will be able to query the database and create their own custom reports without assistance from the help desk. In addition, DVARS will increase its impact through improved accessibility of the tools that support this type of work across the FAA, which will result in greater productivity gains.

Detailed Justification for - 2E12 Time Division Multiplexing (TDM)-to-Internet Protocol (IP) Migration

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
TDM-to-IP Migration	$0	$3,000	$3,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
TDM-to-IP Migration	Various	$3,000.0

What is this program and what does this funding level support?

Major U.S. telecommunications carriers have stated their intention to discontinue Time Division Multiplexing (TDM)-based services as early as Calendar Year (CY) 2020. The FAA is highly dependent on these services. More than 90 percent of the 23,000+ services obtained under the FAA Telecommunications Infrastructure (FTI) contract are TDM-based to meet the interface requirements of systems that provide critical NAS services such as surveillance radar, air/ground voice, and interphone (ground/ground voice). FTI makes extensive use of the infrastructure of commercial telecommunications carriers to reach more than 4,000 facilities operated by the FAA. To reach such widely dispersed locations, the majority of services are provisioned over wireline infrastructure provided by Local Exchange Carriers (LECs) and Inter-exchange Carriers (IXCs). As these carriers phase-out, TDM-based infrastructure and migrate to IP-based technology, the potential impacts to the FAA are significant because the majority of NAS services are dependent upon the precision timing, deterministic performance, and low latency of TDM-based services.

The FAA has developed a TDM-to-IP migration strategy that identifies a three-pronged approach for addressing the phase-out of TDM-based services:

- Modernize NAS systems to support IP communications with standard Ethernet interfaces
- Modernize the system communications interface of NAS systems to be IP-compatible as part of the standard technology refresh process
- Implement FTI provided TDM-to-IP network conversion device

For FY 2019, $3,000,000 is requested to provide funding for the TDM-to-IP Portfolio Programs to begin development of the following TDM-to-IP requirements:

- Continue development of an Enterprise Interface Modernization Solution
- Begin development of changes to the AWOS/ASOS systems to be fully IP compatible (ASWON)
- Contractor support for the PMO's management and oversight of the TDM-to-IP migration activities

What benefits will be provided to the American public through this request and why is this program necessary?

The work under this program supports FAA initiatives to improve the NAS resiliency through a robust infrastructure that has the ability to auto-recover during outages so they will be transparent to FAA end user systems and result in a reduction in air traffic delays

Detailed Justification for - 3A01 Hazardous Materials Management

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Hazardous Materials Management	$31,000	$35,300	$29,800

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Hazardous Materials Management	164	$29,800.0

What is this program and what does this funding level support?

The FAA operates the HAZMAT management program to clean up approximately 657 contaminated areas of concern that require investigation, remediation, and closure activities. Investigations at the identified sites have revealed that toxic contamination resulted from a variety of hazardous substances, including cleaning solvents, degreasing agents, pesticides, asbestos, polychlorinated biphenyls, and heavy metals.

The FAA has identified cleanup schedules in place as part of enforcement agreements with regulatory agencies. These agreements require the FAA to remediate contaminated soil and groundwater. Extensive contamination at the William J. Hughes Technical Center (WJHTC) in Atlantic City, New Jersey prompted the Environmental Protection Agency (EPA) to place the site on the EPA's National Priority List (NPL) or "Superfund" as one of the nation's most environmentally dangerous sites. Other contaminated sites (many of which are located in Alaska) and the requirements of the HAZMAT management program account for a large portion of unfunded environmental liabilities documented in the FAA's financial statements.

For FY 2019, $29,800,000 is requested to continue the management and remediation of 657 contaminated areas of concern (AOCs), as of October 2016. To achieve compliance with all Federal, State, and local environmental cleanup statutes, including the Resource Conservation and Recovery Act (RCRA) of 1976, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and the Superfund Amendments and Reauthorization Act (SARA) of 1986, the FAA must continue mandated program activities.

The $29,800,000 is requested to:

- Continue the management and remediation of 164 contaminated AOCs.
- Continue remediation activities at the National Priority List (NPL) Superfund site at the William J. Hughes Technical Center (WJHTC).
- Move the status of sites listed on the Environmental Protection Agency (EPA) Federal Hazardous Waste Compliance Docket (Docket) to "No Further Remedial Action Planned (NFRAP)" status. The majority of non-NFRAP status sites remaining on the Docket have significant technical challenges to obtaining closure (e.g., long timeframe for site remediation, Superfund site, and ownership liability issues). The five remaining FAA Docket sites include the Mike Monroney Aeronautical Center (MMAC); Ronald Reagan Washington National Airport (DCA); WJHTC; the Alexandria International Airport (AEX) Air Route Surveillance Radar (ARSR); and the Sunset Cove, Alaska (JNU) remote communications outlet (RCO).
- Continue to perform investigations and remediation projects at all other identified contaminated sites under Federal, State, and local mandates and enforcement agreements to limit future liability to the agency and foster environmental stewardship.

- Postponing remedial activities at these contaminated AOCs can lead to noncompliance with the Federal, State, and local environmental cleanup statues. Noncompliance with these statues includes maximum penalty amounts that range from $1,000 (Bahamas) to $100,000 (Alaska) for the first day of violation, and that range from $1,000 (Bahamas and Idaho) to $50,000 (Hawaii, New Hampshire, and New Jersey) for each day after the first day of violation.

What benefits will be provided to the American public through this request and why is this program necessary?

The HAZMAT program intends to annually remove 10 percent of the average Program's cumulative closures from FY 2009 to present calculated as 70 of the AOCs listed in the HAZMAT management program's published Environmental Site Cleanup Report (ESCR). The FAA continues to exceed closing 70 AOCs annually. In FY 2016, the HAZMAT program began the year with 697 AOCs and removed 150 AOCs. However, during FY 2016, 110 new AOCs were added to the program. These new AOCs were predominately inflows from the facility decommissioning program. From FY 2009 through FY 2016, the HAZMAT management program has closed 556 AOCs.

The direct outcome of closing these sites leads to overall decreased environmental remediation (ER) liability to the FAA. The FAA is currently analyzing alternate remedial technology that optimizes remediation and cost efficiency. Examples of this optimization are at Area D, Area 20A, and Area 29 at the WJHTC NPL site, which is expected to yield at least a 1,000 percent return on investment (ROI) at Area D, 69 percent ROI at Area 20A, and 280 percent ROI at Area 29. Investigating, remediating, and obtaining site closure at the FAA's contaminated AOCs also increases employee and public safety by minimizing exposure to toxic and hazardous substances at these sites.

Detailed Justification for - 3A02 Aviation Safety Analysis System (ASAS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aviation Safety Analysis System (ASAS)	$11,300	$12,000	$18,899

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Aviation Safety Analysis System (ASAS)	---	$18,700.0
B. Continued Maintenance For One Additional Year	---	199.0

What is this program and what does this funding level support?

For FY 2019, $18,899,000 is requested to perform technology refresh of existing Information Technology (IT) infrastructure components supporting the Aviation Safety (AVS) safety workforce. This funding is required for Aviation Safety Analysis System (ASAS) Regulation and Certification Infrastructure for System Safety (RCISS) Segment 3 to continue deploying modern IT services in the following areas:

- Mobile Technologies
- Remote Connectivity Telecommunications
- Consolidated Server/Storage Area Network (SAN) Systems
- Safety System Hosting Services
- Enterprise Software
- Disaster Recovery
- Continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

These services ensure continuity of operations for critical and non-critical safety systems. Additionally, these services ensure that critical safety data are safeguarded against loss by providing a secure, reliable and timely back up of data. They also support the coming integration of AVS's disparate safety data, where individual stove-piped applications own specific data sets, into an enterprise level data store that isolates the data from the applications. In this new environment, safety workers assemble data as needed from various data sources to support new business processes. Data in these data stores requires critical recovery response.

ASAS RCISS provides all IT infrastructure components that support the AVS safety workforce and ensures standard and reliable accessibility to safety data. As it has done since inception, the program is continuing to enhance and maintain the AVS IT infrastructure to meet evolving AVS business needs by addressing its mobile safety workforce requirements and changes in the aviation industry. The program focuses on providing safety data to the AVS workforce while they are mobile (off-site); conducting safety inspections and investigations of airlines, manufacturers, pilots, accidents, etc.; and provides methods to access all AVS national safety applications developed by System Approach for Safety Oversight (SASO), Aviation Safety Knowledge Management Environment (ASKME), Aerospace Medicine Safety Information System (AMSIS), and all other AVS national safety programs including the Pilot Records Database (PRD) and Unmanned Aircraft Systems (UAS) initiatives. The ASAS RCISS infrastructure directly contributes to the success of AVS in meeting its mission goals as it is developed, implemented and administered as an integrated IT solution that provides the AVS safety workforce with the tools to perform their vital safety work.

RCISS investments encompass the following six key component areas:

- Devices for AVS's 6,400+ safety workforce (including mobile devices) - Activities include lifecycle replacement of existing devices to meet operational demands and replace outdated or malfunctioning devices.
- Telecommunications - Activities include lifecycle replacement of existing network devices and procurement of additional equipment and services where telecommunications bandwidth is deficient.
- Enterprise Services (hardware and software which allow components of the infrastructure to work together) - Activities include lifecycle replacement of existing devices and software.
- Application Data Servers (hosting of national AVS safety applications) - Activities include lifecycle replacement of existing servers and storage devices as well as supporting AVS migration to cloud based services.
- Commercial-Off-the-Shelf (COTS) software (operating systems, databases, data visualization, etc.) - Activities include acquisition and maintenance of enterprise software licenses.
- Contractor Support - Activities include providing the knowledge and expertise necessary to refine and streamline the ASAS RCISS enterprise infrastructure

ASAS RCISS addresses AVS's need for an enterprise IT infrastructure that supports AVS personnel responsible for promoting aviation safety through regulation and oversight of the civil aviation industry. It supports the AVS safety workforce in their effort to reduce aviation accidents by making real-time safety data immediately accessible to and from all involved, e.g., inspectors, engineers, investigators, and medical examiners. The ASAS RCISS IT infrastructure was designed to be flexible and scalable, allowing for adaptation to meet emerging AVS business requirements.

Additionally, work load capacity, performance, and reliability of the workforce is increased and enhanced by the ASAS RCISS IT Infrastructure. The infrastructure enables AVS to evolve its business processes without additional staffing requirements, such as allowing for a more mobile workforce and the creation of virtual workplaces.

What benefits will be provided to the American public through this request and why is this program necessary?

ASAS RCISS enables the safety benefits promised by the SASO, ASKME and AMSIS programs by providing the IT infrastructure they require. The data developed, manipulated, analyzed, and reported on by the SASO, ASKME and AMSIS programs will reside on the ASAS RCISS IT infrastructure. Without the ASAS RCISS IT infrastructure, the full capabilities and benefits promised by SASO, ASKME and AMSIS will not be realized.

To demonstrate its effectiveness, the ASAS RCISS program provides detailed reports about its IT investments and their progress over time to senior FAA executives. The ASAS RCISS program assesses actual program results against baseline expectations, determining if performance and benefit targets, as well as customer needs, are being met. The program management team continues to conduct surveys and data calls to monitor actual investment costs, schedules, benefits, performance, and mission outcomes.

The RCISS program management team periodically surveys end users to measure effectiveness of mobile safety devices deployed. Results are used to validate that solutions meet end user requirements and to identify lessons learned for future deployments. Surveys conducted to date have successfully demonstrated user satisfaction and validated safety workforce productivity projections.

The following program performance measures have consistently been met:

- Cost and schedule performance variances have never exceeded baseline management thresholds
- Availability of end user mobile telecommunication devices to the AVS safety workforce
- Technology refresh of end user devices to assure an acceptable level of system reliability, maintainability, and availability
- Development of standard aviation safety data sets to ensure enterprise conformity to increase efficiency and effectiveness of data analysis

Detailed Justification for - 3A03 National Air Space Recovery Communications (RCOM)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
National Air Space Recovery Communication (RCOM)	$12,000	$12,000	$12,200

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. National Air Space Recovery Communication (RCOM)	---	$12,000.0
B. Continued Maintenance For One Additional Year	---	200.0

What is this program and what does this funding level support?

For FY 2019, $12,200,000 is requested for RCOM. This project supports the Command and Control Communications (C3) project that provides the FAA with the capability to directly manage the National Airspace System (NAS) during local, regional and national emergencies or unique situations. When normal common-carrier communications are interrupted; C3 provides and enhances a variety of fixed-position, portable, and transportable emergency communications systems that support crisis management; enables the FAA and other Federal agencies to exchange classified and unclassified communications to protect national security; and supports and modernizes the Washington Operations Center Complex and several FAA continuity of operations (COOP) sites. This ensures FAA decision makers have command and control communications during times of crisis. Funding is requested to meet the minimum support necessary to maintain the infrastructure mandated by Federal continuity directives.

FY 2019 Funding will be spent on the following activities:

- $2,409,000 to continue funding the Very High Frequency (VHF)/Frequency Modulated (FM) and national High Frequency (HF) radio network modernization efforts. Existing regional networks will continue to operate in the 25 kHz mode until all antiquated infrastructure equipment has been replaced with 12.5 kHz equipment in accordance with the National Telecommunications and Information Administration (NTIA).
- $3,558,000 to continue funding the Emergency Operations Network (EON). Support includes the continued development of EON Geographical Informational Systems (GIS) layers, maps, and visualization tools, as well as the EON Dashboard, EON Collaborative Communication platform, and the EON Data Discovery platform.
- $1,456,000 to continue funding the Emergency Operations Facilities activities which include the continued support of activities related to audio/video display systems, national situational awareness view, Domestic Event Network (DEN), incident monitoring, Emergency Notification System (ENS), conference-bridge, help desk support, and equipment refresh.
- $344,000 for support of the Communications Support Team (CST) emergency response activities, related communication equipment, and Emergency Response Vehicle (ERV).
- $258,000 for continued funding of Secure Communications (COMSEC) activities and exercises to ensure continued system viability related to all secure telephone, secure facsimile, and secure classified communication equipment.
- $3,329,000 for continued funding of C3 Information Technology (IT) activities used to maintain the IT infrastructure for COOP sites and the Emergency Operations Network.
- $646,000 for continued support and refresh of the Satellite Telephone Emergency Network (STEN).
- $200,000 to continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

In 1995, the National Telecommunication and Information Administration (NTIA) mandated a change in the frequency bandwidth used by the legacy VHF/FM network. As a result, the older VHF/FM radios that are configured to the outdated frequency separation requirements can no longer be utilized. In addition, the current system lacks coverage and integration with current VHF/FM equipment. This makes it difficult, and often impossible, to communicate over long distances. Network hardware has been fielded for approximately 20 years, long past its expected life cycle. For example, the cost to repair one module is more than the purchase of a new modern radio, yet for compatibility reasons, the repair of outdated equipment is continued.

The C3/RCOM program office also has Presidential and Congressionally mandated responsibilities to provide reliable communications support to the White House, Department of Transportation, FAA and other government agencies during national security events, disaster recovery efforts, accident investigations, government exercises, and special invitational events.

Other efforts within the C3/RCOM program revolve around National Security. There are several operational command and control centers within the Washington area and other sites around the country that require modernization. Since September 11, 2001, the C3/RCOM program has had its responsibilities increased to meet the current national security demands.

What benefits will be provided to the American public through this request and why is this program necessary?

The FAA's C3/RCOM program has a mission to develop web-based emergency operation information-sharing tools that create a common operational picture and support effective decision-making. A secure, highly available, and flexible infrastructure has been created for effective collaborative communications, continuity of operations, and adaptive situational awareness for enhancing decision support. This Emergency Operations Network (EON) infrastructure has been built upon existing FAA networks and technologies and the operations framework is built upon the lessons and best practices learned from previous and existing initiatives.

The American public benefits from the C3/RCOM program by ensuring that the FAA can reliably and continuously communicate and exchange information, enabling operations and decision-making at all times, especially during times of crisis and natural disaster.

Detailed Justification for - 3A04 Facility Security Risk Management

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Facility Security Risk Management	$21,000	$20,400	$18,608

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Facility Security Risk Management	---	$17,800.0
B. Continued Maintenance For One Additional Year	---	808.0

What is this program and what does this funding level support?

In 1999, the FAA established the FSRM program. The program implements standardized facility protective measures at all FAA staffed facilities. These measures include personnel access control (via card readers, fencing, gates, and security guards), surveillance (cameras), vehicle access control (barriers), visibility enhancements (lighting), and X-ray machines. The FSRM program participates in the construction of facilities that secure FAA personnel and assets, such as guard houses, and facility retrofitting to protect against blast (explosive attacks).

The FSRM program manages contracts that install security systems, and that provide maintenance services to installed security systems regardless of age, manufacturer, or condition. In addition to the protection of FAA personnel and assets, another program goal is one of standardization across the National Airspace System (NAS). The standardization of security equipment and processes will result in a substantial cost savings to the FAA. To aid in NAS-wide standardization, the FSRM program facilitates security system installation for not only Air Traffic Organization (ATO) facilities, but also for facilities serving the Aviation Safety (AVS) and Airports (ARP) lines of business within the FAA. FSRM is participating with NextGen Planning to identify the security needs and vulnerabilities of NextGen facilities, to ensure that the safety and security of FAA assets and personnel are maintained as the FAA prepares for the future of flight.

The FSRM program is instrumental in ensuring that FAA efficiently and cost effectively implements all issued Presidential Directives aimed at securing Federal facilities and personnel. For FY 2019, $18,608,000 is requested to support security upgrades that will result in increased security at FAA staffed facilities.

- Construction/Installation for security upgrades
- Engineering design and equipment installation for the Eastern and Western Pacific regional offices
- Security PIV upgrades at SL 2 and SL 3 facilities
- Technology refresh of security systems at SL 3 facilities to replace outdated security equipment
- Begin installation of cameras and PIV card readers at all access points to areas housing critical NAS systems in all ARTCCs and ATCT/TRACONs that support the busiest US terminal areas
- Continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request

What benefits will be provided to the American public through this request and why is this program necessary?

FSRM has contributed to obtaining security accreditation at over 980 FAA facilities. This was accomplished by the program's management of national contracts through which security measures such as X-ray machines, cameras, card readers, gates, vehicle barriers, etc., were installed. The installation of the measures led to security accreditation of the facility as required by FAA Order 1600.69. The impact of those upgrades has been to reduce the risk of the facility to intrusion and unauthorized entry. The FSRM program is necessary because aviation assets are attractive targets for those who would seek to harm and terrorize the American public.

Detailed Justification for - 3A05 Information Security

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Information Security	$24,970	$20,700	$16,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Information Systems Security (ISS)	---	$12,000.0
B. NAS Critical Infrastructure Cyber Enhancements	---	4,000.0

What is this program and what does this funding level support?

For FY 2019, $12,000,000 is requested to fund Mission Support Information Systems Security (ISS), and $4,000,000 is requested for National Airspace System (NAS) Critical Infrastructure Cybersecurity. The requested funding supports the integrity and availability of all critical systems, networks, and infrastructure under conditions of increased threat from cyber terrorism and malicious activities. The Federal Information Security Management Act (FISMA) of 2014 requires that the FAA must identify and provide information security protection commensurate with the risk and magnitude of potential harm that could result from unauthorized access, use, disclosure, disruption, modification, or destruction of information that supports the agency, aviation safety and security, and the NAS. This includes detection of alerts and attacks generated against the FAA/DOT infrastructure, mitigation of cyber events, and privacy breaches.

The FAA plays a crucial role in the Nation's critical infrastructure through management of the national airspace and other critical mission systems for air transportation. Protecting this infrastructure and mission from cyber-attacks is crucial and requires a mature and effective security operations capability supported by an integrated security program. The FAA SOC serves as the foundation of the FAA Security Program by providing defensive knowledge of threats, attacks and weaknesses in the FAA networks and systems. Detection of threats and attacks are the Security Operations Center's (SOC's) first priority which enables the FAA to successfully engage in the simultaneous detection of opportunistic malware and attack campaigns.

Funding supports a comprehensive cybersecurity strategy implementation that will enhance and refine the FAA cybersecurity structure. The effort helps to clarify cybersecurity roles and responsibilities, improve management security controls, fully incorporate National Institute of Standards and Technologies (NIST) security guidelines throughout the system life cycle, incorporate all areas of software development and life-cycle processes, and address the interdependencies between aircraft and air traffic systems.

The FAA is evolving its risk-based approach to computer network defense by integrating new technologies into the cybersecurity program. This includes participation in the Continuous Diagnostics and Mitigation (CDM) program, led by the Department of Homeland Security (DHS), which is designed to support the organization's continuous monitoring strategy by centralizing inventory management and control, scanning and patching capabilities, and device monitoring and reporting.

The ISS Cybersecurity Program protects FAA information and information systems, inclusive of personally identifiable information (PII), and ensures the integrity, confidentiality and availability of more than 300 FAA critical information systems, networks, and infrastructure. ISS enhances safety and security between NAS and Non-NAS systems as they are connected to the Mission Support Domain.

The FAA is transforming its Security Operations Center (SOC) to improve processes, communications and escalation, tooling, and analysis capability. The SOC is a 24x7x365 operation that represents the DOT as the single source provider of the cyber "big picture" when reporting to DHS, and provides effective, enterprise-focused cyber security services to its customers. It is the central reporting point for all cyber events occurring within the FAA and DOT. At the Federal reporting level, the SOC holds seats on the National Cyber Response Coordination Group (NCRCG), the DHS-sponsored emergency action team, and the advisory council reporting directly to the White House.

The NAS Critical Infrastructure Cybersecurity Program provides services and capabilities for Air Traffic Control (ATC) to ensure the NAS remains secure and resilient. This includes enterprise security services:

- NAS Data Flow Monitoring (Intelligent Traffic Monitoring (ITM)) – Enables full monitoring coverage of data flows (internal and external) through implementation of cyber security sensors throughout the NAS thereby enhancing modeling and detection of anomalous data flow activities. This supports a proactive versus reactive cyber security response, fostering actions geared to minimizing potential impacts to ATC operations. NAS Data Flow capture and processing infrastructure will be deployed at NAS operational facilities to provide this capability. This capability is currently in development and implementation will be complete in FY 2019.

- NAS Centralized Software Security Management (CSSM) – Provides the FAA with the capability to effectively monitor the security posture of NAS-wide systems. It improves the cyber security posture of the NAS by providing a centralized capability for security patch and malicious code protection updates and establishing a standard secure method to access critical security configuration updates. This capability begins development with funding in FY 2018 and continues through FY 2019.

What benefits will be provided to the American Public through this request and why is this program necessary?

The continuing mission of the FAA is to provide the safest, most efficient aerospace system in the world. Such efforts include satellite communications, navigation, weather and aircraft worthiness to prevent aviation related fatality, injury or significant property loss. The FAA is undertaking multiple strategic and tactical initiatives in the development of a comprehensive and strategic framework to reduce cybersecurity risks to the NAS, civil aviation, and agency information systems. Cybersecurity ensures the reliability and accessibility of systems to the flying public.

The number of users and air traffic in the national airspace, and industry stakeholders, has increased dramatically. This coupled with hundreds of internal and external users traversing the gateways has increased the risk likelihood and potential threat damage. This may include unauthorized access to NAS and non-NAS systems. A major threat facing federal government departments and agencies is cyber espionage. Nation-state actors routinely engage in cyber espionage activities in order to steal critical information in an effort to gain advantages politically, economically, and militarily. There is a pattern of ongoing attacks to access and maintain a presence in the network and data of the target Department or Agency. Sophisticated threats, which are found with increasing frequency within government networks and engage in long-term cyber espionage activities, have become known as advanced persistent threats (APTs). Damage to, or compromising of, FAA systems and aviation safety related information, including Air Traffic, Airway, and Airport Information Systems, Pilot and Airman Medical processing and Certifications, have serious consequences to the entire aviation community and American public.

Detailed Justification for - 3A07 System Approach for Safety Oversight (SASO)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
System Approach for Safety Oversight (SASO)	$17,200	$25,800	$25,400

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
SASO Phase IIB	---	$25,400.0

What is this program and what does this funding level support?

For FY 2019, $25,400,000 is requested to continue the System Approach for Safety Oversight (SASO) Phase IIB, Segment 1a investment program development for the Safety Assurance System (SAS).

The SASO program goal is to increase safety and control cost by adopting the International Civil Aviation Organization (ICAO) mandate to revise Safety Programs to incorporate Safety Management System (SMS) principles. To accomplish this, the SASO Program is reengineering Flight Standards Service (AFS) business processes and developing an oversight system based upon SMS principles. SASO is closing the performance gap between a "regulatory compliance-based" approach and the reengineered SMS-based approach to safety oversight. The SASO program transforms AFS to an SMS-based national safety system standard.

As the regulator of a major segment of the U.S. aviation industry, AFS continually strives to improve aviation safety. AFS is responsible for oversight of nearly the entire civil aviation industry using the National Airspace System (NAS). The legacy safety oversight system is stove piped, reactive in nature, and "regulatory compliance-based." While many technical and human factors problems contributing to accident rates were resolved, more complex organizational factors remain requiring additional systems-based, data-supported analysis and assessment for their resolution.

Increases in technical and operational complexity of aviation operations and introduction of new technologies further stress today's oversight system. SASO implements a more structured data-supported risk-based oversight system allowing inspectors to directly enter information into the SAS tool. FAA uses SAS as a hazard identification and risk assessment tool to formulate surveillance plans and target FAA resources. The scope of the investment includes reengineering AFS business processes and consolidating AFS applications into the appropriate number of enterprise applications to serve 4,800 FAA Aviation Safety employees, in eight regions, at headquarters and approximately 100 field offices, and more than 25,000 additional aviation industry professionals managing aviation safety throughout the United States.

SASO Phase IIB, Segment 1a is the second phase of SAS development and implementation and covers the years FY 2015 through FY 2023. During this phase, SASO expands SAS functionality to include a selection of high priority Title 14 Code of Federal Regulations (CFR) Parts regulated by AFS, and changes AFS business processes to incorporate additional SMS components (safety policy, safety risk management, safety promotion). SASO Phase IIB, Segment 1a implements the SASO program requirements associated with safety oversight of aviation training schools and adds an interface with the Designee Management System. SASO Phase IIB, Segment 1a enhances SAS functionality in the areas of activity recording, office workload list, risk profile, and the Certificate Services Oversight Process. SASO Phase IIB, Segment 1a also develops and implements efficiencies in the repair station assessment process. Finally, SASO Phase IIB, Segment 1a develops SMS safety educational materials and support systems for general aviation certificate holders. Follow-on Phase IIB segments will be prioritized to address remaining SASO program requirements.

During FY 2019, SASO Phase IIB, Segment 1a plans core activities to continue the full-scale SAS automation development, integration and testing process. SASO focuses on accomplishing the SASO Phase IIB, Segment 1a software Development Testing 2 (DT2) milestone early in FY 2019. After completion of DT2, SAS development, integration and testing continues during the year and leads to full Phase IIB, Segment 1a functionality by the end of FY 2019, and SASO accomplishes another acquisition program baseline milestone, Beta Testing. Program activities include Independent Verification and Validation (IV&V) of SAS software throughout the year. FY 2019 funding also supports training course development and change management efforts for the AFS workforce transition to the new business processes and SAS functionality. Finally, FY 2019 funding provides resources for continued program management of the SASO program, including an investment analysis of SASO Phase IIB, Segment 1b, which contain additional Phase IIB requirements that were not funded in SASO Phase IIB, Segment 1a.

The success of the SASO program depends upon continued development funding through FY 2027 to achieve and sustain full benefits. The required funding supports further SAS automation development, policy updates, training, and implementation to achieve the full oversight capabilities and benefits as envisioned during the business process reengineering analysis and design phase of the program.

What benefits will be provided to the American public through this request and why is this program necessary?

The primary benefit of the SASO program to the American public is its contribution to the reduction of aviation accidents and fatalities. By implementing the SMS principles, AFS oversight of the aviation industry will result in fewer accidents attributable to gaps or failures of FAA oversight. Standardization and consolidation of business processes and associated systems will lower maintenance costs as well as increase efficiency of the AFS workforce while maintaining, rather than increasing, the current number of aviation safety inspectors.

Requested resources support development and implementation of reengineered business processes and the SAS. Using the new processes and tools, the AFS workforce will be better able to focus its resources on the highest risk areas in the National Airspace System. AFS expects to contribute to reducing the commercial air carrier fatalities per 100 million persons on board by 24 percent over the nine-year period (2010 - 2018), no more than 6.2 in FY 2018. The flying public is the primary beneficiary of the SMS-based safety oversight system of the aviation industry.

SASO directly supports DOT's Strategic Goal of Safety: Improve public health and safety by reducing transportation related fatalities and injuries.

Detailed Justification for - 3A07 Aviation Safety Knowledge Management Environment (ASKME)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aviation Safety Knowledge Management Environment (ASKME)	$4,200	$4,000	$6,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Aviation Safety Knowledge Management Environment (ASKME) Segment 2	---	$2,000.0
B. Aviation Safety Knowledge Management Environment (ASKME) Segment 3	---	4,000.0

What is this program and what does this funding level support?

ASKME is a suite of functional components designed to support and enable the FAA Aircraft Certification Service (AIR) to more efficiently certify new aircraft and modifications to existing aircraft, and assist The FAA Safety Organization (AVS) to achieve critical agency goals including safety, organizational excellence, continued operational safety management, and international leadership. ASKME will provide specific capabilities including knowledge management, integrated data management, monitoring and predictive analysis of safety data, and business process assistance tools. The use of these tools will strengthen AVS in its core business areas of regulation and certification and further promote the concept of continued operational safety management both inside and outside of the agency, facilitating stronger partnerships with industry, domestically, and internationally.

The ASKME Program will:

- Implement a proactive safety management system that will identify and address safety risks and accident precursors throughout the product lifecycle of design, manufacturing, operations, and maintenance as well as automate lessons learned feedback mechanisms.
- Provide comprehensive, real-time, organization-wide access to current and historic digital and paper-based documentation aimed at supporting effective and timely decision-making in standards, certification, and continued operational safety.
- Enable real-time collaboration among Aircraft Certification Service (AIR) technical staff, industry, international aviation agencies, applicants, approval holders, and designees to facilitate effective and timely decision-making.

When integrated into the safety management approach and practices, these combined capabilities will enhance aviation safety and promote a culture of system safety. For FY 2019, $4,000,000 is requested for activities that include the development, test, and deployment of software enhancements to ASKME Segment 1 and ASKME Segment 2 systems, including updates to the underlying technology, functionality updates based on the changes to the AIR organization and its business processes, and end-user-generated requests.

What benefits will be provided to the American public through this request and why is this program necessary?

The goal of ASKME is to improve the Aircraft Certification Service's (AIR) ability to fulfill its mission and, by extension, facilitate air travel accident prevention. Significant improvements to certification programs, the release of new policies and guidance, designee approval or renewal, and response to inquiries will ensure a positive effect on the vitality, safety, and efficiency of the aviation industry.

Detailed Justification for - 3A08 Aerospace Medical Equipment Needs (AMEN)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aerospace Medical Equipment Needs	$3,000	$7,000	$14,078

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Wind and Wave Evacuation and Survival (WiWAVES) Facility	1	$14,000.0
B. Continued Maintenance For One Additional Year	---	78.0

What is this program and what does this funding level support?

For FY 2019, $14,000,000 is requested to enable the Wind and Wave Evacuation and Survival (WiWAVES) program to replace the aging Water Survival Research Facility (WSRF) at CAMI. To begin the process of building the new WiWAVES facility, the following actions will be required in FY 2019 as follows: (a) Award Construction contract for Phase 1 to include site preparation and relocation of the utilities for the WiWAVES facility. In addition, $78,000 is requested to continue the maintenance of deployed systems from the AMEN II Sustainment II program for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

The Civil Aerospace Medical Institute (CAMI), located at the FAA Mike Monroney Aeronautical Center (MMAC) in Oklahoma City, OK, supports the Office of Aviation Safety's (AVS) mission as the medical certification, education, research, and occupational medicine wing of the Office of Aerospace Medicine (AAM). CAMI also supports numerous federal agencies, local law enforcement agencies, and private industry.

CAMI plans to construct a new Wind and Wave Evacuation and Survival (WiWAVES) Facility, to be located west of the CAMI building. The WiWAVES facility will be approximately a 50,000 sq. ft. building that houses a water survival tank and a dry test area comprising a wind and wave chamber for escape and survival systems equipment studies, wind studies, research, education and testing. The tank and dry test area will be surrounded by structural and mechanical apparatus necessary to support: Fuselage placements; aircraft attachments for multiple escape slides; deployment of water survival inflatables; wind machines to emulate high-fidelity windstorm operating environments; and wave generating capability necessary to challenge the design and function of water safety and survival equipment and procedures. These upgrades are designed to facilitate the FAA's research and education activities that ensure aircraft passengers have the knowledge and equipment necessary for water survival during emergency situations. No other such capability currently exists within the civil aviation industry.

WiWAVES is replacing the current WSRF, a water tank that was installed in 1967 and is deteriorating to the point of potential structural failure. The current WSRF failed structurally in 2012 and was out of service for several months. All activities involving the use of overhead cranes, aircraft escape slide attachments, fuselage dunking equipment, and emergency equipment repair/reconfiguration were not conducted during this period. The antiquated WSRF has been repaired with certain conditions and is continuously being monitored for potential structural failure. The tank's structural failure could severely damage the adjacent surrounding infrastructure and resources, e.g., the newly installed impact sled, computer systems, aircraft simulators, multimedia equipment, classrooms, auditorium, and medical certification records.

What benefits will be provided to the American public through this request and why is this program necessary?

This investment will allow for the continued performance aerospace medical and cabin safety research. This research serves as the knowledge base for Physicians, Physiologists, Human Factors Experts, Engineers, Psychologists, Educators, Flight Attendants, Aircrew, and numerous other academia, industry, and government personnel in the U.S. and abroad who are concerned with the safety of humans in aerospace operations. Identifying survival factors in simulated studies is essential to prevent death and injury.

The beneficiaries of the research resulting from the use of the facility and equipment sought by the WiWAVES program include: the General Public, Aeromedical Scientific and Engineering Communities, Aeromedical Education/Training Communities, Aeromedical Certification, including FAA AAM Regional Flight Surgeons and Aviation Medical Examiners (AMEs), Aircraft Accident Prevention and Investigation, Aircraft Certification, Flight Standards, Legal Counsel, Space Transportation, Quality Management, Aviation Operations Personnel and their organizations, Aircraft manufacturers, and Industry/Government Accreditation/Standards development organizations.

Detailed Justification for - 3A09 NextGen – System Safety Management Portfolio

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
System Safety Management Portfolio	$17,000	$16,200	$14,700

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Aviation Safety Information Analysis Sharing (ASIAS)	---	$14,200.0
B. Continued Maintenance For One Additional Year	---	500.0

What is this program and what does this funding level support?

ASIAS is a collaborative government and industry initiative to share and analyze data to proactively discover safety concerns before accidents or incidents occur, leading to timely mitigation and prevention. The primary objective of ASIAS is to provide the means to discover common, systemic safety problems that span multiple airlines, fleets and regions of the global air transportation system. ASIAS leverages internal FAA datasets, airline proprietary safety data, publicly available data, manufacturers' data and other data, as available. ASIAS fuses these data sources in order to identify safety trends in the NAS, leading to a comprehensive and proactive approach to aviation safety in conjunction with implementation of NextGen capacity and efficiency capabilities.

ASIAS participation includes more than 100 stakeholder organizations from commercial and corporate aviation, general aviation, industry associations, flight training organizations, maintenance/repair/overhaul associations, government agencies, and others within the FAA and across the aviation community. During 2018, accomplishments included the continued development of ASIAS data fusion, which involves joining various data sources, including voluntary pilot and controller reports, digital flight data, radar, weather, and others to build an integrated "Flight Story" at the individual flight level. The objective of ASIAS data fusion is to provide a complete perspective of all available information at each stage of a flight.

For FY 2019, $14,700,000 is requested to provide the following:

- Expand participation/data sharing of UAS operators to acquire operational flight data and establish the foundation for further development of UAS-specific metrics and analyses.
- Enhance the ASIAS infrastructure to include improvements to system efficiency, effectiveness and security, through development and deployment of the Data Fusion architectural framework (ASIAS 2.0) in 2020.
- Develop and test newly designed portal capabilities in order to view aviation safety issues in the full context of the operational environment and expand the portal to accommodate additional aviation communities.
- Refine processes for automatic alerting of detected topics employing machine-learning technologies as appropriate. Establish automated processes to identify emerging issues and previously unknown trends detected in text-based and digital safety reporting data.
- Provide widespread dissemination of ASIAS analytical results, including predictive modeling for vulnerability discovery and tools to correlate human factors with undesired aircraft states, in support of the Commercial Aviation Safety Team (CAST) and General Aviation Joint Steering Committee (GAJSC).
- Continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

What benefits will be provided to the American public through this request and why is this program necessary?

The primary benefit of the ASIAS program to the American Public is its contributions to the reduction of the aviation accidents and fatalities across a broad range of aviation communities. ASIAS is discovering potential safety issues in the NAS and is supporting development of safety enhancements to mitigate risk, working with the Commercial Aviation Safety Team (CAST), the General Aviation Joint Steering Committee (GAJSC) and FAA lines of business.

ASIAS will develop new metrics and analytical methods while continuing to be the focal point for industry collaboration, advancing critical safety initiatives and FAA objectives. These efforts will lead to improved anomaly detection techniques and risk mitigation strategies for commercial aviation, general aviation, rotorcraft and UAS stakeholders in the National Airspace System.

Detailed Justification for - 3A10 National Test Equipment Program (NTEP)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
National Test Equipment Program (NTEP)	$5,000	$4,000	$5,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
National Test Equipment Program (NTEP)	---	$5,000.0

What is this program and what does this funding level support?

The National Test Equipment Program (NTEP) manages the modernization, distribution, calibration, and inventory of test equipment. This equipment is required to perform preventive and corrective maintenance, equipment installations, modifications, and service certifications in support of numerous National Airspace System (NAS) Platforms. Failure to achieve certification of critical NAS systems (at any of the 27,000 FAA facilities) will result in the restriction of air traffic in the facility's air space and potentially cause major flight delays.

Test equipment supports NAS systems on the following platforms: communication, automation, surveillance, power, navigation, and weather. NTEP is responsible with procuring and maintaining test equipment. Furthermore, ensuring the NAS is operating to optimal standards by troubleshooting, repairing, and re-certifying both new and legacy systems.

A large portion of the test equipment is either damaged or rife with supportability and maintenance issues. The problem impacts Mean-Time-To-Restore (MTTR), safety, maintenance cost, and inventory management for every system within the NAS; no other FAA program office or initiative currently addresses this problem.

For FY 2019, $5,000,000 is requested to replace obsolete test equipment. The program will finalize the prioritization of test equipment requirements based on the facility need and equipment availability. Current requirements reflect critical need for oscilloscopes, universal data test sets, vector network analyzers, and reducing the test equipment backlog:

- $1,000,000 is planned for the procurement of 500Mhz oscilloscopes
- $1,500,000 is planned for the procurement of universal data test sets
- $1,500,000 is planned for the procurement of vector network analyzers
- $1,000,000 is planned for the procurement of backlogged pieces of test equipment

What benefits will be provided to the American public through this request and why is this program necessary?

The National Test Equipment Program's mission is to support the restoration of Air Traffic services by procuring and delivering functioning test equipment throughout the NAS. Failure to provide these services will have a dangerously negative effect on the NAS, posing a major safety risk to the technicians, as well as delaying the restoration of critical Air Traffic systems crucial for the protection of the flying public.

Detailed Justification for – 3A11 Mobile Assets Management Program

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Mobile Assets Management Program	$5,760	$3,600	$2,216

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Mobile Assets Management Program	---	$2,200.0
B. Continued Maintenance For One Additional Year	---	16.0

What is this program and what does this funding level support?

The Mobile Assets Management Program (MAMP) provides transportable National Airspace System (NAS) equipment to restore certain operations during periods of extended equipment outages. It ensures continuity of NAS operations. Mobile NAS equipment provides for the continuity or restoral of air traffic control when an airport traffic control tower (ATCT) or other NAS system is out of service due to a disaster or an extensive repair, modernization, or upgrade. The MAMP provides mobile assets that function as ATCTs, terminal radar approach control (TRACON) facilities, remote transmitter/receiver (RTR) sites, remote communications air/ground (RCAG) sites, and other facilities/systems that experience unexpected outages or planned system downtime for non-routine maintenance, modernization, or upgrade.

The FAA's inventory of mobile assets is in a serious state of disrepair and is often incapable of providing its intended service without first undergoing significant maintenance or repair before the asset can be deployed. The inventory consists of 104 assets, of which 45 are directly involved with controlling aircraft. The assets range from 30 kilowatt mobile engine generators (MX) to four-position mobile ATCTs (MATCTs). The near-term priorities are to upgrade/replace eight obsolete large four-position MATCTs and prioritize and restore the remaining assets in the inventory to a full operational capability. The MATCTs, which were acquired in the 1990s, are experiencing material failures and must be upgraded or replaced. The MAMP is currently developing an additional modular airport traffic control tower type with the ability to incorporate TRACON positions and equipment and is designed specifically for longer-term deployments of 12 months or more. A National Mobile Asset Deployment Center (MADC) has been established in the Central Service Area. The MAMP will assist the Eastern Service Area and Western Service Area in the development of designs for their mobile asset staging areas (MASAs). The systems support centers (SSCs) affiliated with respective deployment centers/staging areas will serve as property custodians of the mobile assets. A sheltered storage is mandatory to protect these assets. For FY 2019, $2,200,000 is requested to ensure that a sufficient number of the FAA's mobile assets are available to maintain and restore continuity of aviation operations.

What benefits will be provided to the American public through this request and why is this program necessary?

The American public will benefit from the efficient restoration of air traffic control operations in emergencies or natural disasters within hours of MATCTs arriving on site. The program will be working to ensure the availability and readiness of mobile assets to maintain or re-establish continuity of air traffic operations in response to emergencies and natural disasters. The FAA's mobile assets have been deployed to support relief efforts during natural disasters such as the earthquake in Haiti or the hurricanes that hit the Gulf Coast each year.

Detailed Justification for - 3A12 Aerospace Medicine Safety Information System (AMSIS)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aerospace Medicine Safety Information System (AMSIS)	$12,000	$14,000	$16,100

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Aerospace Medicine Safety Information System (AMIS)	---	$16,100.0

What is this program and what does this funding level support?

The FAA's Office of Aerospace Medicine (AAM) is responsible for advancing the field-of-study of aerospace medicine and for the medical certification of pilots, Air Traffic Control Specialists (ATCS) and other safety critical personnel. AAM processes approximately 450,000 medical applications annually and maintains records on millions of past examinations as part of AAM's role in the oversight of 600,000 pilots and approximately 15,000 ATCS.

Currently, all the coordination between FAA and the medical certification applicants is conducted through the United States Postal Service and is very labor intensive. In addition, the information systems that support the storage and record keeping for this information were originally developed in the 1990's, and while they have undergone several upgrades, the architecture of these systems are becoming unsupportable and will eventually become obsolete. The business processes that support the medical certification of airmen, and the other aviation safety programs, have changed and need to be re-engineered. The information technology must be aligned with Office of Management and Budget (OMB)/Department of Transportation (DOT)/FAA information systems architecture and security standards.

The AMSIS Program will eliminate the shortfall of the current labor-intensive process required by applicants today as well as align the new technology with industry architectural and security standards.

AMSIS will provide better data accessibility and a greater ability to analyze medical information and denial data to identify safety trends that could impact system safety.

AMSIS is necessary to:

- Improve safety for the public by reducing fraudulent certification
- Improve FAA's responsiveness to the individual/pilot
  - Provide better user experience: reduced turn-around times, enhanced ability to track status
  - Provide better user protection: secure Protected Health Information (PHI) and Personally Identifiable Information (PII)
  - Improve consistency with Pilot's Bill of Rights
- Share historical information with pilot employers
  - Improve visibility for airlines and other employers on the certification history of their pilots
- Deliver a better product for use by "front office"/Aviation Medical Examiners (AME's) and "back office"/FAA
  - Improve automation for AME's with "one-stop shopping" like experience
  - Support auditability of Pilot's Bill of Rights by back-office

  - Align to International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), for front-office and back-office use
  - Reduce back-office staffing potential
- Reduce risk that is an exposure to the FAA as a whole
  - Reduce pilot accident(s) due to fraudulent certification and the press attention that might occur from such incidents
- Reduce the security risk
  - Prevent breaches of private, PII
  - Prevent intrusions by insertion of harmful data

For FY 2019, $16,100,000 is requested to continue software development, integration and testing, as well as to provide system engineering and program management support. This work will modernize the tools and processes that are used to process medical certifications and maintain records of current and former airmen and air traffic controllers. In FY 2018 the program will have awarded the prime solution development contract and begun system design and development.

What benefits will be provided to the American public through this request and why is this program necessary?

Cost Avoidance and Savings - AMSIS will provide the tools required to capture, exchange, evaluate, and analyze information with significant improvements in efficiency, accuracy, and detail. AMSIS will simplify current processes and eliminate wasted effort by incorporating current technical medical standards. In addition, the updated automated process will reduce operational cost while improving customer service.
Increased Data Security - The information technology will be aligned with OMB/DOT/FAA information systems architecture and security standards. Because these are medical information systems, AAM must also align these systems with the national health information technology standards and security requirements for medical information systems developed by the Federal government, private sector and voluntary standards organizations, including the International Organization for Standardization. These systems will successfully and securely interface with approximately 4,250 AME's to perform pilot and ATCS medical examinations.
Safety - AMSIS will provide increased access to medical history and support earlier National Driver Register (NDR) checks to determine ineligible candidates more effectively. This will result in an improved ability to prevent pilots from flying while incapacitated by health conditions or substance abuse. For example, by performing a check against the NDR as soon as an applicant files a pilot certificate application, those airmen with driving under the influence (DUI/DWI) convictions will be prevented from being issued a certificate (currently a certificate is issued and then rescinded much later, after the NDR check results come in).

Detailed Justification for - 3A13 Tower Simulation System (TSS) Technology Refresh

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Tower Simulation System (TSS) Technology Refresh	$3,000	$2,000	$500

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Tower Simulation System (TSS) Technology Refresh	12	$500.0

What is this program and what does this funding level support?

For FY 2019, $500,000 is requested to continue procurement and deployment of TSS mobile units to increase the accessibility of Tower Simulation Systems (TSS) for remote tower locations. TSS technology is an integral component of Air Traffic Controller training, providing a higher level of training quality and effectiveness, while decreasing training times and costs at specific locations. TSS provides support for controller qualification and skill enhancement training and can be used as an aid in site surveys for proposed new construction on or near the airfield as well as assisting in the planning of new runways or changes in local arrival and departure procedures in an accurate and safe simulated environment.

The TSS program will provide technology refresh of obsolete tower simulation equipment. The TSS system is currently deployed at 40 sites and supports 195 tower facilities. The current systems have been deployed for more than nine years and are becoming expensive to operate and maintain. The projection systems will be replaced with updated visual technology and the video processors will be replaced with current graphics and image processors to increase fidelity and processing power, and reduce maintenance costs. During FY 2018, the program was able to successfully refresh and install newer technology for 29 systems over 13 site locations. FY 2019 funding will support increased accessibility for remote tower locations with the deployment of 12 mobile systems.

What benefits will be provided to the American public through this request and why is this program necessary?

The FAA releases its 10-year air traffic control workforce plan every year on March 31. It calls for greater efficiency in training procedures and identified a need to speed the training process while maintaining the high standards established by FAA. It is the goal of the TSS technology refresh program to address these needs and continue to provide exceptional training while reducing time-to-certification.

According to the "Controller Staffing Plan," the agency aims to reduce the overall cost of training to Certified Professional Controller (CPC) status. This program results in a more efficient training process that costs less and produces CPCs in less time.

The TSS system provides an essential role within the National Air Space (NAS) system and satisfies the simulation training requirement identified in FAA JO 3120.4P, Air Traffic Technical Training. These systems provide support to both local and district Air Traffic qualification, contingency and skill enhancement training ensuring that the flying public continues to have access to the safest Air Traffic Control System in the world.

Detailed Justification for - 3A14 Logistics Support Systems and Facilities (LSSF)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Logistics Support Systems and Facilities (LSSF)	$0	$0	$7,100

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Logistics Support Systems and Facilities (LSSF)	---	$7,100.0

What is this program and what does this funding level support?

For FY 2019, $7,100,000 is requested for enhancement of the Logistics Center Support System (LCSS). LCSS is a mission support IT procurement that automated the FAA's logistics management and supply chain processes.

The FAA Logistics Center (FAALC) at the FAA Mike Monroney Aeronautical Center (MMAC) in Oklahoma City executes maintenance, repair, and overhaul (MRO) of National Airspace (NAS) systems and equipment, manages the NAS inventory warehouse and distribution facilities, and provides field level services across the NAS for the Air Traffic Organization. The FAALC mission provides routine and emergency logistics products and services to FAA customers at facilities nationwide, as well as to the Department of Defense (Air Force, Navy, and Army), state agencies, and foreign countries. It provides logistics support to systems nationwide, by providing parts, services, supplies and emergency restoration services. The LCSS program enhances the FAALC capability to accurately manage NAS spares and repair requirements in a centralized and automated manner.

Funding at the requested level is needed to complete the final segment of the currently baselined program. Based on the April 2014 program Baseline Change Decision (BCD) for Segment 2 (Implementation), the funds are needed to meet its baseline and contract obligations for FY 2019. The program achieved Initial Operational capability (IOC) in FY 2015 and was placed into production in April 2016. Full Operational Capability (FOC) is planned for FY 2020.

What benefits will be provided to the American public through this request and why is this program necessary?

Once enhancements are made, and FOC is achieved, the system will provide an integrated capability to manage the FAA's supply chain thus reducing multiple legacy systems and eliminating the maintenance costs of those systems. The LCSS system also provides a foundation as an Enterprise Resource Planning tool to build additional capabilities, pending approved investment decisions, into one system as opposed to buying multiple systems to achieve the same goals, and thereby minimize future costs to the FAA for multiple systems that support the FAA supply chain.

The LCSS system at FOC will enable the FAALC to meet the demands of sustaining the NAS in a more efficient and cost competitive manner by managing inventory levels, optimizing delivery channels to meet NAS Availability requirements, and reducing cycle time of parts acquisition. LCSS applies the "Just-In-Time" model of supply chain logistics which has been proven worldwide to be an effective cost management methodology in the delivery of products to customers. LCSS will provide the ability to identify and track

appropriate safety stock levels, lead time to repair/procure, and demand fluctuations allowing for maximum support to the NAS and the flying public, while minimizing inventory of spares and thereby reducing cost.

Failure to implement LCSS enhancements will prevent clear visibility of the demand fluctuations and the necessary resource applications/adjustments to meet NAS requirements. The lack of LCSS analytical tools to optimize serviceable inventory will lead to excessive inventory in support of some fielded systems that results in excessive cost, and less than sufficient inventory in support of other systems which has a direct mission impact.

Detailed Justification for: 3B01 Aeronautical Center Infrastructure Modernization

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aeronautical Center Infrastructure Modernization	$14,000	$14,000	$14,298

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Aeronautical Center Infrastructure Modernization	1	$14,000.0
B. Continued Maintenance For One Additional Year	---	298.0

What is this program and what does this funding level support?

The Aeronautical Center is an aging facility of 133 leased and FAA owned buildings. Missions are accomplished in Aeronautical Center facilities whose personnel train controllers to direct air traffic across country and at airports; train technicians to maintain National Airspace Systems (NAS). Parts and repair services are provided by logistics personnel in these facilities and comprise the FAA's centralized NAS inventory, sharing support of some systems with DoD and foreign countries having common systems. There is a $50 million backlog of requirements to replace heating, ventilation, air conditioning, boilers/chillers, electrical/lighting, plumbing, interior finishes, exterior enclosures, roofs, interior construction, elevators, and stairs to prevent deterioration of building conditions. Seismic, wind bracing, and added fire protection is needed in some buildings. The backlog can be addressed with systematic funding to improve conditions and assure the aging infrastructure remains viable in future years.

For FY 2019, $14,298,000 is requested for the following:

- $10,000,000 is requested for major building system replacement in the Multi-Purpose Building (Bldg 24); a 211,203 square foot building constructed in 1972 that has not had major renovation in 45 years. The funding requested is to add fire detection/suppression systems, asbestos abatement/removal, replacement of electrical distribution/lighting systems, mechanical systems (HVAC), boilers/chillers, telecom, plumbing, finishes replaced in tear out installation: interior doors, walls, ceilings, and floors. The building is the workplace for approximately 600 FAA employees and contractors.
- $2,000,000 is requested to provide technology replacement of telecommunications at the Aeronautical Center. Over a six year phased cycle, funding will replace the telecommunications network switches, routers, internet filtering hardware for redundancy, reliability, security and availability in a total of 74 buildings. In FY 2019, replacement will be complete in 13 of 74 buildings.
- $2,000,000 is requested to provide NAS Integration Support Services and Technical Support Services Construction inspectors.
- $298,000 to continue maintenance of deployed systems for an additional year under the Facilities and Equipment account before transferring to the Operations appropriation in the FY 2020 request.

What benefits will be provided to the American public through this request and why is this program necessary?

Renovation improves facility space and energy utilization, reduces maintenance costs of major systems within renovated buildings, provides for incremental upgrades of telecommunications infrastructure, and improves productivity of personnel using renovated facilities through space efficiencies and improved environmental controls. It extends the useful life of the buildings, 25 - 30 years, for current and future generations of the FAA work force whose missions support the safety of air passengers.

Detailed Justification for - 3B02 Distance Learning

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Distance Learning	$1,500	$1,000	$1,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Distance Learning	---	$1,000.0

What is this program and what does this funding level support?

The Distance Learning Program provides the infrastructure to deliver simulations and training to all FAA employees via Distance Learning Platforms (DLP) and the FAA Academy Virtual Training Network (AVTN). The funding of this program provides for the technology refresh of DLPs at FAA field site Learning Centers, Expansion of AVTN through increased connectivity, and upgraded network multimedia support and services. Technology refresh is accomplished in a phased, multi-year approach. This year's funding will provide for the technology refresh of the DLPs at various Learning Centers located at all Air Traffic, Federal Contract Towers (FCT), and Air Traffic System Specialists (ATSS) Facilities around the world. The FAA is providing the technology refresh of the DLPs for two main reasons: to support high-performance media and simulations required in many lessons and to replace hard to obtain, obsolete parts for current platforms.

This program reduces the cost of training to perform Air Traffic operations and to maintain and operate the National Airspace System (NAS) by providing a standard training platform (the DLP) at field sites to accomplish initial, refresher, operator, and maintenance. This program will provide for funds to expand the Content Distribution System (CDN) configuration that has been developed to store eLMS courseware on the DLPs to mitigate slow networking bandwidth at field sites.

This program provides productivity improvements for Air Traffic Organization (ATO) employees by shortening the time to achieve employee full performance and certifications. The training time reduction is a result of having Distance Learning delivered via DLPs at the employee's field site thus avoiding travel to FAA Academy or factory schools.

For FY 2019, $1,000,000 is requested to fund contracts and hardware for the procurement, configuration, and installation of modernized DLPs to various Air Traffic and ATSS field facilities. The FAA will procure and install 180 DLPs.

What benefits will be provided to the American public through this request and why is this program necessary?

The requested resources will be used to support the FAA initial and qualification training to all Air Traffic Controllers and ATSS personnel. A major cost savings benefit of distance learning is a substantial reduction in student time away from work and reduced travel and per diem costs associated with resident-based training. In addition, distance learning delivery methods increase training effectiveness as well as increase training opportunities for all FAA employees, and provide flexibility in training schedules through local management control.

Detailed Justification for - 4A01 System Engineering and Development Support

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
System Engineering and Development Support	$35,000	$35,700	$38,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. System Engineering Support	---	$35,000.0
B. ATC/AFN Systems Support Program Evaluation	---	3,000.0

What is this program and what does this funding level support?

For FY 2019, $38,000,000 is requested to provide technical contract support services which will ensure sound systems engineering practices and business case development processes, instrumental to the safety, efficiency, and security of the National Airspace System (NAS).

The System Engineering and Development support budget line item provides future enhancement of the Air Traffic System by establishing and documenting the FAA's Enterprise Architecture (EA) requirements. The EA is the blue print for the future air transportation system and must be documented clearly and accurately. This program assists in developing, delivering, and implementing guidance and support tools to move forward the engineering and prototyping effort for NextGen. In addition, contract support services have ensured sound systems engineering practices and business case development processes. Also, the contract provides support to FAA's planning and budgetary processes and contract administration, ensuring consistent application of the AMS (Acquisition Management System) policy.

The research of emerging procedures and technologies will help to determine the best way to develop and deploy critical NextGen initiatives. These activities include demonstrating that NextGen procedures and operational changes will work on a large scale within the current and evolving air traffic system. In addition, automated data processing and information resource support is required to support the development and/or enhancement of computer simulation models, miscellaneous software upgrades, databases, and program management tools. Program management, financial management and investment analysis support are provided to assist with planning, decision-making, and budgetary oversight of the activities involved in implementing newly acquired systems, components, and equipment in existing operational NAS facilities.

Planned FY 2019 Funding:

- Execute the System Engineering 2020 follow on contract acquisition plan
- Conduct Quarterly Performance Reviews of 16 Vendors across over 300 Task Orders
- Provide Support in the following areas:
  - Delivering NAS Enterprise Architecture products
  - Simplified Program Information, Reporting and Evaluation (SPIRE) and LAN Infrastructure support and maintenance that includes Oracle database administration support for various FAA financial and program management tools
  - NAS Systems Engineering Portal including publishing the NAS Segment Implementation Plan
  - NAS Enterprise Planning and Integration support including publishing and maintaining the NAS Enterprise Architecture (EA) Roadmaps and EA Approval Framework
- Business Case Analysis and Life Cycle Cost Estimation development and review support

A. **System Engineering Support:**

- Provides continuous critical support activities which complement NextGen Air Transportation System programs, which include Configuration Management, Infrastructure Roadmaps, Operation Planning, Requirements Engineering, System Engineering Services, Enterprise Integration Services, Forecast Analysis and Investment Planning and Analysis for the life of the NextGen Program.
- Supports critical programs such as NAS Enterprise Architecture (integrate and align the Enterprise Architecture portal), Segment Implementation Plan, and Safety Process Improvement are procured through this budget line item.
- Provides portfolio of multiple prime contractors with large subcontracting teams who can provide support across a broad range of Research and Mission Analysis and System Engineering requirements thus reducing the need for new standalone contracts and contract vehicles which reduces overall costs and promotes efficiency.
- Supports the Office of Investment Planning and Analysis (IP&A) to conduct investment analysis and to support business case development and analyses. Investment analysis is conducted in the context of the FAA Enterprise Architecture and strategic goals and objectives. This work will provide decision makers with a clear picture of investment opportunities, risks and value.
- Supports the integration and development of corporate tools and processes to strengthen NextGen integration into the NAS.
- Provides cost estimating, cost and benefit analysis, operations research, risk and schedule analysis, market surveys, and business case analysis and development in support of investment analyses for NextGen and the NAS. Conduct Engineering Analysis on NextGen systems.
- Supports application and upgrades to program management financial tools. Supports the design, development, maintenance, training, and reporting on all aspects of Simplified Program Information Reporting and Evaluation, FAA Acquisition System Toolset, Financial Management System, and other management tools.

B. **ATC/AFN Systems Support:**

- Supports technical analysis and oversight of acquisition programs goals and performance reporting

What benefits will be provided to the American public through this request and why is this program necessary?

This request will support the agency's goals of improving aviation safety, security, and efficiency while increasing capacity and productivity by providing technical assistance through cost effective contracts for various programs. The technical assistance will provide support for enhancing software tools, integrating and aligning the Enterprise Architecture portal, along with updating infrastructure roadmaps annually. The economies of scale created by the contracts under this project will allow for a reduction in award time of new tasks and a shorter cycle time for product implementation into the NAS. It also increases agility in response to stakeholder requirements and serves to track funding costs and resources efficiently and effectively.

Detailed Justification for - 4A02 Program Support Leases

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Program Support Leases	$46,600	$47,000	$47,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Program Support Leases	---	$47,000.0

What is this program and what does this funding level support?

For FY 2019, $47,000,000 is requested to pay the annual rent on leases for real estate (both land and space) to house facilities required to operate the National Airspace System (NAS).

To operate the NAS, FAA utilizes approximately 2,800 rentable real estate leases since the majority of its facilities reside either on leased land or in leased building space. The Program Support Leases program requests funds to meet contractual obligations including rental payments or other requirements to provide the necessary real property rights for land, tower space, aerial easements, and technical operational space for these leases. Without these property rights FAA could not operate the NAS.

This program funds real estate requirements including:

- Payment of rents for land and space leases that directly support navigation, communication, weather observation and reporting, air traffic control, and other functions that support the NAS
- Funding for leased access roads, easements providing ingress to and egress from leased facilities, and other leased restrictive easements
- Costs associated with the rental and management of land and space for service/maintenance centers, deployment/development centers, laboratories, test beds, and other types of facilities that support the deployment and operation of technical facilities
- Funds for conversion of existing leases to fee ownership or perpetual easements
- Payments for condemnation (leasehold or fee) of real property interests
- Costs for real estate appraisals, market surveys, title reports, land surveys, and other costs associated with the acquisition and management of real property assets
- Funds to relocate offices, facilities, personnel, equipment, and to downsize or consolidate offices when technically feasible and economically advantageous
- Funding for the development of business tools to enhance real estate acquisition and management activities and for implementing program efficiency practices
- Funding for costs associated with real property lease terminations and equipment disposals
- Funding for testing and studies (environmental, suitability, sustainability, cost-effectiveness, etc.) in connection with the leasing, purchasing, usage, management, and disposal of real property

What benefits will be provided to the American public through this request and why is this program necessary?

Sufficient funding to make rent payments in accordance with all real property leases for NAS operational facilities will prevent FAA from incurring significant costs associated with default on leases. Funding for the

implementation of co-location, consolidation, and oversight measures are an integral part of this program in order to achieve long-term savings and effectively use tax payer dollars.

Detailed Justification for - 4A03 Logistics and Acquisition Support Services

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Logistics and Acquisition Support Services	$11,000	$11,000	$11,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Logistics and Acquisition Support Services	Various	$11,000.0

What is this program and what does this funding level support?

For FY 2019, $11,000,000 is requested to fund contractor-supplied logistics and acquisition support services.

The FAA Logistics Support Services (LSS) program manages real estate, acquisitions, and materiel assets for NAS modernization and capitalizes agency assets as required by the agency's strategic plan. The LSS program provides critical support personnel involved in the acquisition of new or upgraded facilities, including air traffic control towers and Terminal Radar Approach Control Facilities (TRACONs), throughout the National Airspace System (NAS). These functions are performed throughout the three Service Areas (Eastern, Central, and Western), and the FAA Technical Center.

This program supplements the Federal workforce in the acquisition, real estate, and materiel management at the FAA regions and centers. These resources perform contract activities in support of FAA Capital Investment Plan (CIP) projects, conduct capitalization and property control-related activities. Additionally, the FAA utilizes LSS resources for asset tracking, documenting the capital cost of FAA facilities, complying with accounting standards set by the Government Accountability Office (GAO) that lead to achieving and maintaining a clean audit opinion.

The requested funding will continue to promote processing efficiencies within acquisition, real estate, and materiel management that have been made over the last several years since this contract was put in place. Funding for the LSS program enables FAA to track assets and requisite documentation for obtaining and maintaining a clean audit opinion. Related project management goals include:

- Complete 80 percent of the annual real property inventory validation effort
- Capitalize 92 percent of all personal and real property capital assets within 65 days of date placed in service
- Capitalize 90 percent of all purchase orders within 45 days and award 90 percent of all contracts (over $100,000) in less than 180 calendar days from the time a purchase request is received from the requiring organization

What benefits will be provided to the American public through this request and why is this program necessary?

By achieving management goals for real and personal property, the FAA ensures that tax payer dollars are utilized in the most prudent and transparent manner possible.

Detailed Justification for - 4A04 Mike Monroney Aeronautical Center Lease

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Mike Monroney Aeronautical Center Lease	$19,300	$19,700	$20,200

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Mike Monroney Aeronautical Center Lease	1	$20,200.0

What is this program and what does this funding level support?

The Aeronautical Center leases provide leased land/building rent and insurance that comprise approximately 80 percent of Aeronautical Center space: 2.7 million square feet of leased space and 1,100 acres of land, having a leased facility replacement value of $696 million. The Center provides facilities that support the work of 7,100 employees, students, and contractors on a daily basis and is the largest concentration of FAA personnel outside of Washington D.C. In addition, approximately 11,000 visitors come to the Aeronautical Center annually.

The Aeronautical Center requires large parcels of land as NAS test sites for surveillance radar, communications, weather, and navigation/landing systems, as well as warehouse, administrative office space, and training facilities. It is a Level IV security site based on numbers of employees, facility square footage, sensitivity of records, volume of public contact, and mission essential facilities whose loss, damage, or destruction would have serious impact on the NAS.

For FY 2019, $20,200,000 is requested to pay rent under the long-term lease agreement and to correct a backlog of deferred sustainment needs in leased buildings to prevent deterioration of facility conditions that affects the missions of FAA organizations. Leased Aeronautical Center facilities support FAA missions that include:

- Aviation training for 90,000 FAA and international students per year in resident and distance learning, including approximately 1,000,000 hours of distance learning delivered annually
- Logistics services and supply support to the operational NAS to all FAA Airway Facility locations, Air Traffic, and approximately 70 Department of Defense (DoD) and international organizations
- Engineering services for NAS systems modification and repair
- Aviation research of medical and human factors impacting aviation personnel
- Standards and flight inspection services
- Regulation certification of safety related positions and equipment, airmen and aircraft records and registration

What benefits will be provided to the American public through this request and why is this program necessary?

This program benefits the American Public and NAS and by avoiding costs through the following:

- Lower lease and operating cost (Includes utilities (gas, water, electric), janitorial, cleaning, security) costs than alternatives when compared with Oklahoma City GSA leased facilities, FAA Headquarters, and other FAA facility locations
- Facilities allow flexibility and growth to support NextGen airspace requirements
- Facilities support NAS operations/maintenance, current and future ATO initiatives
- Facilities decrease energy and repair operations costs

Detailed Justification for - 4A05 Transition Engineering Support

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Transition Engineering Support	$24,100	$19,900	$17,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. NAS Integration Support Contract (NISC)	---	$15,000.0
B. Configuration Management Automation (CMA)	---	2,000.0

What is this program and what does this funding level support?

A. NAS Integration Support Contract (NISC): The NISC program provides engineering and technical resources to the FAA organizations responsible for NAS transition and implementation. The NISC team, working in partnership with these organizations, ensures that capital investments and regional projects are implemented most effectively to support the National Airspace System (NAS) mission. This program provides technical support to assist the FAA's technical workforce in handling a surge in demand for short-term programs and projects that are vital to managing the volume of diverse systems and equipment associated with NAS modernization.

For FY 2019, $15,000,000 is requested to support the modernization schedules for NAS programs. The budget level is necessary to provide continual NISC contract management and infrastructure support for the prime contractor for the NISC III contract valued at $1.4 billion. In addition, these funds will be used for program acquisition management, financial management, administrative support services, continued operation and IT support services for the NISC contract tracking system and reporting system, other indirect contractor costs, and other program management support.

B. Configuration Management Automation (CMA): The goal of FAA's Configuration Management (CM) is to record technical information, including system specifications and installation data, on all systems installed in FAA facilities. CM also requires documentation for all proposed and actual changes to these systems in order for maintenance workers and replacement programs to have accurate and up to date information for maintaining or replacing existing systems.

The CMA project will provide:

- An automated, integrated, single point of access with insight and traceability to configuration baselines solution to support CM of NAS and Mission Support assets and investments
- Ability to effectively manage business rules, trace, predict and manage an asset's status, opportunities, and risks, during any phase of the lifecycle and incorporate necessary current and future changes as the Agency continues to transition to NextGen

What benefits will be provided to the American public through this request and why is this program necessary?

It affords the FAA the flexibility in obtaining the technical expertise required to meet demand surges with minimal lead time and without the need for long-term commitments. The NISC program provides the FAA with rapid access to highly qualified and experienced professional engineering and technical support where and when determined necessary by the incumbent Federal workforce. The NISC program facilitates other national programs in defining, securing and administering the utilization of hard to capture professional labor categories once deemed necessary by those program offices.

Detailed Justification for - 4A06 Technical Support Services Contract (TSSC)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Technical Support Services Contract (TSSC)	$23,000	$23,000	$23,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Technical Support Services Contract	---	$23,000.0

What is this program and what does this funding level support?

For FY 2019, $23,000,000 is requested to continue the TSSC infrastructure. This will enable other programs to use its services to accomplish more than $110 million of project work each year.

Funding the TSSC infrastructure sustains the FAA's national capability to supplement and leverage Federal workforce skills during site-specific National Airspace System (NAS) implementation efforts. TSSC is the agency's primary installation support service vehicle and is used by a myriad of capital budget improvement program customers to achieve timely and cost-effective National Airspace System (NAS) modernization. The TSSC program is the agency's vehicle to provide a workforce multiplier that installs equipment and supports the capital budget improvements to the NAS in a timely, cost-effective manner. These activities include work planning, quality control, subcontracting, the contractor safety program, and award fee paid under the contract, as well as the usual rent, telecommunications, and utility costs incurred under the contract.

Significant work is required to install, modify, and relocate equipment by personnel with electronic, mechanical, and civil engineering skills. Often the engineering and technician support is of short duration and requires skills that the FAA government employee workforce does not have or that exist in insufficient numbers. The TSSC program allows the FAA to avoid hiring additional employees for a limited duration to handle a surge in demand, such as when new equipment is installed at multiple locations and during compressed schedule periods.

TSSC infrastructure funding pays for the following:

- Project implementation safety, security, and quality control efforts
- The prime contractor's costs to award and administer subcontracts to accomplish $35,000,000 of annual public works efforts on behalf of the FAA
- Contractor management of its personnel, office rent, communications, and utilities

What benefits will be provided to the American public through this request and why is this program necessary?

The TSSC program has an award fee for the performance-based acquisition contract vehicle to promote efficiency and FAA customer satisfaction. The TSSC customer award fee evaluation survey participation return rate is typically greater than 90 percent. Direct FAA customer award fee feedback rated contractor rate contractor performance greater than 90 percent in the excellent and good range across several hundred individual contractor performance evaluations in the past years of TSSC performance.

Detailed Justification for - 4A07 Resource Tracking Program (RTP)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Resource Tracking Program (RTP)	$6,000	$6,000	$6,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Resource Tracking Program (RTP)	---	$6,000.0

What is this program and what does this funding level support?

The RTP is a computer management system (including hardware, software, development, training, and support) used by the FAA Service Centers, the William J. Hughes Technical Center, and the Mike Monroney Aeronautical Center for identifying requirements, internal budget preparation, implementation planning, resource estimating, project tracking, and measuring performance of projects. The Corporate Work Plan (CWP) process is the Air Traffic Organization's (ATO) method to implement approved projects and to standardize National Processes in support of the National Airspace System (NAS). The CWP system, which falls under the RTP program, enables users to share FAA's project data during the various stages of implementation (i.e., planning, scheduling, budgeting, execution, and closeout). The CWP toolset and its supporting data are continuously used for reporting project metrics to project managers, responsible engineers, program offices, and various other customers.

For FY 2019, $6,000,000 is requested to continue to keep hardware and software licenses current, program/project management support in the National Airspace System (NAS), maintain Technical Support Services Contract (TSSC) and NAS Implementation Support Contract (NISC), upgrade training documentation, and continue to provide training to users and data administrators. Also, hardware and software licenses will be maintained to keep the cost of upgrades to a minimum. The hardware and software for the CWP TOOLSET, which is the key tool that makes up the CWP, must be constantly maintained and upgraded, to support FAA and the processes that will be impacted as it continues to evolve. The CWP TOOLSET is used to track all ATO Capital projects from cradle to grave. This system is also used to develop the CWP and work releases for the TSSC.

This system interfaces with DELPHI and Fund Control Module (FCM) and various other systems. The CWP TOOLSET is a centralized system with load-balanced servers residing in Oklahoma City, OK.

What benefits will be provided to the American public through this request and why is this program necessary?

The CWP TOOLSET contributes to improving the efficiency of the FAA and enhances program management of FAA Capital Programs. This project provides cost and schedule assistance for major acquisition programs by providing enhanced program/project management capabilities with reliable data on cost accounting of capital expenses for FAA Managers and engineers through the CWP TOOLSET. This product improves productivity (on time completion of projects in the field) when a standardized project management process is supported by the toolset and emulates current operating procedures.

Detailed Justification for - 4A08 Center for Advanced Aviation System Development (CAASD)

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Center for Advanced Aviation System Development (CAASD)	$60,000	$57,000	$57,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Center for Advanced Aviation System Development (CAASD)	---	$57,000.0

What is this program and what does this funding level support?

CAASD is an FAA-sponsored Federally Funded Research and Development Center (FFRDC) operated under a Sponsoring Agreement with the MITRE Corporation since 1990. CAASD's high quality research, systems engineering, and analytical capabilities help FAA meet the technically complex challenges in the National Airspace System (NAS). CAASD provides independent advanced research and development required by the FAA to obtain technical analyses, prototypes and operational concepts needed to fulfill the agency's Strategic Initiatives, under the Capital Investment Plan (CIP). The support provided by CAASD is critical for the continuing development for the future of NAS systems and the NAS Enterprise Architecture.

CAASD's high quality research, systems engineering, and analytical capabilities are key to the FAA meeting technically complex challenges in the NAS. CAASD provides independent advanced research and development required by the FAA in technical analyses, prototypes, and operational concepts needed to fulfill FAA's mission and vision. CAASD plays a key role in meeting FAA's near and long-term mission objectives and in maturing the NAS to meet the nation's public air transport needs. Its expertise is critical to FAA's efforts in transforming the nation's air transportation system in an effective and timely manner.

FAA relies on CAASDs integrated knowledge of the NAS and long-term experience with FAA's enterprise level efforts developing the NAS infrastructure. The challenges the FAA faces in meeting established goals and charting an achievable course for the development of the NAS are extensive and technically complex. CAASD assists FAA with addressing NAS complexity challenges effectively. CAASD provides a unique system-wide integrated understanding, tools, labs, and other capabilities that are fundamental to FAA's ability to address these challenges. The required development of system architecture and comprehensive research, development, and system engineering services can only be provided by an FFRDC whose charter permits special access to sensitive Agency and Aviation Industry information and data, not normally available to support contractors. Numerous elements of the CAASD work program are highly specialized research and systems engineering activities that require extensive knowledge of the present and planned NAS systems.

For FY 2019, $57,000,000 is requested to fund technical, engineering, as well as research and development support for the CAASD program. The FY 2019 funding will support 169 MITRE Staff Years (SY) of research and systems engineering as well as technical and operational analyses.

Planned FY 2019 Funding Goals:

- Develop and deliver a minimum of 350 research products in FY 2019 supporting the following key research areas
  - NAS Architecture improvements to 2025 and beyond
  - FAA Policy analyses of the impact of new entrants to the NAS

  - Right sizing of the NAS
  - NAS modernization efforts for Communications, Navigation, and Surveillance (CNS) and Air Traffic Management (ATM) changes
  - Performance analyses and assessments of NAS operations and systems
- Conduct Quarterly Performance Reviews of CAASD
- Publish the CAASD FY 2019 Annual Report by January 2020

As the FAA's only FFRDC, the support provided by CAASD is critical for the development of policy for the future of the NAS Systems and NAS Enterprise Architecture. The CAASD Program's annual Product Based Work Plan (PBWP) defines an outcome-based program of technically complex research, development, and system engineering activities that support FAA critical mission capabilities to include:

- Safety Analysis and Standards
- Performance Based Navigation
- NAS Systems and Architecture Development
- Certification of advance integrated avionics for more autonomous operations by manned and unmanned vehicles
- NextGen Cybersecurity
- Standards Development
- New Entrants into the NAS (Unmanned Aircraft Systems, Space Vehicle Operation, Commercial Space)

CAASD Provides integrated systems engineering support to the following major FAA Programs:

- NextGen
  - Aviation Safety Information Analysis and Sharing (ASIAS)
  - Automatic Dependent Surveillance-Broadcast (ADS-B)
  - NAS-wide Performance Based Navigation - Area Navigation (PBN/RNAV)
  - System Wide Information Management (SWIM)
  - Data Communications
  - Trajectory Based Operations
  - Airborne Collision Avoidance System X (ACAS X)
  - En Route Automation Modernization (ERAM)
  - Terminal Flight Data Manager – WP4 1 (TFDM)
  - Traffic Flow Management System (TFMS)
  - Time Based Flow Management Service (TBFMS)
- Unmanned Aerial Systems (UAS)
- Commercial Space
- FAA Cyber Security Management of overall Information Systems Security (ISS)

What benefits will be provided to the American public through this request and why is this program necessary?

This is a critical time for the Agency and the evolution of the NAS. NextGen's development of Trajectory Based Operations (TBO) is underway and CAASD provides key research and infrastructure support to those efforts across the FAA. Additionally, MITRE has access to commercial industry knowledge and data not available from any other source. MITRE CAASD leverages commercial aviation industry data (such as fleet equipage, pilot incident information, and airline operations planning) to directly assist FAA in its decision making - acting as a "trusted partner" for both the FAA and the commercial airline industry. Finally, MITRE's long term experience provides crucial support to agency rule making activities from an Aviation Safety stand point.

Detailed Justification for - 4A09 Aeronautical Information Management Program

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Aeronautical Information Management Program	$10,400	$6,200	$6,819

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
A. Aeronautical Information Management Program Segment 3	---	$2,000.0
B. Continued Maintenance For One Additional Year	---	4,819.0

What is this program and what does this funding level support?

The Aeronautical Information Management Modernization (AIMM) Segment 3 will build on the AIMM Segment 2 program, and the Aeronautical Common Service established by that program, to continue integrating aeronautical data services within the National Airspace System (NAS).

AIMM S3 will develop and integrate information flows for the collection, management, and maintenance of aeronautical information in a digital format for machine to machine exchange with NAS Automation systems.

The digital format is essential for enabling NAS automation integration and information distribution to NAS consumers involved in NAS decision support, flight planning, and pilot briefing. These services will increase on-demand NAS operational performance and help manage airspace with timely NAS constraint information like Notices to Airmen (NOTAMs), airspace schedules/status, and static constraints found in Standard Operating Procedures (SOPs) and Letters of Agreement (LOAs).

For FY 2019, $6,819,000 is requested for the Aeronautical Information Management (AIM) Program. The AIMM S3 program is currently preparing for an Initial Acquisition Readiness Decision (IARD) scheduled for the fourth quarter of FY 2017. A Final Investment Decision (FID) is anticipated in FY 2019.

Activities supported in the FY 2019 request include:

- Contract award
- Development of Initial Design documents
- Prototyping of automation integration and authoritative sources for SOP/LOA applications as well as aeronautical service enhancements to support additional sources and consumers within the NAS

What benefits will be provided to the American public through this request and why is this program necessary?

The AIMM S3 program enables the FAA to provide integrated lifecycle management of the aeronautical information necessary to support NextGen capabilities. The anticipated areas of benefits include safety enhancements, flight efficiency and reduction in delay, and cost avoidance based on preliminary scope and mission needs associated with the program.

Detailed Justification for - 4A10 Cross Agency NextGen Management

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Cross Agency NextGen Management	$2,000	$1,000	$1,000

COST ESTIMATE OF WORK TO BE FUNDED THIS YEAR

Activity Tasks	Locations/ Quantity	Estimated Cost ($000)
Cross Agency NextGen Management	---	$1,000.0

What is this program and what does this funding level support?

The Cross Agency NextGen Management program conducts cross agency coordination of multi-agency activities on the future of the aviation transportation system through collaboration with agency partners on research and work plans, and facilitates development of emerging NextGen technologies, tools, and services.

For FY 2019, $1,000,000 of funding is requested to collaborate with partner agencies in supporting the following areas:

- Co-chair Interagency Core Cyber Team (ICCT) and propose high-priority multi-agency research solutions to mitigate gaps and vulnerabilities identified by the ICCT; report results to the FAA's Cyber Steering Committee and the NextGen Executive Board.

Continue NAS Far-Term Concepts Modeling and Analysis – Emphasis on cost/benefit analyses in support of high-priority cross-agency planning and R&D activities, including integrating new entrants into the NAS.

- Develop the following reports: 2019 ICCT End-of-Year Report; progress reports to NextGen Executive Board; and an annual Executive Summary to the Senior Policy Committee.

What benefits will be provided to the American Public through this request and why is this program necessary?

The development of NextGen is a priority for the Administration and active participation by Federal Partner Agencies (e.g. Department of Defense (DOD) Department of Commerce (DOC), National Aeronautics and Space Administration (NASA), and Department of Homeland Security (DHS)) is necessary for modernizing the air transportation system to safely meet the expected growth in air traffic. The Cross Agency NextGen Management program will continue to identify, facilitate, and integrate activities, commitments, and contributions of Federal Partner Agencies and other key stakeholders to ensure the NextGen transformation is realized. The program leads interagency collaboration to resolve complex challenges critical to NextGen. This effort will ensure efficient coordination between all Federal Partners whose decisions impact NextGen. A coordinated multi-agency approach to long-term research and development allows the Partners to align separate efforts to leverage resources and infrastructure resulting in improved coordination of NextGen initiatives.

Detailed Justification for – 5A01 Personnel and Related Expenses

($000)

Activity/Component	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Benefits	$424,616	$429,388	$431,260
Non-Pay	$61,384	$53,312	$58,312
Total	**$486,000**	**$482,700**	**$489,572**
FTP	2,717	2,706	2,706
FTE	2,687	2,664	2,649

What is this program and what does this funding level support?

The request will support a staffing level of approximately 2,650 full time equivalents who are assigned to all phases of managing and implementing major capital acquisitions including site engineering, installation and implementation, and oversight of capital programs. The request also provides for on-site travel, IT support and supplies.

The F&E workforce levels include electronic, civil and mechanical engineers; electronics technicians; quality control and contract specialists; Ops research analysts, and safety inspector personnel. The F&E workforce resides in Air Traffic, Aviation Safety, NextGen, and Finance and Management offices. Seventy-seven percent are located in the field. F&E personnel provide oversight and management of FAA's capital projects including the NextGen portfolio.

For FY 2019 $489,572,000 and 2,706 FTP/2,649 FTE is requested to pay the personnel, travel and related expenses for the Federal Aviation Administration (FAA) Facilities and Equipment (F&E) workforce performing work essential to FAA's efforts to sustain and modernize the National Airspace System (NAS).

The request includes a base transfer of $3,065,000 and 19 FTP/FTE from NextGen (ANG) to the Air Traffic Organization (ATO) in support of the Flight Program Consolidation effort and includes a transfer of 35 FTP positions from ATO's F&E Reimbursable account to ATO F&E Activity 5 direct.

FY 2018 Annualized CR	**$482,700**
Adjustments to Salaries and Benefits	**$1,872**
FY 2018 Annualized Pay Raise	$2,010
Extra Compensable Day	$1,606
Workforce Reduction Through Attrition	-$1,744
Adjustments to Non-Pay Travel	**$5,000**
FY 2019 Request	**$489,572**

F&E personnel and related expenses are distributed across FAA Organizations as follows:

FTE

Organization	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
ATO	1,927	1,910	1,919
AVS	57	57	57
AFN	152	151	150
ANG	551	546	523
Total	2,687	2,664	2,649

(Dollars in Thousands)

Organization	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
ATO	$338,699	$341,009	$350,402
AVS	$9,853	$9,984	$9,918
AFN	$43,785	$36,997	$36,945
ANG	$93,663	$94,710	$92,307
Total	$486,000	$482,700	$489,572

F&E employees perform essential services in managing the acquisition and installation of new systems, including NextGen programs, into the NAS. Major capital programs can take over a decade to implement from proof of concept to final implementation, which requires a sustained engagement. Civil, mechanical and electrical engineers, along with technicians, provide technical support for design reviews, perform site preparation and installation, conduct technical evaluations, and provide systems integration and in-service management. Operations research analysts and cost estimators conduct investment analyses for new capital projects. Contracting officers provide acquisition services, and Safety Inspectors conduct the necessary regulatory and safety oversight functions for new services and operational capabilities being installed in the NAS.

Payroll, travel, and related expenses for the FAA F&E workforce are paid for out of this activity. On an annual basis, approximately 90 percent of the program covers FAA F&E workforce payroll costs; 10 percent of the program supports programmatic travel and related expenses of the workforce.

Each year Congress appropriates over $2.5 billion for capital improvement to the NAS. These funds are available for a period of three years. As a result, each year the FAA is managing three years of active program funding (approximately $3.5 billion per year). On average, the FAA has over 8,000 active projects being managed by F&E staff. Each year the FAA completes 2,000 to 2,500 projects. This requires long-term program management and oversight capabilities to ensure continuity and to get best-value for the government's investment in new systems and technology. Major capital investments like System-Wide Information Management (SWIM), ADS-B NAS Wide Implementation, Data Communications (Data Comm) and Terminal Flight Data Manager (TFDM) are system-wide in scope and take years to fully implement. This budget line item provides FAA personnel with the long-term technical expertise necessary to oversee the design and implementation of new NAS systems as well as provide for the sustainment of core NAS Infrastructure such as radar, communication, automation, facilities, and navigation systems.

What benefits will be provided to the American public through this request and why is this program necessary?

The FAA's Facilities and Equipment capital program invests in developing and implementing new technologies to meet future demand and to sustain the current NAS.

The FAA is undertaking a wide-ranging transformation of the United States air transportation system. NextGen proposes to transform America's air traffic control system from a ground-based system to a satellite-based system. GPS technology will be used to shorten routes, save time and fuel, reduce traffic delays, increase capacity, and permit controllers to monitor and manage aircraft with greater safety margins. Planes will be able to fly closer together, take more direct routes and avoid delays. This transformation has the aim of reducing gridlock, both in the sky and at the airports to accomplish NextGen and to maintain the current infrastructure the FAA requires a stable workforce focused on the sustained effort necessary for the acquisition of major capital assets.

3C. RESEARCH
ENGINERING & DEVELOPMENT

RESEARCH, ENGINEERING, AND DEVELOPMENT

(AIRPORT AND AIRWAY TRUST FUND)

For necessary expenses, not otherwise provided for, for research, engineering, and development, as authorized under part A of subtitle VII of title 49, United States Code, including construction of experimental facilities and acquisition of necessary sites by lease or grant, $74,406,000, to be derived from the Airport and Airway Trust Fund and to remain available until September 30, 2021: Provided, That there may be credited to this appropriation as offsetting collections, funds received from States, counties, municipalities, other public authorities, and private sources, which shall be available for expenses incurred for research, engineering, and development.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Further Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

PROGRAM AND FINANCING
($ in Millions)

Identification code: 69-8108-0-7-402	FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
Obligations by program activity:			
0011 Improve aviation safety	92	118	64
0012 Improve Efficiency	25	30	15
0013 Reduce environmental impact of aviation	43	33	24
0014 Improve the efficiency of mission support	6	5	3
0100 Subtotal, direct program	166	186	106
0799 Total direct obligations	166	186	106
0801 Research, Engineering & Development (Airport & Airway Trust Fund (Reimbursable)	8	8	8
0900 Total new obligations (total)	174	194	114
Budgetary resources available for obligation:			
1000 Unobligated balance brought forward, Oct 1	66	78	70
1021 Recoveries of prior year unpaid obligations	1	. . . . .	. . . . .
1050 Unobligated balance (total)	67	78	70
New budget authority (gross), detail:			
Appropriation, discretionary:			
1101 Appropriation (special or trust fund)	177	175	74
Spending authority from offsetting collections, discretionary:			
1700 collected	9	11	11
1900 Budget authority (total)	186	186	85
1930 Total budgetary resources available	253	264	155
Memorandum (non –add) entries:			
1940 Unobligated balance expiring	-1	. . . . .	. . . . .
1941 Unexpired Unobligated balance, end of year	78	70	41
Special and non-revolving trust funds:			
1950 Other balances withdrawn and returned to unappropriated receipts	2	. . . . .	. . . . .
1951 Unobligated balance expiring	1	. . . . .	. . . . .
1952 Expired Unobligated balance, start of year	5	7	7
1953 Expired Unobligated balance, end of year	4	7	7
1954 Unobligated balance canceling	2	. . . . .	. . . . .
Change in obligated balances:			
Unpaid obligations:			
3000 Unpaid obligations, brought forward, Oct 1 (gross)	141	143	133
3010 New obligations incurred, unexpired accounts	174	194	114
3020 Outlays (gross)	-170	-204	-163
3040 Recoveries of prior year unpaid obligations, unexpired	-1	. . . . .	. . . . .
3041 Recoveries of prior year unpaid obligations, expired	-1	. . . . .	. . . . .
3050 Unpaid obligations, end of year	143	133	84
Uncollected payments:			
3060 Uncollected payments, Federal Sources, brought forward, Oct 1	-3	-3	-3
3090 Uncollected payments, Federal sources, end of year	-3	-3	-3
Memorandum (non-add) entries:			
3100 Obligated balance, start of year	138	140	130
3200 Obligated balance, end of year	140	130	81
Budget Authority and outlays, net:			
Discretionary:			
4000 Budget authority, gross	186	186	85
Outlays, gross:			
4010 Outlays from new discretionary authority	51	88	44

4011	Outlays from discretionary 0balances	119	116	119
4020	Outlays, gross (total)	170	204	163
	Offsets against gross budget authority and outlays			
	Offsetting collections (collected) from:			
4030	Federal sources	-9	-11	-11
4040	Offsets against gross budget authority and outlays (total)	-9	-11	-11
	Additional offsets against gross budget authority only:			
4180	Budget authority, net (total)	177	175	74
4190	Outlays, net (total)	161	193	152

This account provides funding to conduct research, engineering, and development to improve the national airspace system's capacity and safety, as well as the ability to meet environmental needs. The proposed funding is allocated to the following performance goal areas of OST and the Federal Aviation Administration: improve aviation safety, improve efficiency, reduce environmental impacts and mission support. The request includes funding for several research and development activities of the Next Generation Air Transportation System (NextGen), as well as activities related to unmanned aircraft systems.

OBJECT CLASSIFICATION
($ in Millions)

Identification code: 69-8108-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Direct obligations:			
	Personnel compensation			
11.1	Full-time permanent	28	30	16
12.1	Civilian personnel benefits	9	9	5
21.0	Travel and transportation of persons	1	2	1
25.1	Advisory and assistance services	23	26	15
25.2	Other services from non-Federal sources	49	55	32
25.3	Other goods and services from Federal sources	6	6	4
25.4	Operation and maintenance of facilities	...	1	...
25.5	Research and development contracts	18	21	12
25.7	Operation and maintenance of equipment	1	1	1
26.0	Supplies and materials	2	2	1
31.0	Equipment	2	2	1
41.0	Grants, subsidies, and contributions	27	31	18
99.0	Direct obligations	166	186	106
99.0	Reimbursable obligations	8	8	8
99.9	Total new obligations	174	194	114

Employment Summary

Identification code: 69-8108-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
1001	Direct civilian full-time equivalent employment	230	229	132

EXHIBIT III-1

RESEARCH, ENGINEERING & DEVELOPMENT
Summary by Program Activity
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

	FY 2017 ACTUAL	FY 2018 Annualized CR	FY 2019 REQUEST
Improve Aviation Safety	105,370	104,718	43,935
Improve Efficiency	22,243	22,067	8,467
Reduce Environmental Impact	43,187	42,834	19,166
Mission Support	5,700	5,682	2,658
TOTAL	**176,500**	**175,301**	**74,406**
FTEs			
Direct Funded	249	229	132
Reimbursable, allocated, other	0	0	0

Program and Performance Statement

This account provides funding for establishing and overseeing FAA's Research and Development (R&D) policies and plans. Its diverse scientific, engineering and technical workforce supports all aspects of aviation from research on materials to development of new products and procedures.

In partnership with both domestic and international entities within the aviation community, the FAA RE&D programs provide world leadership by conducting high-priority research and developing innovative technologies to support a safe and efficient global aviation system.

	FEDERAL AVIATION ADMINISTRATION	FY 2019 Request	Page
A. Research, Engineering and Development		**74,406**	
A11	**Safety**	**43,935**	
a.	Fire Research and Safety	4,867	9
b.	Propulsion and Fuel System	555	13
c.	Advanced Materials/Structural Safety	2,300	18
d.	Aircraft Icing/Digital System Safety	7,684	22
e.	Continued Airworthiness	4,969	27
f.	Flightdeck/Maintenance/System Integration Human Factors	5,052	32
g.	System Safety Management/Terminal Area Safety	799	35
h.	Air Traffic Control/Technical Operations Human Factors	1,436	39
i.	Aeromedical Research	3,875	42
j.	Weather Program	6,580	45
k.	Unmanned Aircraft System Research	3,318	49
l.	Commercial Space Transportation Safety	2,500	52
A12	**Improve Efficiency**	**8,647**	
a	NextGen Wake Turbulence	3,519	55
b.	NextGen Air Ground Integration Human Factors	1,336	58
c	NextGen Weather Technology in the Cockpit	1,525	61
d.	NextGen Information Security	1,232	65
e.	NextGen Flight Deck Data Exchange Requirements	1,035	68
A13	**Reduce Environmental Impacts**	**19,166**	
a.	Environment and Energy	11,588	70
b.	NextGen Environmental Research Aircraft Technologies and Fuels	7,578	74
A14	**Mission Support**	**2,658**	
a.	System Planning and Resource Management	1,480	76
b.	William J. Hughes Technical Center Laboratory Facility	1,178	78

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RESEARCH, ENGINEERING AND DEVELOPMENT (RE&D) PORTFOLIO OVERVIEW

The Research, Engineering and Development (RE&D) budget is formulated following a systematic process that considers administration, departmental, and agency strategic objectives, program execution, and program evaluation. This process strengthens the alignment between the planning, programming, budgeting and execution of the RE&D program; increases the return on taxpayer investment; enhances productivity; and ensures the relevance, quality, and performance of the RE&D program.

In support of its mission, the FAA manages a diverse research portfolio that advances air transportation safety, enhances airspace capacity, and facilitates the safe and efficient integration of new airspace users. Beyond these core mission objectives, the FY 2019 budget aims to emphasize research and development projects that align with and support administration strategic objectives expressed in Office of Management and Budget (OMB) Memorandum M-17-30 "FY 2019 Administration Research and Development Budget Priorities".

The FAA's portfolio supports research projects performed in tandem with other Federal and non-Federal Partners as well as those that show potential to promote the nation's economic growth through innovation and creation of new products and services for the American people. Furthermore, the proposed portfolio continues to recognize the need for federal leadership in the development and deployment of innovation while fostering collaboration that enables effective technology transfer to the private sector. Recognizing the economic growth potential of the burgeoning Unmanned Aircraft System (UAS) industry, the proposed portfolio provides for continued investment in research to enable their safe and efficient integration into the National Airspace System (NAS). Furthermore, the FAA continues to engage in Cooperative Research and Development Agreements (CRDA) with UAS industry proponents to assist in the development and deployment of industry-borne innovation.

Sustained leadership in development and deployment of innovation necessitates commensurate investments in our research infrastructure and a future focused workforce capable of meeting emerging transportation challenges. To that end, the proposed portfolio continues to leverage Air Transportation Centers of Excellence (COE) as a way of engaging academia and non-Federal investment in addressing current research challenges while providing a pathway to develop a cadre of Science, Technology, Engineering, and Math (STEM) workforce to address transportation challenges of the future.

The agency's RE&D program is presented in the National Aviation Research Plan (NARP). Updated and published annually, the NARP presents a five-year outlook of planned research and expected outcomes resulting from the investments in each of the research activities and programs detailed in this submission. The NARP also aligns proposed research with broader strategic priorities specified in FAA and DOT strategic plans.

Formulation of the RE&D portfolio is coordinated by the Research Executive Board (REB)—a cross agency executive body representing research needs sponsors and program performers. The REB oversees the development and review of the portfolio and approves its presentation to the FAA Joint Resources Council (JRC) for subsequent integration into the agency's budget submission. This framework ensures coordination at all levels for a well-balanced portfolio.

Research project execution and internal project evaluations are conducted by Program Planning Teams (PPTs) composed of program managers (performers) and sponsors to ensure research needs are satisfied. Independent program review is provided by the Research Engineering and Development Advisory Committee (REDAC). The REDAC is a chartered advisory committee performing in accordance with the Federal Advisory Committee Act (FACA); it brings industry and academia together to review the RE&D portfolio and provide independent advice to the FAA Administrator.

The requested funds provide for 21 separately funded programs, each of which is aligned with one or more of three research activities that in turn align with agency and departmental strategic priorities. A fourth activity provides for cross-cutting mission support programs that enable development, coordination and management review of the RE&D portfolio and support the sustainment of laboratory facilities and equipment to perform critical research.

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Detailed Justification for A11.a Fire Research and Safety

FY 2019 – A11.a Fire Research and Safety - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.a Fire Research and Safety	$7,425	7,394	$4,867

What is this Program and what does this Funding Level Support?

The Fire Research and Safety program seeks to prevent accidents caused by in-flight fire and to improve survivability during a post-crash fire. The program is necessary due to the catastrophic consequences of an uncontrollable aircraft fire, which include: the large loss of life and the destruction of the aircraft. The program conducts research to understand the fire safety implications of new technologies and materials the aviation industry continues to introduce in order to decrease weight and increase operating efficiency. This research is used to develop effective mitigation procedures and to update existing regulations, which often do not address the unique behavior of these new technologies. Finally, the program conducts research to better understand and mitigate the threat of lithium battery cargo fires, which are a continuing concern due to the increasing number, sizes and energy densities of batteries being shipped and to the unusual and severe hazards associated with lithium battery fires.

The program supports 1) the FAA's Office of Aviation Safety, which is responsible for issuing regulations, standards, and guidance material to ensure the highest level of safety in commercial aviation; and 2) the FAA's Security and Hazardous Materials organization. Research efforts specific to hazardous material transport are completed in coordination with the Department of Transportation's Pipelines and Hazardous Materials Safety Administration (PHMSA). The program also supports safety enhancements (specifically: SE126, or 'Mitigation of Hazardous Materials Fires') recommended by the Commercial Aviation Safety Team (CAST), which is a voluntary collaboration between regulators and the aviation industry to identify emerging risks to aviation safety and developing mitigation procedures to reduce the risks.

The requested funding supports the fire safety facilities at the FAA's William J. Hughes Technical Center, Atlantic City, NJ, where the majority of the program's research is conducted. These facilities, where research is led by internationally recognized experts in aircraft fire safety research, are the most extensive civil aircraft fire test facilities in the world. The technical expertise developed through the use of these facilities has continually contributed to aviation safety through the ability to quickly and effectively address newly emerging fire hazards. As a result, the international aviation community looks to the FAA for leadership in aircraft fire safety research and development. Research activities to increase aircraft fire safety include fire tests for interior materials, fire detection and suppression systems, fire-fighting procedures and guidance material, testing to validate Halon replacement suppression agents against minimum performance standards, and safeguards to protect against fires involving lithium batteries, fuel cells, and hazardous materials.

Integrated Aircraft Fire Protection System

Current regulations require fire detection and/or fire suppression systems in specific areas in aircraft, such as cargo compartment, engines and APUs, and lavatories. Inaccessible areas above the cabin ceiling, below the cabin floor, behind sidewall panels, and in electronic accessory compartments generally do not require such systems. These areas contain electrical ignition sources and hidden in-flight fires in these areas have occurred. When fires in these areas do occur, the fire location is generally unknown and effective methods to suppress the fires are not readily available. In addition, incidents of smoke, fumes, or odors of unknown origin occur daily on aircraft in the U.S. fleet. Research will be conducted to establish criteria for aircraft-based systems that can detect fires in hidden areas and to discriminate between actual fires and non-

threatening sources of fumes and/or odors. With this information available, the flight crew can make more appropriate decisions based on the severity of the situation and the need to divert the aircraft. Existing systems, such as the fuel tank inerting nitrogen source and/or cargo compartment fire suppression systems could potentially be redirected to fires in areas not currently protected by fire suppression systems. The research will also establish criteria for the fire suppression capability of the integrated fire protection system. Included in this research will be testing of standardized aircraft fire scenarios that will be used to validate Computational Fluid Dynamics (CFD) models capable of predicting heat, smoke and gas movement in the airplane. A validated CFD model will greatly improve the ability of the research effort to examine a wider variety of inflight fire scenarios at altitude and define the performance criteria of the integrated fire protection system. The benefit of such a system will be a reduction of unnecessary flight diversions due to non-threatening odor events, a more rapid response to actual emergencies, and an enhanced ability by the flight crew to be aware of the location and severity of inflight events.

Hazardous Materials Fire Mitigation

Research will be conducted to determine the effectiveness of cargo compartment fire detection and suppression systems on hazardous materials for both passenger aircraft and freighters. The testing will include both Halon 1301, the suppression agent used in existing passenger aircraft cargo compartments, and proposed replacements agents due to the phase-out of Halon for environmental reasons. The testing will include methods of improving the detection of cargo fires from both cargo compartment based detection systems and potential detection devices located within cargo containers and pallets. Research will also be conducted on methods to suppress and/or contain hazardous material fires for six hours. Testing will be conducted to achieve that goal with aircraft cargo compartment based systems, with Unit Load Devices (ULD) based systems, and at the hazardous material packaging level. This research was requested through recent CAST safety enhancement studies on the transport of hazardous materials. The research will include testing of both declared and properly packaged hazardous materials along with undeclared hazardous materials. The benefit of this research will be improved aircraft capabilities to detect and control fires originating from the increasing quantities of high energy density items transported in aircraft cargo compartments.

Improved Understanding of the Role of New Structural and Cabin Materials in Accident Survivability

Aircraft manufacturing is evolving beyond the use of traditional aluminum alloy fuselage structural materials and in materials used inside the passenger cabin. These materials include composites, new metallic alloys, and new seat structures. Existing flammability regulations do not address the potential effect on fire survivability due to differences in flame spread, heat transfer, and toxic gas production from these new materials. Full-scale testing will assess the impact on fire survivability. The testing will include both post-crash external fires and in-flight fire scenarios. Lab scale testing will be conducted to ensure that the existing high level of accident survivability and fire prevention is maintained. New flammability test standards may be developed to ensure required flammability certification tests correlate to full scale test results. The benefit of this research will be to document the effect of new materials used in aircraft construction on accident cause and survivability.

Fire Research

Computer modeling will be used to simulate in-flight fire hazards and identify mitigating strategies that would be prohibitively expensive or impossible to recreate in full-scale tests. Relevant fire hazards include heat transport and smoke movement in aircraft cabins and cargo compartments at cruise altitude; flame spread over materials in hidden areas; under-ventilated burning/smoldering of structural composites; and fire suppression in hidden areas. Numerical simulations will be used to support FAA long range plan to certify by analysis. This includes emerging fire threats at cruise altitude as well as new materials, components, and cabin configurations. The flammability parameters and combustion toxicity of cabin materials with replacement flame retardants will be assessed in small- and bench-scale tests to develop criteria to expedite recertification of materials. This is in response to the Environmental Protection Agency ban on flame retardants commonly used in aircraft cabins.

Major Activities and Accomplishments Planned in FY 2019 Include:

Aircraft Fire Safety

- Assess the ramifications of carriage of hazardous goods on aircraft fire protection methods and equipment, and consider technical feasibility of addressing such goods at the aircraft level.
- Improve understanding of the role of non-traditional structural and cabin materials in accident survivability.
- Conduct testing with fire detection, containment, and suppression technologies capable of improved detection of fires involving cargo and hazardous materials inside ULDs and/or safety packaging.
- Develop integrated airplane fire protection system criteria.

Goals for FY 2019 Funding:

- By 2023, develop the enabling technology to prevent accidents caused by in-flight fires in cargo and passenger large transport aircraft by improving fire detection and suppression capabilities and upgrading the flammability requirements for materials in inaccessible areas and hazardous cargo.
- By 2023, enable the introduction of new, lightweight/energy efficient, fire-safe materials, and components into commercial transport aircraft, such as composite structure, magnesium and other metallic alloys, cabin furnishings, and advanced electrical power sources, including lithium batteries and hydrogen-fueled fuel cells.
- By 2023, support and facilitate the evaluation and replacement of Halon fire extinguishing agents and halogenated cabin material flame-retardants with effective and practical alternatives.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The primary benefit to the American public from this research is the prevention of catastrophic aircraft accidents caused by in-flight fires and increased survivability during a post-crash fire. Other benefits derived from this program include: the introduction of enabling technologies to prevent accidents caused by fire in freighter aircraft and hidden in-flight fires in passenger-carrying airplanes, and 2) the development, validation, and transfer of cost-effective aircraft fire safety technology to the aviation industry.

Effective April 1, 2016, International Civil Aviation Organization (ICAO) approved the prohibition of lithium ion battery shipments in passenger aircraft, a reduced state of charge for lithium ion batteries on freighter aircraft, and elimination of unrestricted small quantity undeclared shipments on freighter aircraft. The ICAO actions were a direct result of FAA fire testing that demonstrated the hazards associated with lithium battery fires. Those test results also led Boeing and Airbus to recommend to operators of their aircraft that bulk shipments of lithium ion batteries be banned in passenger aircraft because the current cargo compartment fire suppression systems were not designed to protect against the severe and unusual hazards of a lithium battery fire, until effective shipping packaging becomes available. In early 2015, United, American, Delta, Qantas, and Cathay Pacific airlines unilaterally banned the bulk shipment of lithium ion batteries, which are manufactured and shipped in far greater quantities than lithium metal batteries, in passenger aircraft. These unilateral measures by the airlines have improved aircraft fire safety, but also underscore the need for the research proposed in this program to safely ship lithium batteries in both freighter and passenger aircraft cargo compartments. Hydrogen powered fuel cells are being proposed to provide electrical power for aircraft systems. Hydrogen is an extremely flammable gas and compressed hydrogen stored onboard aircraft is unprecedented with potential significant new fire hazard implications. These include both leakage during flight and potential contribution to a post-crash fire.

Research products from this program have been implemented in large passenger transport aircraft by regulation throughout the world to improve post-crash fire survivability. The probability of dying from a survivable post-crash fire has been reduced by a factor of three due in part to this past research. This is perhaps best demonstrated by the following recent accidents in which the aircraft were subjected to a post-crash fire: Continental 737 (Denver, 2008), Asiana 777 (San Francisco, 2013) and British Airways 777 (Las Vegas, 2015). There were 592 passengers and crewmembers in the three airplanes and zero fire fatalities. The introduction of new aircraft materials and technologies, and emerging fire threats increases the need for both in-flight and post-crash fire safety research.

A commercial fire research product resulting from this program is the FAA-patented microscale combustion calorimeter, which was standardized (ASTM D 7309) and licensed to several manufacturers. Hundreds of these devices have been sold worldwide since 2007 for research and development of new fire resistant plastics for transportation, building/construction, and electrical/electronic applications.

Detailed Justification for A11.b Propulsion and Fuel Systems

FY 2019 – A11.b Propulsion and Fuel Systems - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.b Propulsion and Fuel Systems	$2,074	$2,058	$555

What is this Program and what does this Funding Level Support?

The FAA establishes rules for the certification and operation of aircraft engines, fuels, and fuel management systems that enhance the airworthiness, reliability, and performance of aircraft propulsion and fuel systems. This program conducts research on advanced damage tolerance and risk assessment methods to reduce and eliminate uncontained aircraft turbine engine failures by ensuring the structural integrity of critical life limited engine components. This research is ultimately used by the FAA's Office of Aviation Safety as the basis for new or revised engine certification and continued airworthiness standards.

For FY 2019, the following three research areas are targeted:

Aircraft Turbine Engines

Although the history of turbine engine operation in commercial aviation is a safe one, the risk of an engine failure is always present and the potential consequences are enormous: the large loss of life in accidents and the destruction of the aircraft. Accidents such as United Airlines Flight 232 on July 19, 1989 in Sioux City, Iowa, and Delta Airlines Flight 1288 on July 6, 1996 in Pensacola, Florida are noteworthy because they were caused by the failure of turbine engine components that caused catastrophic loss of life. Investigations revealed that the primary failure modes of these accidents were the result of material and manufacturing anomalies that degraded the structural integrity of the high energy rotors that led to the uncontained failures. A more recent, non-fatal, uncontained engine event occurred on October 28, 2016 during the take-off roll of American Airlines Flight 383 at O'Hare International Airport. This uncontained failure of the high pressure turbine disk is still under investigation by the National Transportation Safety Board, but serves as a reminder that such failures, although extremely rare, do still occur.

Following the Sioux City and Pensacola accidents, significant collaborative initiatives by the FAA and industry via the Aerospace Industries Association (AIA) Rotor Integrity Steering Committee (RISC) resulted in a number of measures to increase the safety of turbine engines throughout their life cycles. These included improvements to titanium metallurgical quality, nondestructive testing (NDT) methods for production and in-service inspections, and turbine rotor structural design and service life prediction standards. In 2007, the FAA issued a change to CFR 14 rule 33.70 on Aircraft Engine Standards for Engine Life-limited Parts by enhancing traditional safe life rotor design with a damage tolerance (DT) based approach. In support of this major rule change, the FAA has undertaken this research to develop data and a methodology to assist the industry in demonstrating compliance to this rule.

Specifically, the research provided by this funding will develop and validate a probabilistic-based turbine engine design code called DARWIN® (Design Assessment of Reliability With INspection) that determines the risk of fracture of turbine engine rotors containing undetected material anomalies. DARWIN® satisfies FAA requirements defined in section 33.70 "Engine Life-limited Parts" for the purposes of preventing uncontained turbine engine rotor failures. DARWIN® is being developed and validated collaboratively with the major U.S. engine manufacturers. In addition to the software development, this research also provides data to support the preparation of a series of FAA Advisory Circulars (ACs) that provide industry with technical information on acceptable means to comply with the regulation. The series of ACs addresses all aspects of how this rule applies to various rotor materials and geometric features. The list of planned ACs addresses both Nickel and

Titanium materials, as well as, rotor features such as holes, blade slots, and turned surfaces, as shown here:

AC 33.70-2, DT of Hole Features in High Energy Rotors (completed)
AC 33.70-3, DT of Titanium Material Anomalies in High Energy Rotors (completed, awaiting release)
AC 33.70-4, DT of Blade Slots in High Energy Rotors - expected release in FY 2019
AC 33.70-5, DT of Turned Surfaces in High Energy Rotors - expected release in FY 2020
AC 33.70-6, DT of Ni Material Anomalies in High Energy Rotors - expected release in FY 2022

Research undertaken will also address the need to develop better nondestructive testing methods to characterize rotor material conditions that can compromise its integrity. These conditions include compressive residual stresses, abnormal grain size, texturing, and cracks. Improved NDT will not only detect defective components, but it can also be used to validate complex manufacturing processes and to feed more accurate data into DARWIN® to improve its predictive capabilities in the presence of these conditions.

Research will be initiated to enable use of DARWIN® to analyze the risk of failure of new materials such as additively manufactured (3D printed) engine components.

Catastrophic Engine Failure

Specific to the Aircraft Catastrophic Failure Prevention Program, a new challenge has emerged with the proposed open-rotor engine concept, which promises greater efficiency. In this design, the engine containment is removed and two rows of counter rotating fan blades create a new configuration that requires certification. Current ducted fan designs used in large commercial transport completely mitigate a fan blade loss with engine containment. For these new engines, a fan blade failure is not contained therefore fuselage shielding is needed. Research is necessary to improve analytical tools previously developed under the program to evaluate this new configuration.

As a result of the Qantas Airlines uncontained engine failure on the Airbus A-380 aircraft that occurred in November 2010 The Australian Transportation Safety Bureau recommended to review and update the guidance in AC20-128. Research is on-going to revise the large engine debris fragment model and Uncontained Engine Debris Damage Assessment Model (UEDDAM) code.

The current engine and aircraft certification methods require full-scale destructive tests of an engine. There is a need for more robust and accurate non-destructive analytical methods and predictive tools to assess safety risks to the aircraft to minimize or replace non-destructive tests. Research is necessary to achieve and validate certification-by-analysis using analytical and predictive tools. Standardized methods and numerical tools to analyze effects of both engine rotor-burst and fan blade releases assist the FAA certification offices and industry applicants in gaining a common understanding in demonstrating compliances of regulatory requirements. The option for standardized compliance by analysis (for specified rules) for derivative designs of already certified engines will be possible. The analysis tools developed in this program will 1) help to mitigate aircraft damage from uncontained engine failures and prevent potential aircraft catastrophic failures, and 2) allow FAA engineers to validate proprietary tools currently used by engine manufacturers and streamline the certification process. The long-term goal is certification-by-analysis.

Another new challenge for this program is the move away from the traditional aluminum and into composite aircraft structures. This creates a significant increase in the model complexity. Metal alloys typically have the same properties throughout the material and in all directions (i.e., isotropic). Composites have very different properties depending on the fiber orientation in the resin (anisotropic). Industry trends indicate an increased use of composites for both engine containment and fuselage structure. Better algorithms to predict the failure of these materials are needed. Research is necessary to build on the recent success with metals, increase capability of computer platforms through parallel processing, and develop a new generation of predictive anisotropic models.

GA Alternative Fuels

The primary focus of the alternative fuels for this research is to provide data to support the fleet wide authorization of unleaded aviation fuels. It also supports the Piston Aviation Fuels Initiative (PAFI) and ASTM Fuel Specifications. This program is the proving ground for the feasibility of the use of unleaded replacement aviation gasoline fuels.

Approximately 167,000 GA aircraft in the U.S. and 230,000 worldwide rely on 100LL Aviation Gasoline (avgas) for safe operation. 100LL is also the only remaining transportation fuel in the U.S. that contains the additive Tetraethyl Lead (TEL). TEL creates the very high octane levels required to prevent detonation (engine knock) in high power aircraft engines. Operation with inadequate fuel octane can result in engine failure and aircraft accidents. Previous research attempted to find an unleaded replacement fuel with no impact to the existing fleet. No such fuel solution was found. The impact on performance, operability, and compatibility with fuel system materials must be carefully evaluated before approving an alternative fuel. The use of replacement fuels with new compositions poses a significant challenge to maintaining the safety of the fleet.

The requested funding will support: completion of the final reports from the aircraft and engine testing for the transparent fleet authorization; completion of the additional materials compatibility testing to resolve issues uncovered in the program research; identification of the size and scope of the non-authorized fleet; evaluation of the non-authorized fleet to determine how to expand the approvals based on the results of research to date; initiation of research and testing to support expanded authorization to the remainder of the GA fleet with the approved fuels; evaluation of safety impacts related to comingling of approved fuels; identification and development of test requirements (for fleet-wide authorization) of fuel and oil additives necessary to resolve issues uncovered in the program research; initiation of testing on identified fuel and oil additives for safety and efficacy to support fleet-wide authorization; and addressing other remaining issues identified in the UAT ARC report.

Major Activities and Accomplishments Planned in FY 2019 Include:

Aircraft Turbine Engines

Advanced Damage Tolerance and Risk Assessment Methods for Engine Life-Limited Parts

- Prepare program plan to develop analytical capabilities within DARWIN® to support an Advisory Circular that addresses damage tolerance of rotor turned surfaces.
- Develop strategy to validate and incorporate new load interaction models into DARWIN® that are more rigorous and accurate than current analysis.
- Release DARWIN® version 9.4 updated with the following capabilities: 1) ability to analyze blade slots using second–generation auto-modeling, 2) improved user interfaces for 2D & 3D models, 3) the ability to analyze shafts and casings, and 4) an improved fleet risk module, and 4) advanced methods to account for residual stresses.

Catastrophic Engine Failure

Advanced Analysis Methods for Impact of Composite Aircraft Materials in Rotor-Burst and Blade Release

- Continue development of models, guidelines, and validation in conjunction with the LSDYNA Aerospace Users Group.
- Continue support of the Uncontained Engine Debris Damage Assessment Model to support potential new regulations and advisory material.

GA Alternative Fuels

- Complete engine and aircraft test reports on candidate unleaded fuels for transparent fleet authorization.

- Identify the scope of and initiate testing on the non-authorized fleet.
- Complete materials compatibility testing reports.
- Initiate testing on identified fuel and oil additives for fleet-wide authorization.
- Establish contract and cooperative agreement awards for aircraft and engine testing.

Goals for FY 2019 Funding:

- By 2022, develop new analysis capabilities to enable DARWIN® to support a proposed Advisory Circular that addresses damage tolerance of rotor turned surfaces.
- By 2020, complete engine and aircraft test reports on candidate unleaded fuels for transparent fleet authorization.
- By 2020, identify the scope of and initiate testing on the non-authorized fleet.
- By 2020, complete materials compatibility testing reports.
- By 2020, initiate testing on identified fuel and oil additives for fleet-wide authorization.
- By 2020, establish contract and cooperative agreement awards for aircraft and engine testing.
- By 2023, validate composite material models with associated guidance for certification.
- By 2023, maintain UEDDAM in conjunction with DoD, as a means of compliance for ducted and open rotor engines.
- By 2024, develop enhanced capabilities within DARWIN to conduct fracture and life prediction on Nickle rotor components containing inherent anomalies.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The specific benefits of the aircraft turbine engine research to the American public will be the reduction or elimination of commercial aircraft uncontained turbine engine failures and in-flight engine shut downs attributable to rotor design, manufacturing, and service induced defects. Benefits will accrue in the form of reduced risk of engine failures and fewer aircraft accidents, which in turn will lead to fewer injuries, fatalities, and property damage. This research program is necessary because it is producing a publicly available probabilistic damage tolerance based engine design code that enables the industry to meet the enhanced safely requirements for critical engine components as mandated by 33.70. The DARWIN® code (version 9.2) is currently used by nearly all major engine manufacturers. Additional research will enhance the DARWIN® code to allow probabilistic damage tolerance analysis of rotor blade slots, turned surfaces, and Nickel alloy anomalies. Finally, this research will provide additional insight and background data to enable the FAA to fulfill its oversight role during the certification process of new rotor designs and for continued airworthiness. The research conducted under this program is critical to the FAA's ability to understand these challenges and to ensure incorporation of acceptable safety improvements by the user community.

The Aircraft Catastrophic Failure Prevention Program has a long history of addressing the overlap between aircraft certification and engine certification, which is known as engine installation. Continued investment in computing capability promises to provide opportunity to improve the accuracy of failure analysis for the rare but hazardous engine fragment impact events. The long-term goal is to advance certification-by-analysis with predictive tools. This will improve safety and reduce the cost of producing new engine and aircraft designs. Anisotropic composite materials are the current focal areas of interest in impact analysis; and the A-380 accident recommendation is the current focus of aircraft vulnerability analysis. Today, certification of fan blade requires a test that can cost upwards of $20 million. Predictive analysis will 1) improve the design capability, allowing for a more thorough evaluation that improves safety of aircraft, and 2) significantly

reduce the cost of certification. The safety benefits include a reduction in accidents related to engine failures and mitigation of fatalities and injuries if an accident occurs.

General aviation (GA) is a significant and integral part of the U.S. economy creating millions of jobs and making a positive impact on the U.S. balance of trade. Directly or indirectly, GA accounted for over 1.1 million high-skilled, high-wage jobs in professional services and manufacturing in 2015 and contributed over $219 billion to the U.S. economy. This economic bonanza is at risk unless the GA fleet transitions to safe unleaded fuels. The GA Alternative Fuels research provides critical knowledge (through screening and testing) to assure the continued operational safety of aircraft using new unleaded fuels. Successful transition to unleaded fuels will improve the environment by reducing lead emissions from the burning of 197 million gallons (2014 figure) of leaded AVGAS and help sustain a vibrant segment of the Nation's economy. In addition, this program will enhance the FAA's position as a worldwide leader in alternative fuels research, providing joint government-industry developed data that has the ability to impact a majority of the worldwide piston engine aircraft fleet.

Detailed Justification for A11.c Advanced Materials/Structural Safety

FY 2019 – A11.c Advanced Materials/Structural Safety - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.c Advanced Materials/Structural Safety	$6,500	$6,451	$2,300

What is this Program and what does this Funding Level Support?

The Advanced Materials and Structural Safety Program conducts research to support the FAA safety and regulatory activities in the technical areas of composite and other advanced materials, and aircraft dynamic impacts. This program is divided into two research areas: Advanced Materials and Structural Safety (crashworthiness).

Aircraft are enormously complex systems. This is true not just for the electronics and flight control systems, but also for the airframes and the loads placed on them. This is evident from the evolution of the safety of aircraft. The first modern airliners, the Boeing B247 and Douglas DC2, were produced in the early 1930s. While aircraft grew in size over the years, became pressurized, and were fitted with more powerful jet engines, the basic design and aluminum alloys remained little changed until relatively recently. Despite the slow pace of evolution of airframes, hull losses and loss of life due to structure failure remained a constant until the most recent generations of airliners. Each accident and incident added to the tremendous store of knowledge that has contributed so much to the remarkable safety record enjoyed today.

The use of composites in primary structure, that is the most critical areas of an airframe, is new to commercial airliner design, being seen first in the Boeing 787 in 2011. While much of the knowledge gained from 80 years of experience with traditional aluminum aircraft pertains to the design of composite aircraft, a great deal does not. As composite aircraft see service, age, and are exposed to the wide array of environmental conditions of aircraft service, they will react differently than traditional aluminum aircraft. Because of this, issues unique to composite aircraft have already arisen and will almost surely continue to arise. In addition, new composite materials, composite designs, and fabrication techniques are being introduced as composite aircraft inevitably evolve.

For the FAA to understand certification applications for new and modified aircraft, to issue required guidance, directives, and regulations, and to oversee the resolution of issues as they arise, its personnel must have a thorough understanding of the behavior of existing and emerging composite materials, designs, and fabrication techniques. The Advanced Materials and Structural Safety program works with industry, academia (including the FAA's Center of Excellence), and other government laboratories to provide this knowledge. In so doing, the program effectively leverages its resources, with industry fully matching research funds.

The Advanced Materials program investigates damage tolerance and fatigue issues of composite structures, including the assessment of impact damage (e.g., in-flight hail, ground vehicle collisions) and fatigue effects of composite materials on structural strength. The program explores composite environmental and aging effects; control issues related to composite fabrication and continued operational safety, bonded joints, bonded and bolted repairs and the characteristics of new materials and applications used in aircraft structures. The program develops safety awareness training material for advanced composite materials and manufacturing processes for education of aviation workforces.

Advanced Materials and Structural Safety research requirements are driven by industry advancements in construction of airframes and related components presented for certification. The FAA must assure that the changes maintain an equivalent or improved level of safety compared to that achieved with current operational aircraft. Requests from the aircraft certification offices and from the aircraft manufacturers

seeking 'type certification' approval are major influences that shape research requirements. Additional requirements are developed from assessments of existing techniques, protocols, and service histories. These are examined to determine if modifications to certification compliance methods are required for novel materials, processes, and forms. The National Transportation Safety board review of accidents (e.g., AA587 (http://www.ntsb.gov/investigations/AccidentReports/Pages/AAR0404.aspx), R22 (https://www.atsb.gov.au/publications/investigation_reports/2007/aair/aair200701625.aspx) involving these structures provides additional impetus for research required to understand these emerging technologies.

Major Activities and Accomplishments Planned in FY 2019 Include:

Damage Tolerance of Composite Structures

- Work with industry to identify appropriate methods for showing compliance of composite structures with fatigue and damage tolerance (DT) requirements. Fatigue and DT issues arise from manufacturing defects, such wrinkles and porosity, and damage such as from impact. Initial aircraft designs as well as modifications, major alterations, and repairs are considered. Methods to determine composite structural reliability are investigated and appropriate data-driven risk management statistical methods are to be determined.

- Investigate the issues for composite/metal hybrid structure and set related test & analysis protocol. Determine whether real-time environmental issues and other aging phenomena are properly covered by current composite fatigue and damage tolerance structural substantiation approaches.

- Investigate the issues surrounding wide area impact and the resulting barely visible impact damage. Composite structures are susceptible to significant damage from impacts such as from ground vehicles. Often this damage is limited to interior structure and is not detectable by the standard pre-flight visual inspection, leaving a significant risk to the aircraft if the impact is not reported. The maximum internal damage possible without external signs will be bounded. Investigate differences between narrow and wide body aircraft and the effect of skin panel design. Update the relevant course modules. Next major updates are planned for FY 2017 and FY 2020.

- Evaluate the onset, growth, and arrestment of delamination for composite rotorcraft dynamic parts. Document suitable fatigue and damage tolerance test and analysis protocol, which can be used for reliable structural substantiation. Note whether current industry protocols used for damage simulation are appropriate versus more natural defects coming at various load levels and cycle times.

- Investigate high energy impact threats with the greatest potential to damage dynamic rotorcraft components and document related test protocol suitable for structural evaluation.

- Assess the performance and characteristics of emerging composite materials and technologies such as Ceramic Matrix Composites (CMC) and Resin Transfer Molding (RTM).

- Perform preliminary analyses and tests to determine whether the interlaminar stresses that dominate the performance of lap shear joints with 100% load transfer through discontinuous plies can meet the performance expectations of longitudinal splices for pressurized fuselage skin panel joints without considering real-time effects for repeated load and environmental durability.

Composite Maintenance Practices

- Analyze data produced in prior years of this ongoing project to evaluate the variability in structural performance of bonded and bolted repairs as related to human factors such as the level of experience (as related to formal and on-the-job training) and the issues related to specific design and processing details. Document what can be concluded about the quality control procedures that demonstrate high levels of reliability and identify gaps in knowledge for future research. This task addresses parts of the FAA Bonded Repair Size Limits Policy released in 2014. Explore

accelerated tests to simulate the most critical factors affecting bonded repair performance. Explore composite substrate aging issues for both bonded and bolted repairs.

- Use existing test specimens and in-house capabilities to investigate the strength of bonded repairs to in-service aged composites. It may be possible for aged composites to have a lower potential for reliable bonded repairs. This will compliment work being performed by the M&I TCRG.
- Work with industry to identify training issues that should be addressed in a future composite repair structural substantiation training course to support safe maintenance for composite transport airplanes, small airplanes and rotorcraft in the field. Such a course would include a course module that outlines the regulatory expectations, guidance, process control, and proof of structure engineering practices for engineering support to composite repair approval. It would also ensure technical design and process issues affecting repair performance are addressed and show the pitfalls of attempting to apply reverse engineering practices to non-standard composite.

Structural Integrity of Adhesive Joints

- Working with industry, establish requirements for environmental durability test standards for composite bonded joints and document related guidance. Perform in-house research to validate approaches to such standards. Demonstrate the utility of such standards with the composite bonded joints that have demonstrated good performance over long-term service experience and those known to have unacceptable environmental durability.
- Investigate issues to be addressed by guidelines for bond qualification, which would go beyond adhesive material qualification by adding consideration of the bonding process and compatibility with the substrate material. Include associated scaling aspects, and how the production process (from handling and layup through cure) affects the processing window. Create research plan to address these issues and produce the data required to create such guidelines.
- Investigate the effect of processing parameters (moisture exposure and extended cure times) that can cause peel ply to leave a residue on the bonding surface, and the subsequent effect on bond strength and durability.

Continued Operational Safety (COS) and Certification Efficiency (CE) for Emerging Composite Technologies

- Investigate the effects of fire on composite failure analysis procedures and methods.
- Characterize ignition sources from hot particle ejection in composite structure. Develop appropriate detection techniques.
- Identify key characteristics of carbon fiber production, how they are controlled, and what testing needs to be performed in fiber line qualification.
- Investigate the sensitivity of composite materials to new fuels and adequacy of current screening test.

Goals for FY 2019 Funding:

- By 2019, assess loading rates for emergency landing conditions at the component and system level including occupant survivability.
- By 2020, document severe impact damage mechanisms from simulated service vehicle collisions and effect on structural properties. Outline test and analysis guidelines to assure designs are resistant to such damage.

- By 2020, complete an evaluation of field bonded and bolted repair practices to update related guidance and training for composite aircraft structures.
- By 2020, develop information on the effect of environmental and heat exposure on structural properties and durability of composite structures.
- By 2022, provide detailed background on the unique static, fatigue, environmental durability, and impact performance of advanced composite splicing concepts.
- By 2022, provide documentation and background data for regulatory action to assure reliable processing of adhesively bonded structures.
- By 2022, develop a handbook for failure analysis of structures subjected to a fire event after structural malfunction.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

Research funding includes the study and exploration of threats to aviation safety that leads to resolutions, preparation for the safe integration of new technologies in the cockpit, and investigation of continued airworthiness issues. It also helps develop related industry guidelines, training and regulatory guidance materials to mitigate known safety risks and ensure safety awareness in the workforce that is expected to expand in dealing with increased composite applications.

The use of advanced materials and structural concepts is central to a vibrant aviation industry in the U.S. All aircraft manufacturers are using more and more advanced materials on their aircraft. As the methods of structural verification are being extended to new components and aircraft applications, it is important to understand the envelope of acceptable design parameters that have not been explored with traditionally designed advanced composite structures. This will ensure that as more applications are introduced, the safety record of composite structures is maintained. This effort will assure the civil aircraft manufactured with these materials are safe and reliable. The benefit to the American public is a reduction in accidents related to the design and use of composite materials.

Currently, there are no existing structural crashworthiness requirements for transport airplanes. The development of new materials and novel designs has required the manufacturers to provide a level of safety comparable to existing traditional metallic structures. The FAA is seeking to develop a single policy for demonstrating crashworthiness that would be applicable to all transport airplanes regardless of the structure. The FAA would develop requirements to establish acceptable levels of safety and guidelines to help industry meet these accepted levels of safety. The benefit to the American public is a reduction in fatalities and injuries in the event of a crash.

Detailed Justification for A11.d Aircraft Icing/Digital System Safety/Aircraft Cyber

FY 2019 – A11.d Aircraft Icing/Digital System Safety/Aircraft Cyber - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.d Aircraft Icing/Digital System Safety/Aircraft Cyber	$5,102	$5,079	$7,684

What is this Program and what does this Funding Level Support?

Aircraft Icing

The Aircraft Icing Research Program conducts research on structural airframe icing in flight, ground deicing, and anti-icing prior to takeoff, and engine compressor icing due to the ingestion of ice particles into the engine core.

Structural aircraft icing takes place mainly during flight in supercooled clouds, and certification is accomplished mainly through tunnel and flight testing and analysis. Analysis includes the use of computation fluid dynamics (CFD) computer software, which requires validation data to be submitted to the FAA for evaluation of accuracy. The Program has partnered over several years with NASA Glenn Research Center and the Office National d'Etudes et de Recherches Aerospatiales (ONERA) on a multi-year project to develop a high quality database of 3D ice shapes and their aerodynamic effects that can provide a benchmark for industry and the FAA for validation and evaluation of CFD software. Funding in F19 will be for the completion of this database and final report on its development and use.

Structural aircraft icing also takes place in freezing drizzle and freezing rain (collectively called supercooled large drops, or SLD). A new icing certification rule for flight in SLD conditions took effect on January 5, 2015. Means of compliance for SLD environments are not as mature as those used for supercooled clouds not containing SLD. The Program has undertaken a new research effort to partnering with NASA Glenn Research Center addressing means of compliance for the new rule. Funding in F19 will be for continuation of the development and validation of facilities or software acceptable for compliance.

FAA policy for ground icing is guided by the "Clean Aircraft Concept," meant to ensure that aircraft are aerodynamically clean at takeoff. An aircraft with frozen contamination is deiced, and If freezing or frozen precipitation is falling, it is then anti-iced. The Program's ground icing research responds to new issues that arise due to operational issues both in the United States and globally. The Program conducts research on a range of issues that arise in operations, partnering with Transport Canada and the National Research Council of Canada, and enabling the FAA to play a leading role in the international SAE Ground Deicing Committee, which promotes uniformity and safety in ground deicing and anti-icing practices around the world, including the growing markets in Southeast Asia. Funding in FY 2019 will be for research on current issues in support of updated guidance for airlines and fluid manufacturers for the winter of 2019/2020.

Approximately 200 engine icing events, involving many different engines, have been documented over the last twenty years in high ice water content (HIWC) ice crystal conditions in the vicinity of convective conditions, mainly at high altitudes. The events have included stalls, damage, and flameouts, with some cases of multiple flameout and dead stick landings, but no accidents. Ice crystals are ingested into a region of the compressor degrees above freezing, where they impact a surface, through a heat transfer process cooling it to the freezing point and providing a site on which melted or partially melted ice crystals can accrete. The FAA has partnered for several years with the National Research Council (NRC) of Canada on the experimental study of this process. Funding in FY 2019 will be testing using a two-stage rotating rig in a pressure controlled facility.

Digital System Safety

Airborne systems' designs have become increasingly dependent on highly integrated software and hardware architectures that share power, computing, networking, input/output, and other resources to support the needs of multiple aircraft functions. Research is required to address the evolution of these highly complex architectures especially as they begin to integrate with ground systems and NextGen implementation. This will require a flexible system-level approach that focuses on system life cycle assurance in addition to development assurance at the software/digital level. The FAA is also working towards assurance standards and guidance that are focused on flexibility (less prescriptive) that does not compromise safety, or ignore rules. Research is required for these complex digital systems that begin to explore using a risk-based approach, to proactively address emerging safety risks and focus on process- vs product-based oversight.

The FAA has taken a proactive approach to keep pace with the ever-changing technological industry and is conducting research on software and digital aircraft systems, before they become too complex to safely certify. The majority of operational software and electronic hardware issues are due to missing or incorrect requirements. Many of these issues can be attributed to system complexity and associated difficulty in requirements validation to ensure completeness and correctness.

Outputs from Digital System Safety program research will be used to develop new or revised guidance and training material as well as to recommend best practices for the industry. These outputs will generate the following benefits:

- The Malaysian Airlines Boeing 777 incident on August 1, 2005 (caused by a faulty accelerometer being processed by the air data inertial reference unit and used by the primary flight computer, autopilot and other aircraft systems);
- The Qantas A330 incident on October 7, 2008 (Caused by an abrupt pitch down due to a faulty air data inertial reference unit sending incorrect data to the flight control system and caused partially by a single event upset in the digital equipment), and
- Several instance of Boeing 787 (e.g., October 29, 2014 Australian registered B787) transmitting inaccurate ADS-B positional data due to improper software logic used for extrapolation of longitude and latitude.

Aircraft Cyber

The focus of this Aircraft Systems Information Security Program (ASISP) research is on the aircraft itself and does include aircraft connectivity to external links (also called access points or apertures). The research funding will allow the exploration of ASISP-related threats, risks, and common cause failures can compromise fail-safe mechanisms in the architecture, design, and operation of aircraft systems. Previous research activities included defining and identifying the potential associated risks with access points or apertures, generating system level testing to test specific risks for a subset of individual apertures. Additional research is needed for determining how to mitigate aircraft cyber security risks to maintain airworthiness integrity in relation to ASISP risks. The research will address additional issues introduced by connectivity to aircraft systems that are internal and external to the aircraft, protection mechanisms, and related electronic security and safety network concerns.

In FY 2019, the focus of the aircraft cyber security/ASISP research is on risks to commercial aircraft themselves, as opposed to other research efforts that address the Government-owned NAS infrastructure. The aircraft cyber research will explore cyber-related threats and risks that can compromise fail-safe mechanisms in the architecture, design, and operation of aircraft systems, including specific ASISP-related risks that might lead to common-cause failures. The implementation of a Cyber Safety Risk Assessment (SRA) process will establish confidence that appropriate measures will be taken to ensure that the civilian aircraft will not experience a safety event due to a cyber vulnerability being exploited by a threat actor. The SRA process also will leverage expertise and collaboration among several government agencies, the aviation industry and academia to proactively address potential threats to civilian airlines and aircraft so that the public can have higher confidence in the cyber safety of air transportation.

The technical data from the research will be used to provide information to support the development of policy, guidance, best practices, standards, regulations, and training procedures to address gaps, safety issues, and potential malicious intent from various cyber threats. In addition, the outputs will be used to enhance standardization and support timely certification for complex systems associated with cyber security risks.

Major Activities and Accomplishments Planned in FY 2019 Include:

Aircraft Icing

SLD Engineering Tools Development and Validation

- Continued development and validation of facilities or software acceptable for compliance.

Safe Operations and Take-off in Aircraft Ground Icing Conditions

- Data package supporting annual guidance to airline industry for update of the ground deicing programs.

Research on Ice Crystal Icing Conditions to Support Means of Compliance

- Testing with 2 phase rotating rig in pressure controlled facility and analysis of results to evaluate model of compressor icing in high ice water content conditions.

Digital System Safety

Development of Assurance Techniques for Systems Elements

- Leverage collaborative efforts with government, academia and aviation industry partners to identify the risks and evaluate the risks associated with using lead free materials in airborne electronic hardware.
- Leverage collaborative agreements with aviation industry partners and NASA to refine the alternative assurance processes and overarching properties to understand how certification authorities and industry can adequately assess systems for overarching compliance safely within the framework of global harmonization.

Aircraft Cyber

Aircraft Systems Information Security Protection

- Continue to leverage collaborative efforts with federally funded research and development centers, aviation industry partners and Department of Homeland Security to refine the ASISP research processes.
- Execute the Mitigation, Identification, and Evaluation Process for specific identified aircraft cyber safety risks to identify and evaluate potential mitigations for the purpose of understanding how the aviation industry might reasonably respond to associated cyber threats.

Goals for FY 2019 Funding:

Aircraft Icing

- By 2019, complete study on the use of computational fluid dynamics analysis and of test methods and scaling for iced swept wings.

- By 2019, complete modeling study of compressor icing in high ice water content conditions using rotating rig.
- By 2020, develop engineering tools and icing test facilities for freezing drizzle and potentially freezing rain icing conditions.
- By 2021, develop data package of experimental, test, and analytical results that can be used for the development of guidance materials for means of compliance for certification in SLD conditions.
- In 2022, provide data package supporting annual guidance to airline industry for update of the ground deicing programs.
- In 2023, provide data package supporting annual guidance to airline industry for update of the ground deicing programs.

Digital System Safety

- By 2022, identify and analyze software digital system issues that could affect aircraft airworthiness.
- By 2022, determine an acceptable means to analyze, integrate, validate, and verify complex airborne digital systems and improve safety.

Aircraft Cyber

- By 2020, reduce the specific ASISP risks being analyzed with new mitigation processes that encompass the Safety Risk Assessment framework.
- By 2021, develop a comprehensive ASISP Safety Risk Management process and associated guidelines.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

Aircraft Icing

Industry leaders believe that analysis using computational fluid dynamics (CFD) computer software is now sufficiently mature that aircraft icing certification can rely more on Certification by Analysis (CBA), and have asked the FAA to consider expanding the use of this approach. Use of CBA has the potential to increase icing certification efficiency, thus saving costs, while maintaining or enhancing the safety of the flying public. This program is necessary to establish a sufficient database for evaluation and validation of CFD software for icing certification of swept wing aircraft, which predominate among transport aircraft. Certification of aircraft under the new rule for supercooled large drop (SLD) conditions requires improved and validated means of compliance, ensuring safety of the flying public on these aircraft in SLD conditions. This program is necessary for development of needed methods for certification to the new rule. FAA ground icing research enables the FAA to provide industry timely guidance to airlines each winter on safety issues that have arisen, and also to provide international leadership in this area through its role in the international SAE Ground Deicing Committee. In this way it promotes uniformity and safety in ground deicing and anti-icing practices not only in the U.S. but also around the world, including the growing markets in Southeast Asia. This program is necessary for the FAA to continue to play this role both domestically and internationally. Engine power loss and other icing events in high ice water content (HIWC) ice crystal conditions pose a significant risk to the flying public. Research into the complex physical causes of these events in controlled environments provides information essential to industry in minimizing the risk through engine design and modification. This program is necessary to continue the research.

Digital Systems Safety

The Digital System Safety research proactively looks into the safety issues of highly integrated systems and has the potential to prevent accidents/incidents and mitigate fatalities and injuries. While great strides have

been made in the processes of developing and verifying individual components, developing and verifying the functionality and behavior of a system of complex components still contains many challenges to be resolved at both the component level and system level. Inadequate and misunderstood integration, validation, and verification techniques for complex components leave potential for faults to exist with failure manifestation at the aircraft level. Most standards and regulations address development and safety requirements for individual components. Little exists for complex, highly integrated components and resulting systems, particularly using commercial-off-the-shelf equipment developed for a non-aviation (non-safety) market. As technology continues to change and become more complex, the verification and validation processes must change to adequately assess systems for compliance to the regulations and to minimize risk to the public. Research will be conducted in collaboration with the other agencies such as NASA to maximize the benefit and minimize the cost.

Aircraft Cyber

Aircraft network systems security is an increasing concern for current and future aircraft. Recently some of these concerns have also been documented by the Government Accountability Office (GAO), which released a report GAO-15-370 (published April 14, 2015) entitled *FAA Needs a More Comprehensive Approach to Address Cybersecurity as Agency Transitions to NextGen*. The future generations of aircraft will be increasingly network centric with expanded aircraft connectivity for improved safety, operations, and maintenance. The aircraft manufacturers and modifiers are installing avionic systems to allow increased connectivity within an aircraft, as well as to networks external to the aircraft, to take full advantage of new computer technologies for more efficient aircraft operations and safety enhancements. The increased connectivity - particularly to external networks and systems without sufficient security controls - could introduce information security vulnerabilities. If this is exploited, it could impact safe aircraft operations and continued airworthiness. Examples of such external networks and services - referred to as apertures - include airline operation centers, airport gate links, radio and satellite communication (including voice, data & navigation), aircraft software uploads and maintenance, electronic flight bags, flight information databases, etc. These concerns, which encompass certification and continued operational safety, will be addressed through the ASISP initiative. Because air transportation demands are expected to continue increasing in the near future, capacity, and efficiency need to increase to avoid huge delays in civil aviation. One key enabling technology to improve the capacity and efficiency of the NAS is to allow future generations of aircraft to be network centric with advanced avionics systems that will allow for improved safety, operations, and maintenance. This can only occur if the aircraft avionics systems can ensure data integrity and reliability. The ASISP initiative will help the aviation industry and the FAA to promote the safety of aircraft avionics systems from cyber threats and provide the public benefit of timely and safe air transportation.

Detailed Justification for A11.e Continued Airworthiness

FY 2019 – A11.e Continued Airworthiness - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.e Continued Airworthiness	$9,269	$9,214	$4,969

What is this Program and what does this Funding Level Support?

The Continued Airworthiness research program supports the FAA aviation safety oversight responsibility to ensure that aircraft maintain operational safety as they age. The FAA accomplishes this in two ways: first is by anticipating ageing issues during the certification process and ensuring that they are adequate covered in the operations of the application; and, second, by monitoring the in-service data as it is accumulating, finding issues at the earliest possible point, and ensuring that they are managed through Advisories, Directives, regulation, or other guidance.

Since its establishment, the program has led extensive studies on the in-service behavior of airframe structures and aircraft systems. The knowledge and information produced directly supported a wide range of FAA safety rulemaking including: the *Aging Aircraft Safety Rule* (AASR) 2005; the *Damage Tolerance Data for Repairs and Alterations* rule under 14 CFR Part 26, 2007; Order 8110.104, *Responsibilities and Requirements for Implementing Part 26 Safety Initiatives*, 2007, as well as related guidance materials and advisory circulars.

Recent years have seen rapid evolution in every aspect of aircraft. Composites and new metallic alloys are being used extensively in primary structures. Large-scale integration techniques are being applied to combine the many diverse existing electronic systems - as well as entirely new systems driven by NextGen implementation - into a few digital electrical systems. Hydraulic and other mechanical systems are being replaced by electro-mechanical and electro-hydraulic systems, which in turn require radical changes to the electrical power system. Finally, propulsion technology is rapidly evolving as manufacturers seek and incorporate new technologies to increase fuel efficiency. These developments present unprecedented challenges to the FAA's safety oversight role. In the past, the oversight of continued airworthiness has been balanced between efforts in the certification process and during the service life. However, the introduction of so many new technologies in a short period requires a proactive research program to ensure that the certification standards are updated or created as necessary in response to new designs.

Research conducted through this program is extraordinarily complex and multidisciplinary, as it spans every aspect of the aircraft (i.e., everything that becomes airborne) as well as the interactions between components. The research program anticipates and solves problems that require in-depth knowledge of every component of the aircraft and the compilation of in-service data of every safety critical system, subsystem, and component in the airframe, propulsion systems, and electronic and electromechanical systems. The program also supports the FAA's 1) role in reviewing operating and repair manuals as part of the certification process and 2) oversight of operational safety.

For FY 2019, aircraft safety-critical components (a focus of continued airworthiness) are grouped into the following categories:

Aviation Systems

- Aircraft Electrical Systems
- Flight Control Mechanical Systems
- Rotorcraft Systems

Aircraft Structures

- Structural Integrity

Aircraft Electrical Systems

To improve aircraft efficiency, reliability, and maintainability, the aerospace world has found that progressive electrification of on-board services reduces or removes the need of the hydraulic, mechanical and the bleed air/pneumatic systems. Latest airplanes are increasingly using more electric aircraft elements. As technology advances, more electric aircraft architecture will offer advantages that cannot be ignored. Installation and reliability issues may be experienced due to the large volume of installed electronics. Fast progress in semiconductors and materials will result in power density and efficiency improvements in the future. Architectural solutions further improve overall aircraft performance, multiple use, energy-optimized aircraft coupled with high level of integration and interaction between systems will continue to grow exponentially. The output of this research will be used to develop and publish FAA regulations and guidance addressing safe certification of airplanes utilizing more electric aircraft concepts and technologies.

Flight Controls and Mechanical Systems (FCMS)

The small airplane directorate's number one safety goal is to reduce general aviation fatal accidents due to loss of control. FCMS research will address Integrated Flight Path Control to address General Aviation Joint Steering Committee/FAA General Safety Interventions that feeds the design and certification of an advanced flight path control system to enhance general aviation safety. Research will be conducted to address transfer of unmanned aircraft system (UAS) technologies for enhancement of general aviation.

Rotorcraft Systems

Wires represent a significant hazard for low-flying helicopters. Collisions with unobserved wire obstacles can result in helicopter or wire damage, or even injuries or fatalities. Because wires are thin, long objects, they may be difficult to detect to various backgrounds. Even if wire obstacles are visible, the human eye has difficulty in gauging the distance and range, and could lead to incorrectly estimate the time available to avoid them. Both of these problems, wire detection and ranging, could cause collisions. This research will investigate numerous ways to help mitigate wire strikes by providing the pilot with the location of wires near the rotorcraft so they can be avoided.

Structural Integrity Metallic (SIM)

Many of the new metallic materials being introduced are much more process intensive than more traditional materials. Others are alloys, which are being tailored for specific structural applications. In either case a good understanding of their mechanical behavior and long-term durability is needed to provide the appropriate regulatory guidance and to properly update the Metallic Materials Properties Development and Standardization (MMPDS). SIM research will address both air transport and small airplanes and will focus on emerging technologies such as damage tolerance and durability issues of new aluminum-lithium alloys, Additive Manufacturing (AM), and other "tailored" alloys and hybrid fiber metal laminates such as GLARE. Risk management methods will also be developed to support the Aircraft Certification Services Monitor Safety/Analyze Data initiative, which is a data-driven, risk-based continued operational safety decision-making process. SIM research will also consider metal fatigue issues for small airplanes, as 26% of all small airplane airworthiness directives (ADs) address metal fatigue. SIM research will focus on developing probabilistic tools required for risk assessment and risk management of GA. Additionally, research will be conducted to understand the correlation between a measurable turbulence value and structural risk for GA and unmanned aircraft systems with the ultimate goal of standardizing turbulence structural risk. Also, the research will focus on several models of agricultural airplanes, which are used in forest firefighting operations on a seasonal basis. Historically, ADs have been based on load characterizations for agricultural use, which have been proven insufficient in providing an adequate level of safety. The research will focus

on obtaining flight load data specific to firefighting missions in order to address this safety issue and update the existing ADs.

Major Activities and Accomplishments Planned in FY 2019 Include:

Aircraft Electrical Systems

- Continue to evaluate the feasibility of using non-flammable electrolytes for lithium battery systems for aerospace application while retaining or improving the current level of safety in commercial transport aircraft.
- Continue to examine the research data to determine feasibility and safety aspects of adding a requirement for thermal and lifecycle testing for lithium systems for aerospace applications.

FCMS

Integrated Flight Path Control to Address GAJSC/FAA GA Safety Interventions

- Categorize the system faults or pilot errors that have resulted in GA accidents and incidents.
- Develop specific technology interventions, using flight path control, to address the root causes of system faults or pilot errors that have resulted in GA accidents and/or incidents.

Transfer of UAS Technology for Enhancement of GA Safety

- Identify the UAS systems that could be utilized to enhance GA safety. Characterize the systems and components from selected UAS platforms.

Rotorcraft Systems

Wire Strike Avoidance

- Identify wire cutting devices for rotorcraft and determine their capabilities for part 29 helicopters.
- Identify the types of wires in the U.S. that pose a threat to rotorcraft and if there is a database of their locations.

Structural Integrity

MMPDS Support and Design Values for Emerging Materials

- Develop, maintain, and distribute the annual update to the MMPDS Handbook and derivative products.

Damage Tolerance and Durability Issues for Emerging Technologies

- In partnership with Bombardier, Arconic (formerly ALCOA), Constellium and Embraer, analyze data produced under prior funding of this ongoing project to assess emerging metallic structures technology through testing and analysis (with emphasis on full-scale testing of advanced fuselage panels using the FAA's Full-Scale Aircraft Structural Test Evaluation and Research (FASTER) Lab. Prepare test plan for next phase of research.
- In partnership with Boeing, use the in-house Airframe Beam Structure Test fixture to continue efforts to assess bonded repair technology to generic beam structures (e.g., wings and stabilizers).

Emerging Technology – Active Flutter Suppression

- Use data produced under prior funding of this ongoing project to assess active flutter suppression technologies for compliance with certification and continued airworthiness requirements. Begin creating numerical models. Investigate feasibility of using in-house resources to perform wing tunnel tests.

Metal Additive Manufacturing for Aircraft, Engine, and Propeller Applications

- Continue to generate data to assess additive manufacturing technologies in support of developing appropriate policy, guidance, standards, and rulemaking.

- Begin evaluating existing probabilistic damage tolerance and/or fatigue prediction frameworks for their applicability to metal additive manufacturing technologies.

Ag/SEAT Airframe Usage and Operational Loads Monitoring

- Analyze flights loads data collected under prior funding.

Probabilistic Damage Tolerance Based Fleet Risk Management for Small Airplanes

- Improve characterization of random variables and incorporate them into the tool's database.

Goals for FY 2019 Funding:

- By 2019, review the NTSB accident reports for rotorcraft wire strikes to determine location of strike, type of industry, type of rotorcraft, phase of flight, etc., which will be used to determine the direction of the wire strike research program.
- By 2021, develop technical data to evaluate non-flammable electrolyte lithium batteries and battery systems for aerospace applications.
- By 2021, develop technical data to evaluate the feasibility of using fuel cell systems for aerospace applications while retaining or improving the current level of safety in commercial transport aircraft.
- By 2020, provide technical data for use in guidance material to mitigate risk of bird strikes to helicopter operators.
- By 2021, develop a process for establishing mechanical property standards (used in FAA certification guidance) for emerging process-intensive metallic materials, including metal additive manufacturing.
- By 2022, provide data relative to active flutter suppression to allow for the review of pertinent regulations and guidance material, and prepare recommendations for new, modified, or otherwise improved criteria.
- By 2023, provide data to assess additive manufacturing technologies in support of developing appropriate policy, guidance, standards, and rulemaking.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The Continuing Airworthiness program provides increased safety for the public. By developing requirements and guidance for the certification of augmented flight path control, the FCMS research on 'Integrated Flight Path Control to Address GAJSC/FAA GA Safety' could significantly reduce the number of 'controlled flight into terrain' and 'loss of control' accidents in the GA community. In addition, the 'Transfer of UAS Technology for Enhancement of GA Safety' research requirement could dramatically improve GA aircraft safety by reducing accidents caused by stall, spin, and loss of control.

The primary benefit of SIM research is to allow the safe introduction of new metallic material forms and technology advancements onto the U.S. aviation fleet to improve operational safety, ensure continued airworthiness, and prevent and mitigate accidents. In addition, the program promotes a uniform level of safety by developing and maintaining safety standards through a widely recognized government-industry organization. Through this program, FAA resources are optimized by streamlining approval of data submittals, allowing for the rapid response to safety issues, and providing improved confidence in data for decision-making.

Technical data from the RS research will lead to improved rotorcraft safety in known wire strike areas. This program will diminish wire strikes and fatalities by implementing procedures and/or improving the

certification basis for new helicopters and/or revealing new technology to alert pilots to the proximity of wires.

The output of the ES research requirement will have a specific impact reducing or mitigating the safety risks introduced by having a higher electrical energy on aircraft by providing FAA with a thorough understanding of the impacts of the more complex, increased voltage, and highly integrated systems being proposed by OEMs. The proposed research will support FAA certification authorities to be successfully prepared to safely certify in a timely and positive manner more advanced electrical system airplanes. It will enable the development of a safety database for the 270V, 540V and beyond to address current and future reliability issues and will also support EWIS changes to address arc damage, wire separation system installation, and impact on operation.

Detailed Justification for A11.f Flightdeck/Maintenance/System Integration Human Factors

FY 2019 – A11.f Flightdeck/Maintenance/System Integration Human Factors - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.f Flightdeck/Maintenance/System Integration Human Factors	$7,305	$7,274	$5,052

What is this Program and what does this Funding Level Support?

The Flightdeck/Maintenance/System Integration Human Factors Program provides the research foundation for FAA to update guidelines, handbooks, orders, Advisory Circulars (AC's), technical standards orders, 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 Flightdeck/Maintenance/System Integration Human Factors 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 (HUD) 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 implications which must be understood and applied in the appropriate guidance material developed for policy, procedures, operations, and training. This research supports the development of these products. Human error continues to be a major contributor to aircraft accidents and incidents both in commercial and General Aviation (GA). Current research is proactive in identifying error tendencies and thereby enhancing the safe and effective introduction of new technologies and procedures into the National Airspace System (NAS).

Advanced Vision Systems (EFVS, EVS, SVS, and CVS), Head-Up Displays (HUD), and Head Mounted Displays (HMD) research will characterize pilot performance considerations using the latest technology in Advanced Vision Systems, HUDs, and HMDs for low visibility conditions. Research will additionally inform operational requirements, standards, conditions, and limitations to ensure safe operations. This research will increase access to airports in adverse weather conditions without changes to the airport infrastructure.

Fatigue Mitigation in Flight Operations research will evaluate pilot fatigue data and the effectiveness of fatigue risk management approaches utilized by 14 CFR Part 121 and Part 117 certificate holders. This research will improve flightcrew member alertness through regulatory updates and educational materials associated with fatigue risk-management programs (FRMP) and fatigue risk-management systems (FRMS).

Maintenance Human Factors to Support Risk-Based Decision Making (RBDM) and Safety Culture research will provide AFS-300 and the administrator the information needed for appropriate action regarding recommendations from the National Transportation Safety Board (NTSB) related to safety management system strategies and tools. The use of these tools by maintenance organizations will lead to a reduction in maintainer errors.

Major Activities and Accomplishments Planned in FY 2019 Include:

<u>Advanced Vision Systems (EFVS, EVS, SVS, and CVS) Head-Up Displays (HUD) and Head Mounted Displays (HMD): Operational Standards and Approval Criteria</u>

- Develop operational standards and approval criteria for specific Synthetic Vision Systems operations.

- Identify potential pilot performance and operational impacts associated with using Combined Vision Systems in low visibility operations.
- Identify potential pilot performance and operational impacts associated with using Head Mounted Displays in place of HUD in low visibility operations and operations using advanced vision systems.

Fatigue Mitigation in Flight Operations

- Analyze the fatigue risk management programs databases on day-to-day operational fatigue to evaluate the effectiveness of fatigue mitigation outcomes both before and after implementation of 14 CFR Part 117.
- Document the effectiveness of fatigue mitigation of day-to-day operations under 14 CFR Part 117.
- Provide recommendations for updating relevant AC guidance and educational materials.

Maintenance Human Factors to Support Risk-Based Decision Making (RBDM) and Maintenance Safety Culture

- Document methods used to develop, evaluate, and enhance safety culture in aviation and other industries.
- Document the review and categorization of support tools for risk-based decision making.
- Document which human performance issues should be integrated into safety management systems (SMS).
- Document the types of maintenance human errors involved in general aviation accidents and incidents.

Goals for FY 2019 Funding:

- By 2020, reduced accident rate with pilot fatigue in flight operations as a causal or contributing factor.
- By 2020, revisions to Advisory Circulars (e.g., AC 120-103 A) associated with the flightcrew member duty and rest regulations as determined by the continuous monitoring and analysis of the FRMS and FRMP databases.
- By 2020, provide scientific support for Safety Management Systems (SMS) and Risk-Based Decision Making (RBDM) in maintenance operations for aviation inspectors, Part 121 Air Carriers, and General Aviation. This research will result in the delivery of:
    - Increased RBDM empowerment of FAA inspectors and industry to focus attention and resources to hazards that pose the highest risk.
    - Increased integration of human factors-related risk in comprehensive SMS programs.
    - A means to quantify and address maintenance human performance in GA.
    - Documented, valid, and reliable assessment of the impact of human factors research products.
- By 2026, increase safety, access, efficiency, capacity, and throughput in low visibility conditions by expanding the use of advanced vision systems, head-up displays, and head-mounted displays.
- By 2026, develop and/or revise the guidance needed for pilots, operators, inspectors, and airport personnel to conduct low visibility operations using advanced vision systems.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The flying public depends on the FAA to ensure the safety of flight operations and this program supports that goal by providing scientific and technical information to those responsible for regulations and guidance that ensure safe pilot and maintainer performance. Recent NTSB data show that human error is a contributory factor in 81% of aircraft accidents. Tragic accidents such as Asiana and Colgan emphasize the continuing need to address flightcrew performance. While many human errors warrant research, this program has been scaled to address some of the most critical areas for flight safety, as shown in the following:

Advanced Vision Systems — Certification and Operational Approval Criteria

This research program has provided data leading to the increased capacity of the national airspace system by demonstrating the safety of pilots using advanced flight vision systems to land in at airports that do not have the appropriate infrastructure for low visibility conditions. This research program will continue to provide the FAA with guidance to keep up with the rapid pace of technology innovations. Pilot performance will be measured using new technologies to perform additional operations in low visibility conditions, increasing the capacity of our national airspace system.

Fatigue Mitigation in Flight Operations

This research provides the airline industry with methodology to measure fatigue and assess its risk. Research is needed to advance the science of assessing pilot alertness and predicting performance decrements due to fatigue. The findings of this research will be directly applied by the airline industry to improve flightcrew member alertness through educational materials associated with FRMPs and fatigue risk-management systems (FRMS)

Maintenance Human Factors to Support Risk-Based Decision Making (RBDM) and Maintenance Safety Culture

The maintenance products developed under this research program have benefited many organizations and individuals. To date there have been over 1,000 requests for electronic distribution of FAA maintenance human performance and training courses. In FY 2017, two Advisory Circulars were published to provide industry with guidance on maintenance human performance and fatigue. Further research is needed to provide maintenance operators and FAA maintenance inspectors with the best tools to create and maintain a maintenance safety culture based on risk-based decision making.

By taking advantage of new advancements in technology and improving the science of proactive risk assessments, this research will increase the safety and efficiency of air travel by ensuring highest level of human performance.

Detailed Justification for A11.g System Safety Management/Terminal Area Safety

FY 2019 – A11.g System Safety Management/Terminal Area Safety - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.g System Safety Management/Terminal Area Safety	$6,500	$6,463	$799

What is this Program and what does this Funding Level Support?

System Safety Management

The System Safety Management (SSM) program is designed to improve safety through developing safety data collection methods, advanced safety data and risk analysis techniques, and prototypes of risk-based decision-making capabilities to identify and analyze emerging safety issues in a cooperative nature with 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).

Through this program, the FAA developed an infrastructure and capability - called Aviation Safety Information and Analysis Sharing (ASIAS) -that enables the free sharing and analysis of de-identified safety information derived from government and industry sources. Research is being conducted to understand the unique challenges posed by helicopters in terms of helicopter flight data monitoring (FDM) equipment, data formats, and processing techniques; and how to apply different safety risk methodologies to increase safety across the complex mix of helicopter mission segments and operational environments. Research will identify the tools and techniques necessary to analyze rotorcraft flight data and create prototype safety metrics specific to the unique needs of the helicopter community and its various mission segments.

In addition, the FAA developed methodologies and a concept of operations to improve its oversight of Air Traffic Organization (ATO) facilities. The program developed a methodology to determine risk at ATO facilities within the National Airspace System (NAS) by using safety indicators. The FAA's field and headquarter personnel can target available oversight resources towards facilities posing the highest risk to air traffic safety using this methodology. The program also developed a methodology and decision-making prototype tool to support the evaluation of risk controls that are proposed by the ATO to mitigate or eliminate potential hazards due to changes in NAS. The scope and capabilities of the decision-making prototype tool, identified as the Integrated Domain Safety Risk Evaluation Tool (ID-SRET), supports the evaluation of risk controls proposed by the ATO to mitigate or eliminate potential hazards due to changes in NAS.

The System Safety Management program addresses issues identified in several U.S. Government Accountability Office (GAO) studies (e.g., http://www.gao.gov/assets/310/304182.pdf and http://www.gao.gov/assets/600/590389.pdf) that call for the FAA to collect better data and improve its effort to identify and address safety issues. In addition, the ID-SRET projects support the FAA commitment to the International Civil Aviation Organization's (ICAO) Global Aviation Safety Plan (GASP), which establishes objectives for 'implementation of an effective safety oversight system' and 'full implementation of the ICAO State safety program framework' by 2022, and 'establishment of an advanced safety oversight system including predictive risk management' by 2027. This program also promotes the FAA Risk-Based Decision Making Strategic Initiative.

The FY 2019 funding will support the FAA Administrator's strategic initiative of improved risk-based decision-making. Loss of separation is a major safety concern for the aviation safety, and close encounters between IFR and VFR aircraft is one of the ATO's top five priorities. The effective identification and mitigation of

hazards associated with NAS system changes and Air Traffic Control (ATC) procedure changes are needed to reduce the chance of loss of separation. More specifically, the FY 2019 funding will allow the FAA to complete and transform the ID-SRET into a functional capability that can be used as a risk-based decision support tool for safety oversight of ATO operations. FY 2019 funding will also allow the FAA to develop a Safety Oversight Management System (SOMS) capability to support The Air Traffic Safety Oversight Service (AOV) oversight of ATO compliance with safety standards.

Terminal Area Safety

The Terminal Area Safety (TAS) program improves the safety of operations near or at an airport. Research projects in the program focus on developing training solutions and identifying effective technologies to mitigate key causes of fatal accidents such as the loss of control, runway excursions, and runway overruns. These are the leading causes of fatalities in the worldwide commercial jet fleet as indicated in the *Boeing Annual Summary of Commercial Jet Airplane Accidents* that is based on corresponding ICAO, NTSB, and Flight Safety Foundation (FSF) definition of accidents and events (*Statistical Summary of Commercial Jet Airplane Accidents Worldwide Operations 1959 – 2014*).

Through this program, the FAA recommended solutions to reduce fatal accidents in the terminal area through:

- Extending simulator models to allow for better upset training;
- Exploring alternatives to determine runway slipperiness, and
- Developing objective motion criteria to minimize inappropriate simulator training.

In addition, the FAA intends to recommend solutions to reduce fatal accidents in the terminal area through:

- Improving flight crew response during upset and recovery with an effective Angle-of-Attack indicator;
- Enabling safe helicopter approaches when using advanced vision systems;
- Exploring consistent operational standards for a stable approach to reduce runway excursions, and
- Developing a logical go-around training curriculum that mitigates the operational go-around problems that have arisen.

These projects address the principal causes of fatalities in the commercial jet fleet but also fill aviation safety research gaps identified in NTSB's Safety Recommendations A-07-003, A-04-62, A-07-64, A-01-069, and A-96-094 available at https://www.ntsb.gov/layouts/ntsb.recsearch/RecTabs.aspx.

Several landing overruns on wet runways, such as Southwest Airlines Flight 1919, a Boeing 737-700 at Chicago Midway Airport, IL on April 26, 2011, has raised questions regarding the validity of current wet runway stopping performance requirements and methods. In FY 2019, research will address issues regarding wet runway stopping performance requirements and methods and NTSB recommendation A-11-029 available at https://www.ntsb.gov/safety/safety-recs/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=A-11-029. The purpose of this research is to perform flight tests on representative domestic and international runways that support turbine-powered airplane operations in order to validate the wet-ungrooved and wet-grooved wheel braking coefficient models in 14 CFR Part 25.109(c).

Major Activities and Accomplishments Planned in FY 2019 Include:

System Safety Management

Safety Oversight Management System (SOMS)

- Complete SOMS Concept of Operations (ConOps), which will include description of use cases to define AOV end user roles and scenarios in oversight activities such as audits and assessments. The ConOps will demonstrate how the SOMS will enable AOV users to target ATC facilities posing the highest risk to air traffic safety.

- Complete preliminary SOMS model and methodology, which will include safety oversight profiles for limited ATC facilities, systems, procedures, and safety standards.

Integrated Domain Safety Risk Evaluation Tool (ID-SRET)

- Complete the development of limited version of the ID-SRET, which will provide risk-based decision making support for AOV in evaluating NAS system changes and ATC procedure changes. The IS-SRET and its applications in supporting of AOV's surveillance process will be demonstrated.

Terminal Area Safety

Wet Runway Wheel Braking Testing

- Form study team with air carriers and manufactures to review the validity of current wet runway stopping performance requirements/methods and agree upon a test plan to evaluate stopping performance on wet runway.
- Develop preliminary experiment design for flight tests of wheel braking in a wide variety of wet runway conditions to identify potential factors, runways of interest, and scenarios for the flight tests.

Goals for FY 2019 Funding:

System Safety Management

- By2021, complete and transform the ID-SRET prototype into a functional capability that can be utilized as a risk-based decision support tool for safety oversight of ATO operations.
- By 2023, provide risk-based decision-making support prototype tools to enhance Aviation Safety Services' oversight capabilities.

Terminal Safety

- By 2022, develop and validate models to estimate the wheel braking capability of aircraft based on runway parameters and meteorology data.
- By 2023, provide recommendations for wet runway performance standards as well as runway construction and maintenance standards.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

SSM projects benefits the public through a reduction in the risk of accidents and incidents associated with air traffic control; in particular, by providing risk-based analysis capabilities that identify and assess emerging safety risk issues to support AOV's oversight mission. Many upcoming NAS changes affect airborne and ground-based systems as well as aircraft, airport, and air traffic procedures – elements that cross multiple FAA lines of business. The ID-SRET will help to ensure that proposed changes to the NAS do not increase risk associated with existing NAS systems. The SOMS will help the FAAs field and headquarter personnel target available oversight resources towards facilities posing the highest risk to air traffic safety using this methodology.

Research projects in the SSM program are necessary to support improved risk-based decision-making. This allows the FAA to (a) identify system-level vulnerabilities through evaluating and developing aggregate level data and metrics, (b) determine indicators of performance (safety metrics) and processes to reliably identify potential risk, and (c) identify and assess risks associated with anticipated changes in procedures or technologies.

TAS wet runway braking testing research benefits 1) the public by reducing the risk of runway overruns on wet runways and 2) the aviation community by developing wet runway performance and runway

construction/ maintenance standards that reduce the risk of miscalculating aircraft stopping performance on wet runways.

Research projects in the TAS program are necessary to support the development of new operational guidance and data packages in support of training and standards that mitigate risk of fatal accidents such as the loss of control, runway excursions, and runway overruns in the terminal area.

Detailed Justification for A11.h Air Traffic Control Technical Operations Human Factors

FY 2019 – A11.h Air Traffic Control Technical Operations Human Factors - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.h Air Traffic Control Technical Operations Human Factors	$6,165	$6,157	$1,436

What is this Program and what does this Funding Level Support?

The Air Traffic Control/Technical Operations (ATC/TO) Human Factors program responds to research and development (R&D) requirements defined by offices in ATO and other FAA headquarters technical sponsors. The program provides timely R&D products and consultation services that focus on improving the safety and efficiency of complex ATC systems. As R&D budgets have declined, efforts have been concentrated using in-house FAA R&D capabilities and staff to address ATO challenges in four human factors R&D focus areas (1) methods and data to optimize the controller and technical operations workforces, (2) guidance to reduce air traffic controller and technician errors and improve safety, (3) efforts to support integration of technology into the NAS; and (4) development of recommendations and methods for enhancing human performance, including individual and team performance.

To provide the greatest benefit with scarce R&D resources, we are sharpening our focus on improvements at 'keystone' facilities (such as the TRACONs and ARTCCs directly serving the Core 30 airports) based on our understanding of how specific facilities impact the NAS. We intend to get ahead of the human factors and training challenges through targeted research that yields understanding of human performance, and particularly those factors that contribute to facility-specific impacts, especially for high-impact facilities. In the training domain, we are prepared to conduct research to evaluate the effectiveness of realistic simulation capabilities that will provide a medium for training complex task performance where ATC system safety depends on job task performance. Effective use of simulation may reduce the time required for controllers to reach certification.

ATO human factors challenges currently center on evolution of the workforce and the advancing technologies and associated procedures that are expected to be implemented in the NAS over the next several years. The workforce challenges are especially acute in the large terminal radar air traffic control facilities (TRACONs) and in several of the busy air route traffic control centers (ARTCCs). FAA is challenged to hire, place, and train several thousand new air traffic controllers in the coming years, while continuing to provide safe and efficient air traffic services to the users of the National Airspace System with a dwindling number of fully qualified staff (Certified Professional Controllers). We will also see considerable hiring and training to address a shortage of several hundred technical operations specialists, who are essential for maintaining and certifying systems and services for use in the air traffic control system. Funding in FY 2019 will enable us to help our ATO customers improve the efficiency with which they can recruit, hire, and train new aviation professionals.

In support of system acquisitions that are managed within the ATO Program Management Office, the R&D program in FY 2019 will further limit the focus to integration of human considerations to enhance user-system design. Human performance is a key factor in total system performance, and enhancements to human performance will contribute to enhancing the total system's performance, reducing errors, and helping reduce life cycle ownership costs. The program, through the FAA's Program Management Office (PMO) coordination, strives to provide useful human factors R&D results that support the development and implementation of new technologies and procedures in the National Airspace System. In FY 2019 the program will increasingly rely on offices in the ATO for implementation of the requirements in FAA Order 9550.8 *Human Factors Policy*, specifically, that

'Human factors shall be systematically integrated into the planning and execution of the functions of all FAA elements and activities associated with system acquisitions and system operations. FAA endeavors shall emphasize human factors considerations to enhance system performance and capitalize upon the relative strengths of people and machines. These considerations shall be integrated at the earliest phases of FAA projects.' The program assures that the proper roles and responsibilities are assigned to the ATO workforce to assure that controller and technician capabilities are compatible with the advanced technology they use in their jobs, and that the resulting level of air traffic system performance meets operational requirements and fulfills the safety and efficiency objectives. Our headquarters human factors team also continues to provide human factors subject matter expertise to the Joint Resources Council and will coordinate with the PMO human factors office for reviewing how acquisitions have complied with human factors design requirements through the In-Service Decision review checklist process.

The ATC/TO Human Factors program currently includes the following research activities:

- Conduct analyses and develop recommended practices for facility managers to increase the likelihood that controller trainees will succeed in field training, such that trainees are not lost due to factors other than their ability to control air traffic.
- Conduct targeted analyses to support data-driven decision making at the FAA Academy's Air Traffic Division, to document and provide recommendations for improving the reliability of raters who evaluate ATC student performance.
- Develop data mining methods to obtain and evaluate controllers' use of new equipment and system functions that provide additional air traffic control capabilities, and develop an approach for analyzing the data that will provide insights to acquisition programs and operational evaluation teams about which capabilities have been under-used as well as some of the operational human factors aspects that may limit their use.
- Identify and analyze elements of air traffic control system user interfaces that may introduce human error potential in ATC operations, and recommend candidate elements for additional evaluations through high fidelity human-in-the-loop simulations that include multiple new systems and functions.

Major Activities and Accomplishments Planned in FY 2019 Include:

R&D to Support Controller Selection, Placement, and Training Performance Evaluation

- Develop measures of controller on-position core technical job performance.
- Assess use of alternative training technologies and practices to improve field training efficiency and reduce the time for developmental controllers to reach full certification.

Air Traffic Control Safety R&D

- Recommend improvements to controller visual scanning techniques to reduce runway incursions and loss of standard separation at tower-controlled airports.

R&D to Support Selection, Placement, and Training Performance Evaluation of Technical Operations Personnel

- Conduct analysis of Engineering Services and future Service Support Center (SSC) Technical Operations jobs to identify critical job skills requiring unique selection and training considerations.
- Develop tools to support rapid assessment of job applicants in the areas of Technical Electronics Knowledge and skills.

Goals for FY 2019 Funding:

- By FY 2019, determine the success rate of CPC internal transfers from lower-level tower-only ATC facilities to higher-level combined Tower/TRACON facilities and report on how that success rate compares with the success rates of new hires at those facilities.
- By FY 2020, complete the development of the Technical Operations Pre-Hire Selection Tool to increase standardization and efficiency in identification of qualified applicants for air traffic system maintenance and support jobs.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The National Airspace System (NAS) is a human-centered enterprise. NAS safety and efficiency depend on well-designed, operated, and maintained systems. The FAA's Human Factors research program provides products to enhance the quality of this service through the successful integration of the human into the total system. The benefit is reflected in improvements to air traffic safety and efficiency, which are both necessary for an air transportation system that serves the American public.

Among the most complex and prevalent problems facing aviation safety are those involving human error. To achieve quantifiable improvements in aviation safety and improve efficiency, increasing emphasis is being placed on the human operator and those involved with the safe and efficient conduct of flight (e.g., supervisors, air traffic controllers, maintenance technicians). The human factors program is responsible for proactively identifying the potential for human error and recommending mitigations to reduce the probability that people will make errors, minimize the impact of such errors, and enhance the potential for human operators and maintainers to arrest the error and recover in a timely manner.

Improved Efficiency: This research program provides products that are intended to increase the probability of success in training and make better use of FAA resources for training air traffic controllers and technical operations personnel.

Better Safety: This program improves human performance by reducing the likelihood of human error and increasing the probability that controllers and maintainers will successfully recover from undesired events. One of the critical elements of this program relates to the human performance aspects of safety in the NAS. A review of the FAA ATC five greatest safety concerns during recent years shows that all of the issues involve controller performance. This program provides the human factors research and expertise upon which FAA system development programs rely to ensure that FAA ATC/TO systems are accepted by the user community and utilized to achieve maximum operational benefit.

Detailed Justification for A11.i Aeromedical Research

FY 2019 – A11.i Aeromedical Research - Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.i Aeromedical Research	$8,538	$8,514	$3,875

What is this Program and what does this Funding Level Support?

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. Personnel at the Civil Aerospace Medical Institute (CAMI) in Oklahoma City, OK, discover methods and recommend strategies to enhance the safety, security, health, and performance of the most important aspects of the National Airspace System (NAS): the human operator and the public, which she/he serves. CAMI is the only entity that performs this work on behalf of the U.S. This research will lead to a better understanding of advanced technology, disease, human performance, and environmental stress factors (alcohol, fatigue, hypoxia, g-forces) that concern aeromedical certification decision-making processes, education programs, and accident investigation practices, certification of aircraft equipment and protective devices, and harmonization of standards across the world.

The legislative foundations, drivers, and other supporting basis for the Aeromedical Research Program herein described include Public Laws; Code of Federal Regulations (CFRs); Executive Office of the President National Plans and Directives; DOT/FAA Orders and Business Plans; and several human safety guidance documents, including those of the National Transportation Safety Board, the International Civil Aviation Organization, and other private and public organizations. The earliest of such documents dates back to the Federal Aviation Act of 1958, PL 85-726 as amended by PL 100-591 (See 49 U.S. Code Title 49, Subtitle VII, Part A, Subpart iii, Chapter 445, § 44507).

The 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 and therapeutic solutions. It also concerns aircraft materials, equipment, cabin configurations, life support systems, and evacuation procedures that 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. Advances in computational biology, omics sciences, modeling & simulation, and tools to facilitate the integration of very large aeromedical data sets containing disparate information will lead to improved knowledge management and decision-making processes in aerospace medicine.

Aeromedical research is performed by in-house personnel of the Aerospace Medical Research Division of CAMI. The division has two branches, Bioaeronautical Sciences and Protection & Survival, each with five research teams. The Forensic Toxicology and Biochemistry research teams serve as the primary national site for toxicology testing for federal agencies. The Functional Genomics research team is the pioneer in biomarker research pertinent to aviation safety, and the Knowledge Management research team supports all research efforts involving information technology. Protection & Survival personnel provide state-of-the-art information, procedures, and equipment evaluations relative to aircraft accident investigation, survivability, atmospheric and radiation risk, health, and security of passengers and crewmembers during normal operations and emergency events. The Cabin Safety, Biodynamics, and Environmental Physiology research teams are key contributors to the development of national and international safety equipment standards and survival procedures. The Medical research team and the Autopsy Program team maintain unique databases that facilitate the aeromedical review of aircraft accidents; and the Numerical Sciences research team is the national source of expertise for cosmic radiation events of aeromedical concern (maintaining the only repository of integrated civil aeromedical information that pre-dates safety management system concepts).

Major Activities and Accomplishments Planned in FY 2019 Include with the funding allocate include:

No research will be performed as defined by the Office of Aviation Safety (AVS) Aeromedical (AM) and Rotorcraft Safety (RS) Technical Community Representative Groups' Requirements. Only one activity will be supported with the allocated FY 19 funding:

Goals for FY 2019 Funding:

Aeromedical Accident prevention and Investigation

Processing of biological samples from fatal aircraft accidents for forensic toxicology analysis.

Accident Investigation and Prevention

Forensic toxicology report in support of accident investigation and prevention.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The benefit offered by the funding provided is the delivery of forensic toxicology reports in support of fatal accident prevention and investigation processes.

The aim of Aeromedical research is to strengthen the human link in the NAS. Its output serves as the knowledge base for physicians, engineers, psychologists, aviation inspectors, accident investigators, educators, and numerous other academia, industry, and government professionals in the U.S. and abroad who are concerned with the safety of humans in aerospace operations. The efficacy of any product introduced in the NAS will be compromised if the safety and health of the user of such products (operators and customers) is neglected. Even uninhabited air vehicles and sophisticated automated systems ultimately involve human input; the human is invariably subject to physiologic breakdown, and therefore less than optimal performance. The aeromedical research program is unique in its expertise regarding this human vulnerability in civil aviation.

Aeromedical research is required to gain knowledge, validate information, interpret its analysis, provide conclusions, and facilitate the execution of the resulting recommendations as required in the form of FAA advisory material and regulatory documents. This expertise is fundamental to the continued technical and scientific discovery that would assure the future of the FAA as a world leader in human safety in aerospace operations. As such, it is critical to the regulatory mission of the FAA to maintain and enhance its in-house aeromedical research program, unique in the nation for civilian aviation operations, and a model sought by international civil aviation authorities. Indeed, academic research priorities are subject to the temporary nature of their mission and industry research activities are necessarily subject to corporate concerns relative to remaining competitive and realizing financial profit. On the other hand, the FAA's aeromedical research program (a) promotes *collaborative* scientific discovery throughout the nation and with international entities, (b) allows for long-term high-risk/high-return research goals, and (c) ensures independent science and technology assessments in support of the regulatory mission of the FAA. The results of aeromedical research benefit the American public by providing:

- Continued Operational Safety – Results of research maximize the strengths of the human link in the NAS by improving human safety through evidence-based medicine.
- Enhanced Standards and Policy – Investigation and analysis of injury and death patterns in civilian flight accidents and incidents enable the development of preventive strategies including language for aeromedical and engineering standards and policies, educational materials, and criteria concerning equipment, technology, and procedures for human protection and survival from stressful environments and emergency events.
- Risk Management – The results of research support accident investigation, aircraft certification, flight standards, and medical certification processes to identify hazards and augment aeromedical safety information systems towards an Aeromedical Safety Management System. This system in

turn proactively addresses emerging safety risks to humans in the NAS by using consistent, data-informed approaches to make smarter, system-level, risk-based decisions.

The Aeromedical program is monitored through the AVS Quality Management System procedures. These procedures involve multiple metrics and are based on the International Organization for Standardization's standard ISO 9001:2015. The program is also managed through numerous controls pertinent to resources and schedule; project technical soundness and scientific merit; safety; competency; and stakeholder satisfaction. Numerous forums, including the FAA's Research, Engineering, and Development Advisory Committee, review the aeromedical research program on a periodic basis. The program remains successful as evidenced by the realized benefits described above and the delivery of high quality products and services within the provided budget and schedules. These include scientific publications, advisory and regulatory language, laboratory methodologies, medical and engineering certification criteria, analytical software tools, affidavits/court testimony, aeromedical information systems, educational material, cabin safety and biodynamic engineering assessment procedures, aeromedical accident and forensic toxicology reports, and technology evaluations.

Detailed Justification for A11.j Weather Program

FY 2019 – A11.j Weather Program - Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.j Weather Program	$15,476	$15,346	$6,580

What is this Program and what does this Funding Level Support?

As the aviation meteorology authority for the United States (US), the FAA is solely responsible for determining aviation weather requirements and weather research programs regarding impacts on the National Airspace System (NAS). The FAA's Weather Program, in particular, performs applied research intended to mitigate the impact of weather on the National Airspace System (NAS). 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 weather processes. This work is frequently conducted in collaboration with the FAA's designated weather provider, the National Weather Service (NWS).

Advanced weather information is expected to enhance NAS safety and capacity by supporting better operational planning and decision-making by operational users including air traffic managers, flight dispatchers, and pilots. In the near and midterm, some research will support tools and methodologies used by NWS forecasters to improve the accuracy and relevancy of legacy weather products and services still mandated by FAA regulatory guidance and/or international agreement.

The Weather Program leverages research activities with members of industry, academia, national laboratories, and other government agencies through interagency agreements, university grants, and memorandums of agreement. The Weather Program partners with the National Oceanic Atmospheric Administration (NOAA) Earth System Research Laboratory, and the NOAA National Centers for Environmental Prediction and the Environmental Modeling Center to develop high resolution; rapidly updating models that have and continue to be implemented into NWS operations. These modeling efforts have resulted in enhanced diagnosis and forecasts of weather hazardous to aviation, including turbulence, convective weather, ground and in-flight icing and restricted ceilings and visibility (C&V). Weather Program radar technique development efforts, in partnership with the NOAA National Severe Storms Laboratory (NSSL); have developed radar applications implemented into NWS operations that are enhancing in-flight icing, turbulence, and convective weather forecast capabilities. The Weather Program in partnership with NSSL developed a multi-radar multi-sensor (MRMS) capability that provides high-resolution three-dimensional radar grids for advanced weather detection and aviation forecast applications, now running operationally at the NWS.

Weather Program icing efforts have developed in-flight and ground diagnosis and forecast capabilities, including the capability to differentiate between freezing rain and freezing drizzle. These results are being used in current research efforts to develop a terminal area ground and in-flight capability that provides icing and precipitation type information. This information is used by aircraft dispatchers and pilots to make ground anti-deicing decisions and takeoff and landing decisions, and by pilots, dispatchers, and controllers to make flow and route of flight decisions. These efforts are being coordinated and leveraged with radar technique development at the NOAA NSSL. Weather Program turbulence research efforts have developed CONUS turbulence forecast capabilities. These efforts have been coordinated with the radar technique

development efforts at NOAA NSSL. Planned efforts will address the expansion of turbulence capabilities globally in harmonization with International Civil Aviation organization (ICAO) requirements.

In FY 2017, the Weather Program transitioned an initial version of the Offshore Precipitation Capability (OPC) to the FAA PMO for interim operations use by selected facilities responsible for offshore airspace in the Caribbean, Gulf of Mexico, and off the US East Coast. The OPC merges information from lightning, satellite, and weather model data into a radar-like depiction output of the location and intensity of precipitation and storms in offshore airspace that has heretofore been limited or unavailable. The capability provides an accurate situational awareness tool helpful in controller pre-planning, anticipating pilot requests, and route availability. It is a cost effective strategic weather planning tool that provides NAS-wide applicability, not just a single location solution.

The Weather Program will continue to develop and enhance forecast capabilities and weather translation techniques to meet emerging NextGen requirements and operational improvements. This will include applied research in naturally occurring atmospheric hazards including turbulence, convective activity, icing, and restricted C&V. Additional forecast capabilities to address convectively induced turbulence will be developed to enhance en route safety and capacity. Alaska in-flight icing diagnosis and forecast capabilities and oceanic convective weather forecast needs for NextGen will also be developed. Additionally, using much of the research outlined above, the FAA is coordinating and leveraging with NOAA and NWS to develop a consistent set of gridded weather information for use in evolving NextGen ATM decisions and decision support processes. FAA national and international partnerships will continue addressing mitigation of ice crystal weather threats to aircraft turbine engines.

Major Activities and Accomplishments Planned in FY 2019 Include:

Turbulence

- Continue development of Hi-Res turbulence forecast capability.

Convective Weather

- Continue development of 0-36-hour probabilistic forecast of oceanic convection capability and improve thunderstorm initiation forecast accuracy in the 0-4 hour time-frame over the CONUS.

Ceiling and Visibility

- Continue development of CONUS (probabilistic) and Alaska forecast grids for transfer to NWS

Quality Assessment

- Plan and coordinate scientific meteorological assessments of enhancements to convective weather, turbulence, and ceiling and visibility forecast capabilities for CONUS and Alaska.

Aviation Weather Demonstration and Evaluation Services

- Plan, and coordinate user-based assessment of an advanced icing forecast capability.

Terminal Area Icing Weather Information for NextGen

- Commence analysis of initial flight test results to quantify the ability to diagnose and forecast the detection/discrimination of freezing drizzle from freezing rain aloft.

Mitigating the Ice Crystal Weather Threat to Aircraft Turbine Engines

- Commence analysis of flight data for evaluation of airborne weather radar for detection of high ice water conditions in-flight and Part 33, Appendix D in coordination with the FAA Certification Service addressing engine ice crystal icing.

Goals for FY 2019 Funding:

- By 2019, conduct flight campaign to obtain data to quantify the ability to diagnose and forecast the detection/discrimination of freezing drizzle from freezing rain aloft.
- By 2020, complete development of global-scale probabilistic convection guidance capability for implementation. This is anticipated to reduce aircraft encounters with convection worldwide in collaboration with World Area Forecast Centers.
- By 2021, assess and validate data for TAIWIN from numerical weather prediction models and weather radars with research flight test data collected.
- By 2022, complete development of high-resolution ceiling and visibility analysis capability to National Weather Service for implementation into Helicopter Emergency Medical Services (HEMS) Tool. This will improve safety of operations in areas with limited observation capabilities.
- By 2023, complete incorporation of a machine learning technique into the Offshore Precipitation Capability to enhance the near real-time estimate of precipitation including thunderstorms.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

This request will enable the Weather Program to continue to develop and enhance diagnosis and forecast capabilities that will benefit the American public. This will include applied research in naturally occurring atmospheric aviation hazards including turbulence, convective activity, icing, and restricted ceiling and visibility. FAA will either deploy these capabilities on new or existing platforms and systems or transition them to NWS platforms or procedures through FAA regulations. These benefits include:

- Increased GA safety in Alaska, as focused efforts target enhancements to in-flight icing, turbulence, and restricted ceilings and visibility analyses and forecasts.
- Enhancements to convective weather forecasts that minimize gate-to-gate delays and improve efficiency of flights.
- Enhancements to turbulence analyses and forecasts to increase passenger comfort, safety of passengers and crew, safety of GA operations, and increased capacity in the NAS.
- Enhancements to icing diagnoses and forecasts to increase safety and decrease flight times especially for GA and commuter passengers.

The Weather Program works as evidenced by the implementation into operational use of significant safety, capacity, and efficiency enhancing capabilities including:

CoSPA, originally derived from the name Consolidated Storm Prediction for Aviation, is an advanced convective storm prediction algorithm to minimize flight delays caused by thunderstorms. It supports a key NextGen OI related to improved thunderstorm forecasts as well as the FAA Strategic Priority of improved efficiency. CoSPA was evaluated by ATM users over two convective storm seasons and found to be equal or better than current operational forecast capabilities and provide information critical for FAA Air Traffic Management. It was estimated that CoSPA will save 10,000 hours of delay annually equating to $26.8M in delay cost savings. CoSPA was transitioned to the FAA Air Traffic Organization's Program Management Office for test and evaluation prior to operational implementation.

ADDS (Aviation Digital Data Service) is a web-based portal offering access to weather information in text, digital, and graphical formats for a wide community of NAS users including pilots, dispatchers, and ATM. It provides access to forecasts, analyses, and observations of aviation-related weather conditions and hazards, including inflight icing, turbulence, and restricted ceilings and visibility. It is currently operational at the NWS (www.aviationweather.gov), receiving more than 15 million "hits" per day on average.

Rapid Refresh (RAP) Weather Forecast Model, operational at the NWS, provides a 1-hour update rate and 13 km resolution of more accurate wind forecasts and improved analyses and forecasts of aviation hazards including en route turbulence, convective weather, in-flight icing and restricted ceilings and visibility over North America and Alaska. The Weather Program also funded the development of the High Resolution

Rapid Refresh (HRRR), also operational at the NWS, which provides storm-scale resolution to capture convective activity at the cell level.

Weather has been clearly identified as a having a significant impact on NAS efficiency and is a factor in GA accidents. The NextGen Implementation Plan identifies improvements in the areas of weather detection and forecasting as well as dissemination. The Weather Program supports NextGen operational improvements and FAA Strategic Priorities related to efficiency, capacity, safety, and environmental impacts. Weather is frequently cited as a primary or secondary cause for accidents and injuries. Per the National Transportation Safety Board, turbulence is the leading cause of inflight injuries and the GA fatality rate in weather related accidents, on average is 35% (GA accounts for 75% of weather related accidents). Between 2007 and 2016, air carrier delay hours were reduced by more than 55%, from 733,00 hours down to 328,000 hours, resulting in savings of more than $315 million in delay costs. While there are several factors that played a part in this reduction, forecast improvements and weather mitigation techniques developed from Weather Program research efforts directly contributed. However, $300 million in delay costs still occur annually. Continued evolution of improved forecasting algorithms with applicability to achieving higher aviation safety and capacity during hazardous weather is needed. The Weather Program also supports the need to provide high quality weather observations and forecasts, often in conjunction with the NWS, uniquely designed to allow for rapid and effective decision making by ATM, dispatchers, and pilots to proactively select safe and optimal routes. Weather Program initiatives whether benefitting commercial or GA, advancing science or facilitating integration into NAS decision support tools, are ultimately supporting the achievement of the NextGen weather vision.

Detailed Justification for A11.k Unmanned Aircraft Systems Research

FY 2019 – A11.k Unmanned Aircraft Systems Research - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.k Unmanned Aircraft Systems Research	$20,035	$18,872	$3,318

What is this Program and what does this Funding Level Support?

The Unmanned Aircraft Systems (UAS) Research program supports FAA efforts in implementing the Next Generation Air Transportation System (NextGen) by studying safety implications of new aircraft operational concepts and technology to the National Airspace System (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.

Safe, efficient, and timely integration of UAS into the NAS poses substantial technical challenges not only to the FAA but also to the aviation industry. UAS often use new or novel technologies to achieve unique operational capabilities that challenge the expectations of current NAS users. These unique capabilities have demonstrated potential to address commercial applications as well as scientific research needs. Integrating UAS into the NAS will potentially affect the entire NAS due to various sizes of UAS (less than a foot up to the size of a commercial jet), a wide range of maximum take-off weight (less than a pound to the weight of a large jet), large performance disparities in reference to the existing certificated aircraft, and capabilities of operating in all classes of airspace. Even UAS weighing less than 100 pounds may be capable of operating in Class A airspace and the integration of a significant volume of UAS air traffic could potentially disrupt normal aircraft traffic flow and induce unknown safety hazards.

Research activities within the UAS Research program will generate technical information to support development of policies, guidance materials, and advisory circulars on using new or novel technologies to demonstrate regulatory compliance while operating UAS in the NAS. UAS-specific technical issues such as detect and avoid, datalink aircraft control and communications with air traffic control, and emergency response requirements, will also require research. UAS will also be integral to NextGen development and will help validate UAS Concept of Operations (CONOPS) integration requirements and meet UAS Roadmap goals.

FY 2019 funding will support the UAS program in conducting research on UAS technologies that directly impact the safety of the NAS. The FY 2019 portfolio of work will be focused on human factors, training devices, detect and avoid (DAA), and research that will support the safe, efficient, and timely integration of UAS in the NAS within the 14 Code of Federal Regulations (CFR) regulatory framework. Additionally, funding will provide for engineering, technical, and management support of overall research activities.

Major Activities and Accomplishments Planned in FY 2019 Include:

This research supports the integration of UAS into the NAS by studying new operational concepts and technology, and providing information that supports the development of new rules and regulatory standards. Outcomes of this research may also lead the development of new procedures or modifications to NAS equipment.

<u>UAS Human Factors Control Station Design Standards</u>

This research will focus on unique UAS safety concerns that are specific to unmanned aircraft. Unique HF aspects include data link degradation and loss, decreased sensory cues, and remote pilot control handoffs.

- Provide final technical report of minimum requirements and best practices to ensure that UAS Control Stations are held to appropriate minimum standards to ensure their safe integration into the NAS.

High Visual Contrast for UAS

This research will help mitigate safety risks by making UA more salient to operators and pilots of manned aircraft therefore aiding with see and avoid.

- Conduct literature review to outline current state of research supporting UAS visibility requirements.
- Complete plan describing the designed experiments to expand, refine, and/or validate the prior related research results.

UAS Flight Data Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing) Program

This research will aggregate high quality UAS flight data with commercial and general aviation flight data and surveillance data, in order to develop enhanced safety analyses for NAS stakeholders and to support UAS integration in the NAS.

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

Air Carrier Operational Considerations for Unmanned Aircraft Systems

This research addresses safety concerns specific to Air Carrier Operations for UAS to include air carrier staffing, training, testing, duty, and rest requirements. It could help establish a separate rulemaking activity specific to air carrier operations.

- Conduct a literature review on the required crew and staffing for operating UAS in various kinds of operations to include those unmanned aircraft and operations.
- Conduct a literature review that identifies the required knowledge, skill, and tests for operating UAS in various kinds of operations to include those unmanned aircraft and operations that would be outside the current Part 107 framework.
- Conduct a literature review on duty and rest requirements to include pilot fatigue for both manned and unmanned operations.

Minimum Detect and Avoid (DAA) Display and Flight Path Information

This research supports the development of minimum requirements for Detect and Avoid (DAA) display and flight path guidance information required for UAS pilots to execute a maneuver to remain well clear.

- Conduct study according to research plan and analyze results of how ACAS-XU fits into UAS Detect and Avoid capabilities.
- Provide technical report of how ACAS-XU fits into UAS Detect and Avoid capabilities.

UAS Automation/Autonomy

This research will examine the interaction between UAS pilots and automated UAS to provide data for developing standards and best practices for pilot information management of UAS and address automation issues (e.g., mode awareness).

- Conduct a literature review to outline current state of research supporting UAS Human-Automation Interaction requirements and plan follow-on work in this study to expand, refine, and validate the results of the prior work.

Goals for FY 2019 Funding:

- By FY 2020, conduct experiments and complete analysis of paint schemes and colors to increase visual contrast, the use of anti-collision/position lighting, and equipping the aircraft with noise-making devices to alert people on the ground.
- By FY 2020, collect additional UFDM data, examine technologies and techniques required to integrate UFDM into ASIAS, develop additional UAS analysis tools and techniques.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The safe integration of unmanned aircraft into the NAS is a significant challenge. Current UAS research contributes and informs technical and regulatory standards, policy guidance, and operational procedures on which successful UAS integration depends. These research efforts significantly contribute to addressing the challenges of integrating UAS into the NAS by leveraging studies of UAS operations and associated technologies. These research programs will help develop unmanned aircraft systems, training, technology, and procedures that increase the safety of UAS operations and increase the confidence of the American public that UAS flights can be safely and efficiently integrated into national airspace. The research will facilitate approval and use of systems that prevent accidents and help reduce the severity of UAS accidents in the NAS. This research will also develop standards to mitigate human factor causes of incidents and accidents due to control station or pilot training design deficiencies.

Detailed Justification for A11.l Commercial Space Transportation Safety

FY 2019 – A11.l Commercial Space Transportation Safety- Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A11.l Commercial Space Transportation Safety	$2,453	$2,431	$2,500

What is this Program and what does this Funding Level Support?

The primary mission of the Office of Commercial Space Transportation (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. AST's secondary mission is to encourage, facilitate, and promote commercial space launches and reentries. More recently, Congress tasked AST with promoting the continuous improvement of the safety of launch vehicles designed to carry humans. The AST Research and Development (R&D) program will optimize AST's mission execution through the development of improved regulations, safety assessment tools, and public safety technologies.

First, the R&D program supports the development of improved regulations and industry guidance material to address lessons learned and to keep pace with the dynamic commercial space transportation industry. R&D in this area helps provide industry with maximum flexibility to innovate by regulating only to the extent necessary and building a performance-based regulatory framework to the maximum extent feasible. AST plans include research to improve regulations that govern launch and reentry, and launch and reentry sites, as well as industry guidance to support industry compliance with AST regulations.

Second, AST R&D will improve safety analyses and other tools to facilitate the safe and efficient integration of space traffic through the NAS, a component of the FAA Administrator's Strategic Initiatives. AST's research will advance this initiative with a detailed understanding of man-made and naturally-occurring hazards in the space environment to increase safety and efficiency while getting into and out of the NAS. State-of-the-art theoretical, analytical, and computational investigations will result in improved assessment methods: results that are easier to understand, easier to execute, require fewer input data, and/or require data that are easier to collect. Specific research efforts include the development of a voluntary reporting program similar to the Aviation Safety Action Program so that employees can self-report safety concerns and events.

Third, AST R&D will focus on advanced vehicle safety technologies, human spaceflight and physiological safety guidelines that provide a direct benefit to the strategic needs of industry (e.g., improved preparation and operations, and ensuring safety of human spaceflight occupants). Specific areas of research include the development of recommended practices for crew human factors for suborbital winged commercial space flight vehicle, and the demonstration of advanced surveillance technology, including cockpit displays, capable of improving airspace management during launch or reentry.

The multiple research activities included in the FY 2019 R&D program will be conducted with grants to the Center of Excellence for Commercial Space Transportation (COE-CST) and contracts. AST has committed to funding the COE CST at a minimum level of $1,000,000 through FY 2020. The balance of the FY 2019 funds will be used to address other key areas for commercial space operations, guidelines, and regulation. Overall, the FY 2019 funding will continue the activities to meet AST's needs for an improved regulatory framework, safety assessment methods, and industry guidelines and technologies. This important research will allow AST to keep pace with the dynamic commercial space transportation industry. Research activities are grouped below according to their focus areas, on safe and efficient integration (of increased commercial space launch and reentry activity into the NAS), advanced safety assessment methods, advanced vehicle safety methodologies, and human spaceflight safety.

Major Activities and Accomplishments Planned in FY 2019 Include:

Advanced Safety Assessment Methods

- Develop an initial framework for a voluntary safety data reporting system useful for CST operations.

Advanced Vehicle Safety Technologies

- Demonstrate advanced surveillance technology, capable of improving airspace management during launch or reentry.

Human Spaceflight Safety

- Identify draft recommended practices for crew human factors for suborbital winged commercial space flight vehicle.

Goals for FY 2019 Funding:

- By 2020, initiate rulemaking to streamline the existing regulations for launch and re-entry licenses, address automated flight safety systems, and improve on the current one-size fits all approach.
- By 2020, identify draft recommended practices for automated flight safety systems.
- By 2020, develop and assess separation standards for improved airspace management of launch/reentry vehicles, such as hybrids and manned stratospheric balloons, during non-explosive phases of flight.
- By 2021, develop improved models and methods to reduce over-conservatism applied to airspace keep-out areas used to protect against launch or re-entry failures.
- By 2022, develop methods to share data and software tools that estimate aircraft hazard areas suitable for use in early design and mission planning.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

Protecting the safety of the uninvolved public and their property from the potential consequences of commercial space launches and reentries demands that the FAA keep pace with the emerging technologies and operational concepts coming from a diverse and exponentially growing industry. The areas discussed above highlight critical topics that must be addressed for AST to achieve its statutory missions. Funding the program at the requested level will allow the FAA to continue to develop the portfolio of high-value research activities designed to ensure that CST is efficiently regulated in a streamlined manner that prioritizes public safety and facilitates the competitiveness of the US in the international marketplace.

AST has consistently conducted license and permit application evaluations resulting in determinations made within the statutorily mandated time limit to ensure the continued safety of the public. This record has been maintained while experiencing significant growth in the number of space launch systems, operators, and spaceports, the complexity of operations. This research program will position the FAA to have increasingly timely guidance and regulations, and improve our responsiveness to this emerging sector. Similarly, the industry would benefit from improved techniques, practices, and technologies that result from a strong FAA commercial space R&D program.

The CST industry has noted that some regulations in 14 CRF 400 have not kept pace with modern operations and technology, such as the lack of requirements or formal guidelines for autonomous flight safety systems. The public and industry will benefit from a modernized set of efficient and effective regulations. In addition, the FY 2019 budget will fund an R&D project recently requested by the CST

industry to develop methods to share data and software tools that estimate aircraft hazard areas suitable for use in early design and mission planning.

An efficient and effective system to regulate the CST is in the public interest. A safe and efficient CST industry will help maintain an assured space access capability to meet United States Government needs, and strengthen U.S. competitiveness in the international commercial launch market. A healthier, more competitive US space transportation industry will facilitate new markets, encourage new industries, create high technology jobs, lead to greater economic growth and security, and promote the US leadership role in space. In addition, improving the cost effectiveness of CST would allow the USG to invest a greater share of its resources in other needs such as facilities modernization, technology advancement, scientific discovery, and national security.

Detailed Justification for A12.a NextGen – Wake Turbulence

FY 2019 – A12.a NextGen – Wake Turbulence - Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A12.a NextGen – Wake Turbulence	$8,609	$8,540	$3,519

What is this Program and what does this Funding Level Support?

This research program is conducted to obtain additional throughput capacity gains by developing wake separation standards that adjust to the atmospheric conditions being encountered by the aircraft and through evaluating the flight performance of the leading and following aircraft. These complex technology-based dynamic air traffic control (ATC) wake hazard mitigation solutions and associated decision support tools are expected to increase National Airspace System (NAS) runway throughput capacity another five to seven percent above what can be achieved with the simpler current static wake separation procedures that have been researched by the NextGen - Wake Turbulence research program and further developed for implementation by the FAA's Wake Re-Categorization (RECAT) program. This research also provides ATC the wake hazard mitigation separation it needs to apply to new aircraft types being introduced into the NAS. Other near-term products produced by this program are ATC wake mitigation procedural solutions that help alleviate delays due to airport construction and runway maintenance projects that restrict airport operations.

Increasing NAS throughput capacity is the major focus of this research program; however, it also supports the analyses required to determine that the program's products will not adversely affect NAS safety. Developing safe, capacity-efficient, ATC wake hazard mitigation solutions requires measured wake decay and transport data to validate the analytical and probabilistic models. This data is used in evaluating proposed changes in wake hazard mitigation procedures. Aircraft generated wakes are not visible and do not lend themselves to be sufficiently detected by today's ground-based and air-based surveillance systems. Currently, the program has three wake data collection sites located close to major airports, using prototype Light Detection and Ranging (LIDAR) systems to collect and compile measured tracks of aircraft generated wakes. This program also analyzes wake data collected in flight by the Canadian National Research Council and wake data collected by NASA in collaboration with other research organizations. This collected data is being used to validate the outputs of wake transport and decay models being developed for evaluating proposed ATC wake hazard mitigation solutions and real-time applications in ATC wake hazard mitigation decision support tools. Early versions of these models are already contributing to safety case analyses for Paired Departures and proposed changes to intersection departure separations as part of an enhancement to ATC's use of RECAT wake mitigation separations.

Prior to this research program, ATC procedures use to mitigate the wake encounter hazard were safe, but reduced airport runway throughput capacity during periods of heavy demand, contributing to flight delays and aircraft operating costs. Based on the research from this program, wake separation procedures and standards have been safely modified by ATC Orders 7110.65W, 7110.308A, 7110.316, 7110.659C, 7110.123 and prior versions to provide more peak runway throughput capacity at our nation's airports. Outputs of this research program that do not require any changes to the NAS infrastructure - such as recommendations for wake hazard mitigation separation standards for new aircraft (A380, 747-8/9, 787) go directly into operational use. Yearly, there are 25 to 125 new aircraft types recognized by International Civil Aviation Organization (ICAO), which the FAA must assess for wake turbulence categorization. While this must be done for all aircraft types, the FAA has a special commitment to the National Transportation Safety Board (NTSB) to assess Super, Heavy and Upper large aircraft for wake turbulence separations (in front and behind) prior to entry into service. These required assessments are accomplished by the NextGen – Wake Turbulence research program in partnership with Flight Standards. Another example is the authorization for use of dependent staggered approaches for closely spaced parallel runways (FAA Order 7110.308) at SFO

and other qualifying airports. Other program outputs require follow-on F&E efforts, such as RECAT, to translate the concepts of applying technology and wake science into subsystem components of ATC automation systems.

The funding level supporting this research program addresses the needs of the FAA Air Traffic Organization and the Aviation Safety Organization to ensure new throughput capacity-increasing procedures and technology solutions are safe in terms of wake encounter risk. The program also provides the knowledge-based applied wake research, which has and will continue to enable incremental increases in airport and air corridor throughput capacity. It also provides analyses requested by airports (and associated air carriers) to determine if their runways can qualify for use of ATC wake mitigation procedures that would result in higher runway throughput capacity. The research program works with controllers, airlines, pilots, and aircraft manufacturers to include their recommendations and ensure training and implementation issues are addressed in the program's research from the start. Customers receiving direct benefit from this program include; pilots, FAA ATC, Flight Standards organizations, air carriers, and airport operators. Stakeholders include; commercial pilot unions, FAA unions, other International Civil Aviation Organization (ICAO), air navigation service providers, and aircraft manufacturers.

The NextGen – Wake Turbulence research program funding addresses both the FAA's near-term need (capacity-enhancing wake mitigation procedures and processes) for enhancing current operations and developing wake mitigation solutions that will be required as FAA transitions to trajectory-based and flexible terminal operations.

Major Activities and Accomplishments Planned in FY 2019 Include:

- Develop FAA wake separation to be applied to new aircraft entering service in 2019-2021 timeframe. This work will be incorporated into ATC Orders and associated decision support automation to further enhance NAS capacity.
- Evaluate en-route aircraft wake turbulence generation fast-time model and analyze potential ATC wake hazard mitigation procedure changes.
- Explore the use of aircraft wake transport and decay real time predictions in determining wake mitigation protection to be used by ATC in trajectory-based operations.

Goals for FY 2019 Funding:

- By 2019, maintain and enhance (if required) measurement, modeling and analysis capabilities to evaluate in terms of wake hazard generated and capability of mitigating a wake encounter, a new aircraft and design concepts.
- By 2023, develop feasible concepts including procedures, processes, and applications of NextGen era capabilities that allow the safe relaxation of the ATC wake encounter hazard mitigation constraint on NAS throughput capacity.
- By 2024, make available algorithms for use by flight deck avionics and ground-based ATC decision support tools that will allow safe and throughput-efficiency, dynamically adjusted wake hazard mitigation separations and operations between aircraft.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

Investing in the NextGen - Wake Turbulence Program provides the NextGen research and development, advanced wake mitigation processes and solutions that will be required to gain increased airport runway and air corridor throughput capacity both in the near and far term (2020 and beyond). More airports and air corridors throughput capacity translates into lower operating costs for air carriers and the ability to expand their business without airports having to invest in difficult (public resistance) and costly runway construction projects. For passengers, more throughput capacity translates into reduced flight delays,

especially a reduction in flight delays associated with weather events. More available throughput will encourage air carriers to schedule additional flights – widening the flight choices for passengers and potential reduction of fares due to increased competition between air carriers. The benefits can also be realized in terms of more direct flight paths and a corresponding reduction in emissions and noise.

The RECAT wake separation standards are based on the research and data collected by this program, implemented for ATC's use at multiple airports across the NAS, has resulted in a 15% increase in airport departure throughput capacity and a 10% increase in airport arrival throughput capacity (during instrument approach operations). The following are the benefits reported by Delta Air Lines concerning its Hartsfield-Jackson, Atlanta International Airport (ATL) hub operations subsequent to the introduction of the RECAT Phase 1.5 at ATL in June 2014:

- Taxi times have reduced; varies from half a minute to two minutes.
- Aircraft spend less time in the terminal airspace – reduction varies from half a minute to one minute.
- Operating time reductions mean yearly savings in the Atlanta Hartsfield operations of $14.8 million (low side) to $38.1 million (high side). (Estimates are prior to 2015 fall in aviation fuel prices.)

The research by the NextGen – Wake Turbulence Program is now and will continue to provide necessary data and modeling results to drive the development of safe, more advanced capacity-efficient ATC wake mitigation solutions and standards that will add an additional 5% to 7% throughput capacity in the NAS. The resulting lessening of flight delays and decrease in flight costs especially during weather and other events at an airport that causes ATC to switch to capacity constraining instrument flight rule operations.

Detailed Justification for A12.b NextGen – Air Ground Integration Human Factors

FY 2019 – A12.b NextGen – Air Ground Integration Human Factors - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A12.b NextGen – Air Ground Integration Human Factors	$8,575	$8,504	$1,336

What is this Program and what does this Funding Level Support?

This research program aims to maximize flight deck human-system performance by proactively identifying and responding to the coordinated impacts of NextGen technologies and future air-ground procedure integration needs. This program provides FAA stakeholders with scientific data, technical information, and targeted human factors solution integration strategies to support strategic FAA policy development, guidance material updates, and technology evaluation criteria. FAA stakeholders will apply program outputs to address known and potential human factors issues that are related to emerging NextGen technologies, strategic flightcrew adaptation/readiness needs, and complex procedure development.

The FY 2019 research program will focus on the examination of the individual and summative impacts of NextGen changes on future air-ground human-system interactions, and potential human factors integration issues driven by developmental NAS concepts (e.g., Trajectory Based Operations (TBO), transition to a time-based ATM, etc.). This research will emphasize four core areas: Human Error & Complex Systems, Avionics Design & Evaluation, NextGen Air-Ground Procedures, and NextGen Flightcrew Readiness.

Human Error & Complex Systems will identify the impact of emerging flight deck technologies on total human-system performance. This includes understanding whether potential technologies will reduce or increase the opportunity for human error. This research will use data-driven recommendations and repeatable human error assessment methods to support the development of guidance for NextGen operational and equipment approvals, training program criteria, and flightcrew procedure development. The results of this research will support updates to FAA regulations that are related to pilot training and airworthiness standards (e.g., 14 CFR, Part 121 Subparts N, O & Y), and procedure design.

Avionics Design & Evaluation will identify potential NextGen flight deck human-system integration issues that may arise from the introduction of future technologies, procedures, and modes of operation. The products of this research will help to quantify the risks associated with new technologies in the NextGen operational environment.

NextGen Air-Ground Procedures will identify and respond to human factors issues that may arise from the introduction of complex NextGen procedures. This includes issues that are related to design, depiction, usability, and fly-ability of instrument procedures and associated charts for inclusion in advisory material and standards for instrument procedures and associated charting. This research will also produce guidance and best practices that will reduce susceptibility to errors by pilots. The guidelines, recommendations, and data will address known difficulties with use of instrument procedures, and also address NextGen instrument procedure requirements.

NextGen Flightcrew readiness will identify new training and checking requirements for pilots and dispatchers acting as individuals, crews, and teams in the NextGen environment. This work also ensures that Flight Standards will have sufficient information and criteria to evaluate and approve these procedures.

Major Activities and Accomplishments Planned in FY 2019 Include:

NextGen: Human Factors Guidelines for Advanced Instrument Procedure Design and Use

- Document lessons learned and recommendations for PBN pilot operations and implementation for the development of guidance for procedure designers and evaluation.

NextGen Procedures, Tasks, Skills, and Training for NextGen Air Carrier Pilots and Dispatchers

- Analysis of all relevant job tasks (job task analysis, competency analysis, media analysis, instructional strategy analysis, risk analysis, etc.) for pilots and dispatchers, to include individual, crew, and team tasks for NextGen operations.

NextGen Flight Deck Systems-Flightcrew Interfaces, Installation, Integration, and Operations

- Complete analysis and reports for: ADS-B/ACAS; Advanced Display Technologies; Advanced Control Systems; EFVS; HUDs; and LVO/SMGCS.
- Report with guidance on compliance with the human factors related regulations (e.g., 25.1302, 2X.773, 2X.777, 2X.1523, 2X.1309) which will be used by AVS to update the regulatory and guidance material (ACs, etc.).

NextGen Human Error and Complex Systems

- Develop FAA System Safety Guidelines as a set of repeatable human error assessment methods to evaluate applicant compliance with 14 CFR 25.1302.

Goals for FY 2019 Funding:

- By 2020, minimize pilot and dispatcher error rates associated with new implementation of NextGen operations.
- By 2022, see reduced accident rates due to human error with airspace procedure design or use as a causal or contributing factor and improved operational implementation of PBN-based airspace procedures, with reduced need for redesign after initial implementation.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The NextGen - Air Ground Integration Human Factors program 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 FAA's Air Traffic Organization's service units for ensuring safe, efficient, and effective human system integration in transition of NextGen capabilities.

Research supports development of policy, standards, and guidance required to design, approve, and operate NextGen equipment and procedures. To meet the requirements of new NextGen capabilities, human factors research supports updates to standards for pilot certification and training. Additionally, this research will include integrated evaluations of NextGen procedures and equipment to identify and recommend mitigations for air ground integration human factors challenges. In particular, these evaluations will address human performance aspects of multiple NextGen technologies, procedures, and capabilities operating at the same time. For example, the use of RNAV/RNP, ADS-B, and data communications for precision, multiple-aircraft dependent approaches will be evaluated.

A U.S. Congress, Office of Technology Assessment report titled 'Safe Skies for Tomorrow' concluded that long-term improvements in aviation safety will come from human factors solutions and that such solutions are established through consistent, long-term support for human factors research and development,

analysis, and the application of human factors information. Human performance is often the largest contributor to system variability, so the implementation of advanced systems and the implementation of new procedures associated with NextGen will challenge the human components of the aviation system. Reviews of accidents and incidents have identified that human factors and human performance is a major factor in two thirds to three quarters of all civil aviation accidents. Specifically, research is required to ensure that system design, procedures, and training support the flightcrew functions, responsibilities, information needs, and interactions necessary for successful implementation of NextGen operational improvements, which often involve multiple new technologies operating in parallel.

Detailed Justification for A12.c NextGen – Weather Technology in the Cockpit

FY 2019 – A12.c NextGen – Weather Technology in the Cockpit - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A12.c NextGen – Weather Technology in the Cockpit	$4,059	$4,031	$1,525

What is this Program and what does this Funding Level Support?

The NextGen - Weather Technology in the Cockpit (WTIC) program is tasked with developing recommendations for a minimum weather service (MinWxSvc) needed to support sound pilot decision making and cockpit decision support tools (such as the Flight Management System) through the provision of meteorological (MET) information that is ready for direct integration to support operations in the transformed National Airspace System (NAS). The WTIC program will determine and recommend standards and guidance for a Part 121/135 and a Part 91 minimum weather service. The Minimum Weather Services will define the necessary MET information, the associated parameters of the information (i.e., accuracy, latency, update rates), and presentation elements to safely and efficiently incorporate it into collaborative decision making (CDM) relative to adverse weather decisions and performance based navigation. In defining the Part 121/135 minimum weather service, the WTIC program will also specifically reduce or resolve inefficiencies including those that result in excessive greenhouse emissions. The WTIC program in defining the recommended Part 91 minimum weather service will specifically resolve or minimize previously-identified and WTIC-identified general aviation (GA) safety risks. The Part 91 minimum weather service will also address shortfalls in training and will include training updates associated with minimum weather service recommendations.

Some specific NTSB facts and data demonstrating the need for this program include:

- Approximately 29% of all GA accidents are weather related.
- Weather related accidents have one of the highest fatality rates.
- The overall GA accident rate has decreased over the last few years, but it has increased approximately 20% for recreational/personal GA flights.
- For Part 121 flights, approximately 37% of the 446 accidents reported over a recent 10 year span are weather related.
- For Part 121 flights, turbulence is the number one cause of serious passenger injuries accounting for approximately 71% of 446 reported accidents.

The minimum weather services, including the resulting standards and guidance, recommended by the WTIC program will enable NextGen weather-related goals including reducing weather delays via increasing capacity and efficiency under adverse weather conditions, enhancing air traffic management (ATM) and aircraft re-routing flexibility to avoid adverse weather, reducing safety risks which have the potential of lowering the number of weather-related accidents and incidents, and reduction of emissions through lower fuel consumption resulting from optimized routing and rerouting during adverse weather. In addition, the WTIC program will develop functional and performance requirements based on the WTIC concept of operations and pilot roles in performance based navigation operations far-term concepts.

In addition to supporting NextGen goals, the WTIC program benefits numerous stakeholders that include Flight Standards by providing minimum weather service recommendations and supporting research data to support their efforts to update/develop standards, guidance documents, and pilot written exams. The WTIC

program also benefits Flight Services and Future Flight Services by providing research to support their goals of enhanced automated services to general aviation pilots at reduced costs compared to voice services and to modify VFR Not Recommended (VNR) statement procedures that align more with the increased use of automation and meet pilot preferences for delivery of services. The WTIC program also benefits non-FAA stakeholders such as the Aircraft Owners and Pilots Association (AOPA) and RTCA. There are benefits to General Aviation as the result of addressing selected weather related safety issues identified by AOPA. Benefits to RTCA include participation in various special committees and performing research to support their development of weather related standards and guidance documents.

The WTIC Program conducts demonstrations and evaluations for service and benefits quantification of new concepts and MET technologies for possible applications in NextGen. Also, the WTIC program will work closely with multiple RTCA special committees, European Organization for Civil Aviation Equipment (EUROCAE), and other industry and stakeholder committees to further the program objectives as well as the development and harmonization of industry and government minimum systems standards. Demonstrations and flight evaluations will be conducted to verify minimum weather service recommendations for airworthiness standards or recommended practices. The NAS mid-term concept of operations (ConOps) and numerous NextGen operational improvements (OI's) have identified a need for additional or higher quality MET information in the cockpit or integrated with decision support tools. This MET information will enable NextGen operations and performance based navigation to achieve planned benefits in adverse weather conditions.

For GA operations, the WTIC program is performing research to identify gaps of MET information in the cockpit that were identified as causal factors in previously reported accidents or incidents and gaps of MET information in the cockpit that have potential of being a causal factor in a future GA accident or incident. The WTIC program is developing recommendations to resolve or reduce these MET information gaps to potentially reduce the weather-related GA accident, fatality, and incident rates. In addition, the WTIC program is providing enhanced training modules, curriculums, and questions for the pilot written exam on the minimum weather service recommendations and evolving cockpit MET technology.

Recent newsworthy accomplishments of the WTIC program include numerous airlines and aircraft manufacturers implementing the Eddy Dissipation Rate (EDR) algorithm using the WTIC developed technical transfer package and cockpit reader to provide objective turbulence information to the cockpit which enhances crew management relative to turbulence encounters and enhanced efficiency due to improved turbulence avoidance decision making. For General Aviation, the WTIC program has provided 100 new weather related test questions to Flight Standards, published numerous articles in general aviation magazines informing pilots of gaps associated with weather latency, inadvertent flight into Instrument Meteorological Conditions (IMC), and "change blindness" that results from cockpit displays that have poor salience causing pilots to miss information informing them of deteriorating weather conditions. Current anticipated outcomes from the WTIC produced research outputs include enhanced safety, a reduction in aviation emissions that are harmful to the environment and public health, wind and temperature precision requirements to support NextGen aircraft 4-D navigation operations, and fully implemented NextGen capabilities that are utilized and provided anticipated benefits in adverse weather conditions.

Major Activities and Accomplishments Planned in FY 2019 Include:

- Develop resolutions to causal factors if any NextGen application program anticipated benefits were not successfully verified by demonstration when accurate and timely wind information was provided to the Flight Management System (FMS) and Air Traffic Control (ATC) or Aeronautical Operations Centers (AOCs) systems.
- Continue performing trade studies to develop draft MinWxSvc rendering recommendations for selected MET-uncertainty information for GA and Part 121/135 cockpits.
- Develop MinWxSvc recommendations based on the results of the oceanic demonstration results and the associated benefits analyses.
- Complete analysis of results from the operational demonstration of a cockpit Tactical Turbulence Notification and develop associated MinWxSvc recommendations.

- Begin gap analyses of helicopter operations to identify any unique safety risks, operational shortfalls, and operational requirements related to adverse weather conditions.
- Identify MET automation (technology and information services) applicable for GA operations and begin trade studies to assess their potential benefits and impacts.

Goals for FY 2019 Funding:

- By FY 2019, complete assessment of impacts of selected MET automation on MET information in the cockpit and pilot decision making.
- By FY 2021, complete trade studies to resolve selected gaps in special GA operations cockpit MET information and technology.
- By FY 2022, begin final assessment of recommendations for uncertainty information in Part 121/135 and Part 91 cockpits.
- By FY 2022, begin development MinWxSv wind application recommendations to enable planned benefits of NextGen far term concept operations in selected wind profiles.
- By FY 2024, perform gap analyses to identify gaps in Part121/135 minimum weather service MET information being integrated with newly implemented NextGen and GA cockpit technology and automation.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

Per NTSB data shown above, adverse weather continues to be one of the major causes of accidents, incidents, injuries, and fatalities. In addition, adverse weather contributes to inefficiencies in operations for commercial airlines and business aviation. Though recent advances in cockpit MET technology and information have provided improvements in safety and efficiency relative to adverse weather encounters, NTSB and airline performance statistics indicate that there is still significant opportunity for continued improvement in both areas.

Enhancing aviation safety and efficiency, as well as reducing gaseous emissions, are objectives that the FAA, the American public, and the government fully support. The WTIC program is necessary to achieve these goals since current gaps in cockpit MET technology and information, and pilot use of these, significantly impacts the ability to attain them. WTIC research is needed to identify resolutions to these gaps which ultimately will enable aviation to achieve the desired goals and planned benefits of NextGen. The WTIC developed minimum weather services will provide recommendations to resolve the current gaps related to cockpit MET information and technology while not limiting competition and commercial innovation since the recommendations will identify minimum levels necessary to achieve desired results, but will not limit industry in methods to meet or exceed the recommendations.

WTIC funding will be used to execute a portfolio of research projects that will identify gaps that are causal factors in safety hazards and risks for all types of aircraft and research projects that will resolve or reduce known and identified gaps. By reducing or resolving these cockpit MET-related gaps, the American public should see improvements in aviation safety and efficiency as well as a reduction in gaseous emissions. The trade studies, demonstrations, and verifications being performed by the WTIC program are necessary to identify optimum resolutions to the associated gaps and to ensure that there are no unanticipated negative impacts that will result in new gaps, risks, or operational shortfalls. Previous WTIC research has already identified dozens of gaps and has produced a number of recommendations to resolve/reduce selected gaps. The impacts of cockpit MET-related gaps are cross cutting across aircraft types, current operations, and NextGen operations so they are most effectively resolved by the WTIC Program which is focused on identifying solutions for all stakeholders versus being solely focused on a specific operational scenario or aircraft type.

Metrics for the WTIC Program include monitoring NTSB statistics for a reduction in weather and turbulence related incidents, accidents, and injuries, improvements in throughput at core airports during adverse weather, the number of standards invoked that incorporate WTIC minimum weather service recommendations, and WTIC conducted demonstrations verifying the resolution/reduction of current cockpit MET-related gaps and their associated operational shortfalls.

Detailed Justification for A12.d NextGen – Information Security

FY 2019 – A12.d NextGen – Information Security - Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A12.d NextGen – Information Security	$1,000	$991	$1,232

What is this Program and what does this Funding Level Support?

The purpose of this program is to conduct research on big data methodologies addressing cyber security parameters such as data volume, data rates, behavioral data, and a variety of other parameters to help prevent disruptive cyber incidents that may impact NextGen future air traffic operational data which includes the NAS, R&D, and missions support domains. The research will include Air Traffic Management Operations, Net-Centric Operations, and NAS Infrastructure. The big data research will include various communications such as Internet Protocol (IP) traffic, SWIM traffic based on Service Oriented Architecture (SOA) standards, big data in the cloud (public, private, community, and hybrid), and various application data within FAA systems and external aviation partners' systems communicating with FAA systems. The long term goal is to help prevent disruptive cyber incidents within the NextGen future traffic which will include digital and flexible communication in future Air Traffic Control (ATC) mission and improve big data cyber security within Air Traffic Management Operations, Net-Centric Operations, and NAS Infrastructure (communication, and information management) resilience in:

- Big Data – to effectively compile and correlate large volumes of data, new technologies, and algorithms.
- Visualization tools – related to big data to develop visualization techniques: creative visual presentations of data that quickly differentiate warning signs from normal operating behaviors.
- The cyber security operations structure to be agile and flexible to adjust to the most recent data collected on emerging threats.

While the current measures in place for the information security for the National Airspace System (NAS) are robust, the rapidly evolving capabilities of our potential adversaries and sharply decreasing costs of exploits necessitates some prudent exploration of advanced detection and defense capabilities for the NAS systems.

For the purpose of this research, operational data is the representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by human or automated means. Those data elements that are shared across organizational lines, support mission critical functions, or represent the greatest data needs of the agency and its customers.

Behavioral Data includes the gathering of information from observing activities of users, information systems, and processes and measuring the activities against organizational policies and rule, baselines of normal activity, thresholds, and trends, which includes behavioral monitoring.

The program directly supports the FAA's cybersecurity goals as outlined in the FAA Cybersecurity Strategy 2017-2022 - specifically, the FAA's overall cyber security capability development - by researching advanced tools, techniques and processes that can be adapted for use in the NAS. The program also 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.

This program is sponsored by the FAA's Cybersecurity Steering Committee (CSC). The CSC has members from the Chief Information Officer's office, the FAA's Air Traffic Organization, the FAA's NextGen

Organization, the FAA's Office of Security and Hazardous Materials, FAA's Office of Aviation Safety and the U.S. Department of Transportation. It is chaired by the FAA Chief Information Security Officer. The committee is thus able to look at aspects of cybersecurity for ATC across all domains and maximize the investments to provide the highest benefit for the agency.

A research roadmap, based on actual NextGen technology implementations, to improve the FAA's capability in operating a mixed-trust, massively interconnected network of systems and external domains of different levels of security pastures and controls was developed in FY 2018. Based on this version of the roadmap, FY 2019 funds will be applied to initiate the following topics:

- Develop the behavioral Data Algorithms, which will include Network traffic and network flow patterns
- Apply behavioral Data Algorithms for potential insider threats.
- Develop advanced big data analytics approaches to detect and respond to advanced persistent and insider threats.
- Investigate the feasibilities of applying impact assessment and risk analysis methods developed to determine and manage cybersecurity risks while connecting to external systems with NAS stakeholders and users.
- Conduct analysis of the data captured to develop appropriate domain-dependent behavior baselines at various levels (enterprise, networks, specific systems, and devices) based on the domain requirements and time-history intervals.
- Develop big analytical capabilities for aggregating and correlating current behavioral and operational data with the intent of understanding, predicting and responding to cyber events.

The vast majority of the research effort in this area will be in adapting extremely useful foundational research on trustworthy systems - performed by partner agencies (i.e., Department of Defense, Department of Homeland Security, National Science Foundation) and other entities - to the unique needs of the FAA. The FAA has developed the cyber test facility for ATC at the William J. Hughes Technical Center (WJHTC) and has the ability to rapidly configure the test environments to verify and validate adapted systems to ensure that they meet FAA's needs. In addition, the program will leverage the WJHTC Computing and Analytics Shared Services Environment – an environment consisting of data, compute power, and analytical tools.

This research effort will also include collaboration with other Government agencies, primarily DHS Science and Technology (S&T) and US Air Force Research Laboratory (AFRL) to support the FAA cybersecurity needs.

Anticipated FY 2018 activities and accomplishments include:

- Develop NextGen Information Security Research Roadmap for Big data technology
- Initiate collaboration with other Government agencies, primarily DHS Science and Technology (S&T) and US Air Force Research Laboratory (AFRL) to support the FAA cybersecurity needs. Collaboration will include evaluating Big Data tools and products developed by DHS, AFRL, and Massachusetts Institute of Technology/Lincoln Labs (MIT/LL), which can be used for FAA's Big Data R&D efforts.
- Evaluate Big Data tools developed by other government agencies

Major Activities and Accomplishments Planned in FY 2019 Include:

- Develop the enabling technology and algorithms to diminish certain cyber-attack impacts on the NAS.
- Continue the development of big data analytical capabilities with visualization tools for aggregating and correlating current operational, behavioral, and environmental data with the express intent of understanding, predicting and responding to cyber events. Continue enhancements of cyber testing capabilities that will support the NAS operational improvements

(OIs) by helping identify and quantify known risks and keeping pace with the increase in cyber threats to the NAS.

- Refine the research roadmap, based on actual NextGen technology implementations, to improve the FAA's capability in operating a mixed-trust, massively interconnected network of systems and external domains of different levels of security postures and controls.

Goals for FY 2019 Funding:

- By 2019, develop the enabling technology to diminish certain cyber-attack impacts on the NAS with resilient self-adaptive techniques.
- By 2019, continue the development of big data analytical capabilities for aggregating and correlating current operational, behavioral, and environmental data with the express intent of understanding, predicting and responding to cyber events.
- By 2020, update the research roadmap. This will be based on research findings and actual NextGen technology implementations that improves the FAA's capability in operating a mixed-trust, massively interconnected network of systems and external domains of different levels of security postures and controls.
- By 2021, provide a systematic approach to continuously identify cybersecurity-risk-based mission critical equipment and develop corresponding technology solutions of improved security postures.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The NAS is an integral part of the nation's critical infrastructure as identified in PPD-21. Maintaining the continued operations of the nation's air traffic management systems and preventing interruptions of the NAS functions are essential to provide the most efficient air travel system for and to ensure the safety of both air traveling public and the citizens on the ground. This NextGen Information Security research will enable the FAA to provide the necessary protections of the air traffic control services and associated functions from potential disruptive cyber events, specifically as the IP-network based and Service Oriented Architecture (SOA) NextGen technologies are being implemented. This research will benefit all of FAA's Lines of Business (LOB).

Detailed Justification for A12.e NextGen – Flight Deck Data Exchange Requirements

FY 2019 – A12.e NextGen – Flight Deck Data Exchange Requirements - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A12.e NextGen – Flight Deck Data Exchange Requirements	$0	$0	$1,035

What is this Program and what does this Funding Level Support?

The implementation of Trajectory Based Operations (TBO) in the NAS requires the ability to exchange extensive information between the flight operator and the Air Navigation Service Provider (ANSP) in a secure manner. The current voice based information exchange mechanisms are not adequate to enable the rich data exchange requirements of TBO. The implementation of Data Communications (DataComm) Aeronautical Telecommunications Network (ATN) Baseline 2 (ATNB2) is expected to address these requirements, however, equipage of ATNB2 capabilities will be limited among non-scheduled air carriers and business jet operators, and retrofit of older equipment among large air carriers will be limited due to the costs of equipage. The resulting mixed equipage in data communication capabilities will result in less than optimal realization of the efficiency benefits envisioned through TBO. To supplement the ATNB2 equipped aircraft, alternate means of data exchange capabilities are possible by leveraging emerging technologies that are already being implemented by flight operators. Technologies such as Electronic Flight Bags (EFBs) and Aircraft Interface Devices (AIDs) coupled with data link capabilities can provide a subset of the capabilities of ATNB2 to enable increased participation in TBO, benefiting the NAS. It is imperative that these new capabilities have robust security protocols and exchange mechanisms that ensure that safety critical systems onboard the aircraft and NAS automation systems on the ground are not compromised.

The Flight Deck Data Exchange Requirements program addresses the data exchange format and performance requirements which enable enhanced data exchange between onboard avionics systems and ground systems to enable TBO. Recent advancements in flight deck automation such as EFBs, AIDs, and the availability of new on-board data links have introduced an opportunity for flight operators to leverage these technologies in the collaborative decision making process. There is ongoing work to evaluate the feasibility of utilizing these technologies to enable operational functions like trajectory negotiation and downlink of aircraft specific intent data to synchronize trajectories with ground automation with extensive work in improving the ground automation capabilities, but further research is required on the flight deck automation performance and information security requirements. This research will evaluate the emerging technologies that enable the exchange of data between certified avionics such as Flight Management Computer (FMC), and non-certified avionics like EFBs through aircraft interface devices. The research will evaluate the current security requirements and state-of-the-art security standards that can be imposed on the new FD data exchange architecture. This will enable safe data exchange between certified and non-certified systems, the performance standards required to enable operational information exchange like intent downlink and trajectory negotiations, and the data exchange protocols to enable seamless integration between airborne and ground systems. The project will also seek to evaluate and address the security requirements for information exchange and interaction between certified and non-certified avionics, and between airborne and ground automation systems to maintain the integrity of systems that are safety critical to flight operations while enhancing data exchange capabilities.

For FY 2019, the requested funding will be used to develop a research plan, evaluate and develop an initial technical and operational assessment, define a security framework to assess technologies, initiate, and maintain coordination with key industry stakeholders and organizations, and develop concept and use cases for flight deck data exchange.

Major Activities and Accomplishments Planned in FY 2019 Include:

- Develop Flight Deck Data Exchange Requirements research plan.
- Initiate stakeholder engagement with key industry representatives and organizations.
- Identify a framework to assess the necessary technologies and information security for flight deck data exchange requirements.
- Develop an initial concept and operational use cases to identify data exchange requirements utilizing certified and non-certified flight deck automation systems.

Goals for FY 2019 Funding:

- By 2019, conduct initial stakeholder engagement.
- By 2019, complete assessment of existing information exchange and security requirements.
- By 2020, complete final Flight Deck Data Exchange Requirements research plan by 2020.
- By 2020, complete final concept and operational use cases.
- By 2020, identify flight deck information exchange architecture alternatives.
- By 2021, finalize detailed research plan for flight deck data exchange requirements.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

This program aims to benefit the American Public by addressing the national aviation priority of flight deck and ATC integration for NextGen operational capabilities. Ongoing research conducted by this program will ensure that pilots receive the right information at the right time for decision-making and collaboration with ATC in order to operate in the NAS safely.

Through this work, the Flight Deck Data Exchange Requirements program will enable the participation of an increased number of aircraft in the necessary data exchange environment required to enable collaborative decision making and the evolution to TBO. By leveraging these capabilities, more aircraft can conduct dynamic and flexible operations that reduce the inefficiencies present in a rigid navigation and surveillance structure. These requirements and flight deck capabilities will enable flight operators to operate at their optimal performance envelopes while reducing the need for air traffic control intervention and restrictions by enabling reduced and delegated separation management. The flying American Public derives benefits in the form of safer flights, reduced delays, and more optimized and predictable flights. In the long term, TBO environment enhanced by advanced flight deck capabilities will lead to lower operating costs for the FAA as well as the airline industry.

Detailed Justification for A13.a Environment and Energy

FY 2019 – A13.a Environment and Energy - Budget Request
($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A13.a Environment and Energy	$16,013	$15,893	$11,588

What is this Program and what does this Funding Level Support?

The FAA is utilizing a comprehensive strategy to mitigate the environmental impacts of aviation to enable its sustained growth. The strategy employs a holistic approach that builds on aviation's history of technological and operational innovation to develop:

- Improved scientific knowledge and integrated modeling;
- New aircraft technologies;
- Air traffic management modernization and operational improvements; and
- Policies, environmental standards, and market based measures.

The Environment and Energy (E&E) Program is a key component of the FAA's environment and energy strategy. This Program is advancing our understanding of aviation noise and emissions at their source, how they propagate and are modified in the atmosphere, and their ultimate health and welfare impacts on the population – both near airports and much farther afield. This knowledge is then 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 aviation environmental tool suite is built upon a sound scientific understanding of aviation noise and emissions as well as their environmental, health, and welfare impacts. The Program is using these models and knowledge to inform decision-making on technology development, operational procedures, and policies relating to aviation's energy use and environmental impacts.

Despite the technological advancements achieved during the last 40 years, and the resultant 95% reduction in the population exposure to significant noise, the impact of aircraft noise demands considerable Federal resources and is a constraint on aviation growth. Since 1982 the FAA has provided over $10.5 billion for sound insulation of houses and schools around U.S. airports. Environmental impacts, especially aircraft noise, are often the number one cause of opposition to airport capacity expansion and airspace redesign. A GAO 2000 Survey of the 50 Busiest Commercial Airports in the US found that 72% of delayed work and 25% of project cancellations of airport capacity expansion projects was due to environmental issues (http://www.gao.gov/archive/2000/rc00153.pdf). Further, a 2010 GAO Report found that new runway construction from initial planning to completion takes a median of 10 years, but delays from lawsuits or addressing environmental issues can add an additional 4 years to the median time (http://www.gao.gov/assets/310/309622.pdf). These GAO studies were conducted prior to the implementation of precision navigation, which has been accompanied by increased airport community concerns regarding noise.

Research that is several decades old provides the foundation for the current definition of aircraft noise significance, land use compatibility guidelines, and federally funded noise mitigation programs. The E&E Program is supporting the FAA's noise research roadmap, which is providing the scientific basis to update FAA noise policy. Efforts are ongoing within the E&E Program to improve our understanding of the impacts of airport noise on community annoyance, sleep disturbance, cardiovascular health, and children's learning. These efforts are being done in collaboration with lines of business and staff offices across the FAA and with other Agencies, across the Federal Government, that have policies regarding noise compatible land use. The results from the FAA noise research roadmap, including the national environmental survey of airport

communities, are also informing the development of tools to assess the consequences of various operational procedures on noise, in addition to other issues such as fuel burn, emissions, including fine particulate matter, and safety. It also ensures that effective mitigation efforts are developed to help affected airport communities and to ensure the U.S. response to aircraft noise keeps pace with the needs of NextGen.

Research is also needed to ensure the U.S. response to aviation noise keeps pace with new entrants to the National Air Space such as unmanned aerial systems, civil supersonic aircraft, and commercial space vehicles. The E&E Program is providing the technical basis for a review and possible elimination or modification of existing regulations to enable the development and growth of supersonic air transport. The effort to evaluate supersonic air transport is being done in close collaboration with industry and NASA as well as international partners through the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP).

While energy efficiency and local environmental issues have traditionally been primary drivers of aeronautics innovation, the current and projected effects of aviation emissions on our global climate are a serious long-term environmental issue of concern to the aviation industry. Aside from their associated health and welfare impacts, noise and emissions are a considerable challenge in terms of community acceptance of aviation activities and this challenge is anticipated to grow with new entrants such as unmanned aircraft systems and supersonic aircraft.

The Program is also supporting the development of a comprehensive suite of analytical tools to quantify the environmental consequences and impacts of aviation. These analytical tools provide the FAA with the ability to characterize and quantify the interdependencies among aviation-related noise and emissions, impacts on health and welfare, and industry and consumer costs, under different policy, technology, operational, and market scenarios. At the center of these analytical tools is the Aviation Environmental Design Tool (AEDT), which can model the noise, fuel burn and exhaust emissions that result from aircraft operations from the airport gate through ground movements, takeoff, climb-out, cruise, approach, and landing at the aircraft's final destination. AEDT has replaced the FAA legacy tools for environmental compliance: Noise Integration Routing System (NIRS), Emission and Dispersion Modeling System (EDMS), and Integrated Noise Model (INM). Efforts are ongoing to develop AEDT Version 3 which will have improved abilities to model noise at lower noise levels by improving takeoff weight and thrust modeling and improving the aircraft performance module. These improvements will lay the ground work to further improve the noise modeling capabilities of AEDT Version 4 which will have an explicit incorporation of airframe noise. In older aircraft, the jet exhaust was the dominant noise source; however, in modern aircraft, airframe noise has become a dominant noise source on approach and one that is distinctly heard by some members of the community. AEDT Version 4 will also incorporate both an improved local-scale airport air quality model and capabilities to model civil supersonic aircraft. The capabilities provided by AEDT Versions 3 and 4 will improve our ability to evaluate the changes in noise, fuel burn and emissions, including fine particulate matter, that result from the introduction of NextGen as well as greatly improve our ability to design effective options to mitigate noise, fuel burn and emissions. The end result will be tools that aid in the development of an aviation system with increased capacity that also has reduced environmental impacts.

This Program is providing knowledge and tools to streamline environmental review processes that are required for infrastructure projects and other Federal actions. It is also a key element of the FAA's efforts to address the public opposition to NextGen. The research funded by this Program is helping the FAA to understand community concerns about noise and emissions by quantifying the impacts of aviation on airport communities. The analytical tools that are supported by this Program are required for environmental reviews and this funding is improving these tools in terms of their suability and accuracy. Funds from this program are also being used to develop screening tools that can be used to expedite the environmental review process.

The E&E Program is providing the necessary knowledge and tools to evaluate all of the options being considered by the aviation community to mitigate environmental impacts of aviation. There are also important interrelationships and trade-offs among impacts due to noise, emissions, and fuel use that need to be understood and quantified when developing environmental mitigation strategies. The development of an interdisciplinary approach that considers the interdependencies among fuel use, aircraft noise, and various air pollutant emissions is a key element for the E&E Program. The goal is to develop a more complete understanding of the complex interdependencies that exist among aircraft noise, fuel use, and emissions as well as their health and welfare impacts. This knowledge is being incorporated into an

integrated environmental modeling framework that is used to evaluate policy and technological options to mitigate the environmental impacts and energy use from aviation. This knowledge and the resulting analytical tools will enable the development of aircraft operational concepts with lower noise, emissions, and fuel burn that could also maintain or increase capacity. This integrated environmental modeling framework provides the tools necessary to support further research to expand the future range of mitigation options.

Major Activities and Accomplishments Planned in FY 2019 Include:

- Advance the understanding of noise impacts on social welfare and health.
- Improve ability to model the air quality and climate impacts of aviation emissions.
- Enhance the aviation environmental tool suite to improve its ability to calculate environmental consequences and impacts of aviation.
- Analyze mitigation options for reducing environmental impacts including policy measures and standards being developed at the International Civil Aviation Organization Committee on Aviation Environmental Protection (ICAO CAEP).

Goals for FY 2019 Funding:

- By 2019, complete analyses to support the development of a new engine exhaust particulate matter standard in ICAO CAEP.
- By 2019, explore appropriate metrics for community exposure to aircraft noise.
- By 2019, develop improved analytical tools and methodologies for cost-benefit analysis of both domestic and international policy options and scenarios.
- By 2019, complete analyses to inform the development of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) within ICAO CAEP.
- By 2020, advance understanding of the public reaction to advanced supersonic airplanes to support the development of en-route noise standards for airplanes that exceed Mach 1.
- By 2021, release AEDT Version 4 with improved noise characterization.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

The increased knowledge and analytical capabilities provided by the E&E Program would help the aviation industry overcome the environmental challenges that are currently constraining aviation growth.

This request would continue the successful research that has been carried out by the E&E Program. This funding would continue efforts to advance our scientific understanding of the environmental impacts of aviation, developing tools to quantify these impacts, and then using the tools to inform policy making regarding the environmental impacts of aviation.

Much of the research in this program to improve the underlying science is carried out via the Aviation Sustainability Center (ASCENT), a leading aviation cooperative research organization with a broad portfolio of contributions. More information on ASCENT can be found at http://ascent.aero. ASCENT is building on the success of the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence as highlighted in their 10-year symposium found at http://web.mit.edu/aeroastro/partner/reports/public-symposium-2013.pdf. More information on PARTNER can be found at http:// partner.aero/.

The E&E Program has enabled the development of AEDT to quantify the integrated fuel burn, noise, and emissions consequences of aviation as well as the aviation portfolio management tool (APMT) to convert

these consequences into impacts on the community. AEDT version 2c (AEDT2c) was publicly released in 2016 and is the FAA's standard noise and emissions model replacing the NIRS, INM, and EDMS. More information on AEDT can be found at https://aedt.faa.gov/. AEDT2c is saving the government money by enabling noise, fuel burn, and emissions to be run simultaneously using a single input file instead of having multiple programs, as was the practice before its release. AEDT also provides a standard platform that facilitates exchange and reuse of data and results, thus optimizing usage of resources. Additionally, AEDT is used internationally by academia, industry, and manufacturers in 30 countries, and growing, thus establishing AEDT as the recognized reference tool for modeling environmental consequences and furthering the global leadership position of the U.S. E&E Program. Funds from this program would ensure the continued improvement and development of AEDT.

The U.S. aviation industry relies on the international harmonization of standards to ensure that aircraft that leave the U.S. are accepted for operation in other parts of the world where they land. This is important to the nation as the aviation industry is responsible for over ¼ of U.S. exports. At present, there are aircraft and engine standards that limit noise and emissions. The U.S. aviation industry relies on the FAA to negotiate these standards at ICAO CAEP and to certify that their aircraft and engines meet these standards such that they can sell them to airlines around the world. It is in the competitive interest of U.S. industry to ensure that these standards continue to be negotiated internationally such that we have harmonized global standards and that the FAA is able to certify that U.S. produced products meet the latest international standards. If the FAA does not have this ability because the standards are either not harmonized or are not promulgated domestically, then U.S. manufactures of aviation products need to seek certification from foreign governments. The result is increased cost for industry and delays in product launches of new aircraft and engines.

The E&E Program has been instrumental in supporting the development of a new standardized particular matter emissions measurement system for gas turbine engines. This new system was approved by ICAO CAEP in February 2016 to measure aircraft engine exhaust to ensure compliance with the existing international engine exhaust visibility requirements. The new measurement system can be used at the same time as gaseous emissions measurements, which are also required. This is instead of the old measurement process which was time consuming and had to be done separately from the gaseous emissions measurements. The end result is that the new standardized particulate matter emissions measurement standard reduces emissions certification time by half saving industry time and money while improving the quality of the emissions measurements. This new system is currently being used to develop the emissions database to create an international aircraft engine particulate matter standard.

During the ICAO CAEP/8, CAEP/9, and CAEP/10 meetings - which took place in 2010, 2013, and 2016, respectively - AEDT and APMT were used to inform the U.S. positions on the internationally negotiated nitrogen oxide, noise, and fuel efficiency standards. The tools were also the primary providers of the data upon which the standards were evaluated and selected. Continued funding for the E&E Program would ensure the U.S. has the scientific information to make informed decisions on a particulate matter standard and a global market based measure for aviation, both of which are currently being developed in ICAO CAEP. Each of these could have a multi-billion dollar impact on the aviation industry and on the health and welfare of the American public.

Detailed Justification for A13.b NextGen – Environmental Research-Aircraft Technologies and Fuels

FY 2019 – A13.b NextGen – Environmental Research – Aircraft Technologies and Fuels – Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A13.b NextGen – Environmental Research-Aircraft Technologies and Fuels	$27,174	$26,941	$7,587

What is this Program and what does this Funding Level Support?

The NextGen – Environmental Research – Aircraft Technologies and Fuels program is developing solutions to reduce the impacts associated with aviation noise and exhaust emissions, and increasing energy efficiency and availability. In partnership with industry, the program will accelerate the maturation of engine and airframe technologies to reduce aircraft noise, fuel use, and emissions. The maturation of aircraft and engine technologies is a key component of the NextGen strategy to overcome the environmental challenges facing aviation.

The vast majority of improvements in environmental performance over the last three decades have come from enhancements in engine and airframe design. It is expected that a combination of technologies, air traffic management, and policy measures will be required to provide sufficient environmental protection to ensure sustained aviation growth.

The NextGen – Environmental Research – Aircraft Technologies and Fuels Program supports the Continuous Lower Energy, Emissions, and Noise (CLEEN) program. The CLEEN Program is focused on technology maturation to reduce current levels of aircraft noise, fuel use, and regulated pollutants. With the support of the CLEEN Program, the aviation industry is able to expedite the integration of these technologies into current and future aircraft. CLEEN helps accelerate technologies through a crucial phase in their maturation, culminating in full scale ground and flight test demonstrations and showing readiness for product implementation. At the conclusion of the development effort for a CLEEN technology, each company, having cost shared the development with FAA, is invested in the technology's success and confident in its maturity to enter product development for entry into service. Once entered into service, the CLEEN technologies will realize their noise, fuel burn, and emissions benefits throughout the fleet for years to come. 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. For example, the low emissions engine combustor has met and exceeded the original CLEEN goal for nitrous oxide reductions. This combustor has been introduced into service in 2016. Other demonstrated CLEEN technologies have shown significant progress toward the fuel burn and noise reduction goals.

In FY 2019, the NextGen – Environmental Research – Aircraft Technologies and Fuels Program will continue to advance system design, integration, and testing of CLEEN aircraft technologies for accelerated progress towards flight demonstration and system-wide assessments within the second phase of the CLEEN program (CLEEN II) and begin solicitation activities for CLEEN III.

Major Activities and Accomplishments Planned in FY 2019 Include:

- Continue the second round of CLEEN activities (CLEEN II) in year 5 to assess and demonstrate aircraft and engine technologies that can reduce energy use, emissions, and noise.

- Initiate the solicitation activities for CLEEN Phase III (CLEEN III).

Goals for FY 2019 Funding:

- Through 2020, demonstrate technologies that can reduce energy use, emissions, and noise in the second phase of the CLEEN Program.
- By 2020, assess the benefits of the airframe and engine technologies from the second phase of the CLEEN Program.
- By 2020, initiate CLEEN Phase III activities to demonstrate technologies that can reduce energy use, emissions, and noise.
- Through 2021, continue CLEEN Phase III activities to demonstrate technologies that can reduce energy use, emissions, and noise.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

This Program will enable continued success in the CLEEN Program to mature aircraft and engine technologies. The technologies matured in the first five-year period of CLEEN will reduce U.S. fleet-wide fuel burn by 2% from 2025 through 2050, representing a cumulative savings of 22 billion gallons of jet fuel. The CO2 savings are the equivalent of taking 1.7 million cars off of the road over the duration of this 25 year period. It will also save airlines 2.75 billion dollars per year. These benefits are in addition to substantial reductions in noise and emissions that degrade air quality (go to http://partner.mit.edu/projects/eds-capability-demonstration-assessing-cleen-program for further details).

The CLEEN Program matured a low emission combustor technology which entered into service in 2016 in an engine with almost 8,000 orders already placed. The CLEEN Program also anticipates another CLEEN engine technology will have more than 4,000 orders placed after 2020. As additional new aircraft and engine products are announced by industry, there will be many more orders placed for products that were matured via the CLEEN Program. Additional details on first two phases of the CLEEN Program are available at
http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20454.
https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20994.

With continued funding, this program will enable the FAA, through the second phase of the CLEEN Program (CLEEN II), to partner with industry to mature technologies with the result being a fleet of aircraft with lower noise, emissions and fuel burn. Specifically, the technology goals of the second phase of the CLEEN Program are to develop and demonstrate certifiable engine technology that reduces:

- Noise levels by 32 decibels cumulative, relative to the Stage 4 standard.
- Aircraft fuel burn by 40% relative to year 2000 best-in-class in-service aircraft
- LTO cycle, NOx emissions by 70% below the International Civil Aviation Organization standard adopted in 2011.

By reducing the environmental impact of aviation through new technologies this funding helps to ensure the continued growth of aviation while also reducing the impacts of aviation noise and emissions on airport communities as well as on the public at large.

Detailed Justification for A14.a System Planning and Resource Management

FY 2019 – A14.a System Planning and Resource Management - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A14.a System Planning and Resource Management	$2,288	$2,282	$1,480

What is this Program and what does this Funding Level Support?

The System Planning and Resource Management (SPRM) activity leads the planning, coordination, development, presentation, and review of the FAA's research and development (R&D) portfolio. Its key programmatic outputs include the National Aviation Research Plan (NARP), the Annual Research and Development Review – both of which are annual statutory deliverables to Congress – and administration of the congressionally mandated (P.L. 100-591 Section 6 Advisory Committee) Research, Engineering and Development Advisory Committee (REDAC) and resultant reports. SPRM also provides program advocacy and outreach and maintains alignment with departmental R&D program planning and performance reporting guidance.

SPRM leads the portfolio planning, formulation, presentation and review activity to ensure the FAA meets the President's criteria for R&D, increases program efficiency, sustains and maintains management of the program within operating cost targets, and enables effective program review by the REDAC and the OST Office of Research and Technology.

Established pursuant to the Federal Advisory Committee Act (FACA), the REDAC reviews FAA research commitments annually and provides guidance for future R, E&D investments. The members of this committee and its associated subcommittees are subject matter experts drawn from various associations, user groups, corporations, government agencies, universities, and research centers. Their combined presence in the REDAC fulfills a congressional requirement for FAA R&D to be mindful of aviation community and stakeholder input.

SPRM also develops program guidance and conducts compliance reviews to ensure that departmental R&D program planning and performance reporting requirements specified in the Fixing America's Surface Transportation (FAST) Act are satisfied. It also coordinates the establishment and administration of the Air Transportation Centers of Excellence (COE) Program and ensures compliance with related Financial Assistance and Grants Management departmental policy guidance.

Major Activities and Accomplishments Planned in FY 2019 Include:

R&D Portfolio Development

- Lead the development of the R&D Budget Portfolio.
- Coordinate development, review, and presentation of the NARP in accordance with statutory requirement.
- Coordinate development, review, and presentation of the R&D Annual Review in accordance with statutory requirement.
- Conduct REDAC Portfolio Review in accordance with statutory requirement and FAA Policy Order.

- Complete and deliver Annual Federal Advisory Committee Act (FACA) Report as required by GSA Directive.
- Complete Annual Modal Research Plan as required by the FAST Act.

Goals for FY 2019 Funding:

Sustain and maintain program operation within specified operating cost targets as follows:

- Maintain an R,E&D management workforce of no more than 10% of the total R,E&D workforce, each year through FY 2020.
- Control expenditures of the REDAC to less than 1/10 of 1% of the total R,E&D budget, and each year through FY 2020.

What Benefits will be Provided to the American Public Through this Request and why is this Program Necessary?

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

Detailed Justification for A14.b William J. Hughes Technical Center Laboratory Facility

FY 2019 – A14.b William J. Hughes Technical Center Laboratory Facility - Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
A14.b William J. Hughes Technical Center Laboratory Facility	$3,412	$3,401	$1,178

What is this Program and what does this Funding Level Support?

This program sustains research facilities located at the William J. Hughes Technical Center Laboratory (WJHTC) to support Research and Development (R&D) program goals. These programs require specialized facilities to emulate and evaluate field conditions. The R&D laboratories are comprised of the Cockpit Simulation Facility (CSF), Target Generation Facility (TGF), Research Development and Human Factors Laboratory (RDHFL) and The NextGen Prototyping Network (NPN).

R&D programs require specialized facilities which provide flexible, high-fidelity environments to conduct research and perform HITL simulations which evaluate advanced air traffic concepts. Researchers measure baseline human performance using existing air traffic controller configurations and determine changes in performance when new systems or procedures are introduced to identify and evaluate human factors (HF) issues. These laboratories include integrated cockpits, air traffic controller workstation capabilities (simulated and real), and specialized biometric data collection systems to evaluate the system and human components that can only be addressed in a full mission end-to-end simulation environment.

The R&D laboratories are fully integrated with the other WJHTC capabilities which allows for an extremely high fidelity environment supporting R&D research. This research encompasses capabilities of the current day, NextGen, and the transition - for example mixed equipage and adjacent site deployment. The funding provides for existing infrastructure support, project support, engineering support, R&D facility modifications and improvements, equipment and software/hardware licenses, and support tools.

Simulation Facilities - (CSF & TGF)

The Simulation Branch supports development and test programs at the WJHTC by generating realistic traffic for engineering, operational, and HF evaluations of National Airspace System (NAS) equipment, procedures, and operations. The TGF is a dynamic controller-in-the-loop real time/fast time Air Traffic Control (ATC) simulation capability used to generate real time, interactive traffic in support of HITL's. Realistic aircraft trajectories and associated digital radar messages and maps for aircraft and controllers are generated in a simulated airspace environment. Simulation pilots are provided by the Simulation Branch and include a cadre of current and retired airline and commercial pilots who interact with air traffic controllers and dynamically control aircraft movement during HITL simulations. The Simulation Branch also maintains several cockpit simulators of transport category including B-737-800, A-321, Embraer 175, and several General Aviation (GA) aircraft. All cockpit simulators are integrated with TGF and are capable of acting as interactive targets in NAS simulations.

Concepts and Systems Integration – RDHFL

The RDHFL conducts research to acquire a better understanding of the role that a human plays in current and future aviation systems. This research environment is specifically designed to measure and assess human performance and workload. Additionally, the RDHFL investigates how new technologies should be integrated into air traffic control and airway facilities systems. This research increases the overall safety of the NAS while also minimizing implementation costs by evaluating the effectiveness of air traffic concepts and requirements. The RDHFL has supported a number of legacy system and NextGen projects in many

areas of research including NextGen Terminal Radar Approach Control (TRACON) (Human Factors Division), En Route Data Communications, modular NextGen TRACON facilities, separation management, tower ground surveillance, Unmanned Aircraft Systems (UAS), wildlife Human Factors mitigation simulation, weather simulations, virtual reality demonstrations and many more. The RDHFL will continue to provide the resources to conduct robust and high fidelity HITL air traffic simulations.

Network Capabilities (NextGen Prototyping Network)

The WJHTC R&D laboratories are connected to each other and to other FAA and partner R&D facilities through the NextGen Prototyping Network (NPN). The NPN serves as the FAA primary research and development network that provides a scalable and secure infrastructure that facilitates R&D activities. FAA WJHTC, Florida Test Bed, and Oklahoma City, OK laboratories as well as Government (Department of Defense Research Network, National Aerospace and Space Agency, National Weather Service) industry, and academia resources are accessible via the NPN private network. The NPN also has established connections to the FAA Telecommunications Infrastructure (FTI) which affords supportability of full lifecycle management of NAS Programs. The funding level supports network engineering and resources required to fulfill the planned network related major activities for FAA programs, such as cyber security, Unmanned Aircraft Systems (UAS), Commercial Space, and other FAA related research and development.

Major Activities and Accomplishments Planned in FY 2019 Include:

Simulation Facilities

- Implement intelligent agent-based capability for En Route controllers to the TGF simulation platform.
- Develop a rotorcraft cockpit simulator with initial flight capability.

Concepts and Systems Integration – RDHFL

- Enhance the simulation infrastructure with capabilities added to the baseline NAS automation systems.
- Develop and integrate Future Air Navigation System 1A (FANS 1A) data communication capabilities into the En Route simulation infrastructure.

Network Infrastructure - NPN

- Support cyber security activities related to the future NAS which includes Incident Response Process (IRP), Continuous Diagnostics, and Mitigation (CDM) roll out, and other collaborative, multi-partner cyber exercises.
- Support UAS and Commercial Space development and NAS integration activities. These include FAA and other Government (ex DoD, NASA, DHS, etc.) UAS activities related to system safety and NAS integration.

Goals for FY 2019 Funding:

Simulation Facilities

- By 2020, implement intelligent agent-based capability to TGF for CONUS simulations in Tech Center R&D and field support laboratories as well as remotely located simulation facilities.
- By 2020, provide a rotorcraft cockpit capability to the WJHTC infrastructure. By 2021, provide the capability for flight plan exchange through data communications in one or more transport category cockpit simulators.

Concepts and Systems Integration – RDHFL

- By 2020, enhance the simulation infrastructure with capabilities added to the baseline NAS automation systems.

- By 2021, develop and integrate a conceptual 4 Dimensional Trajectory (4DT) controller interface to support trajectory based operations.

Network Infrastructure - NPN

- By 2021 support cyber security IRP exercises with the Department of Defense.
- By 2023 Integrate FAA and partner networks and facilities into the NPN baseline to expand the collaborative capabilities and position the FAA to best support NextGen research within the FAA, other government agencies, industry and academia partners.

What Benefits will be provided to the American Public Through this Request and why is this Program Necessary?

The R&D laboratories are fully integrated with the other WJHTC capabilities which allows for an extremely high fidelity environment supporting R&D research. This research encompasses capabilities of the current day, NextGen, and the transition - for example mixed equipage and adjacent site deployment. The American public benefits by having an efficient and flexible platform to evaluate future NextGen concepts and technologies that will enhance the safety and efficiency of air travel.

In order to provide this robust research platform, it is necessary to modify, upgrade, and sustain the R&D laboratory infrastructure in order to support the R&D program goals.

Simulation Facilities

The capability developed by the simulation branch will enable the research of complex problems due to weather, UAS, and commercial space flight in a controlled laboratory environment. The fully integrated facilities will enable research from the ground and airborne elements for a complete simulation capability. The capital investment will be offset by the cost savings and safety of performing this research in simulation rather than the use of live aircraft. The implementation of new technologies, such as the intelligent agent-based capability, would allow for a reduction in the number of test subject participants needed for a given study in order to further maximize cost savings and efficiencies. Moreover, the safety of simulation will allow the study of the extremes that would not be possible in live flight conditions.

Concepts and Systems Integration – RDHFL

The benefit of doing proactive HF research on proposed changes to the NAS is to identify human performance issues early in the concept development phase. Human Factors related issues resolved prior to implementation result in cost savings and ensure that the agency's safety standards for air traffic control operations are met.

Network Infrastructure – NPN

Use of the NPN maximizes shared resources, relieves the need to establish separate connections, and minimizes duplication of efforts and the resources to manage these extra connections and efforts. The NPN provides a common network approach that affords distributed access to NextGen and R&D laboratories, and a distributed set of capabilities that frees up R&D funding which is extremely important during times of austere budgets. The modern enterprise network architecture of the NPN ensures data separation and end-to-end segmentation for both FAA and partner networks. It meets the most stringent security requirements while providing a flexible and scalable architecture to best meet R&D program needs.

GRANTS-IN-AID FOR AIRPORTS

(LIQUIDATION OF CONTRACT AUTHORIZATION)

(LIMITATION ON OBLIGATIONS)

(AIRPORT AND AIRWAY TRUST FUND)

(INCLUDING TRANSFER OF FUNDS)

For liquidation of obligations incurred for grants-in-aid for airport planning and development, and noise compatibility planning and programs as authorized under subchapter I of chapter 471 and subchapter I of chapter 475 of title 49, United States Code, and under other law authorizing such obligations; for procurement, installation, and commissioning of runway incursion prevention devices and systems at airports of such title; for grants authorized under section 41743 of title 49, United States Code; and for inspection activities and administration of airport safety programs, including those related to airport operating certificates under section 44706 of title 49, United States Code, $3,000,000,000, to be derived from the Airport and Airway Trust Fund and to remain available until expended: Provided, That none of the funds under this heading shall be available for the planning or execution of programs the obligations for which are in excess of $3,350,000,000 in fiscal year 2019, notwithstanding section 47117(g) of title 49, United States Code: Provided further, That none of the funds under this heading shall be available for the replacement of baggage conveyor systems, reconfiguration of terminal baggage areas, or other airport improvements that are necessary to install bulk explosive detection systems: Provided further, That notwithstanding any other provision of law, of funds limited under this heading, not more than $112,600,000 shall be obligated for administration, not less than $15,000,000 shall be available for the Airport Cooperative Research Program, and not less than $33,194,000 shall be available for Airport Technology Research.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

Program and Financing
(in millions of dollars)

Identification code: 69-8106-0-7-402	FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
Obligations by program activity:			
0001 Grants-in-aid for airports	3,386	3,164	3,189
0002 Personnel and related expenses	108	107	113
0003 Airport technology research	31	31	33
0005 Small community air service	10	10	. . . .
0006 Airport Cooperative Research	15	15	15
0100 Total direct program	3,550	3,327	3,350
0799 Total direct obligations	3,550	3,327	3,350
0801 Grants-in-aid for Airports (Airport and Airway Trust Fund) Reimbursable	. . . .	1	1
0900 Total new obligations, unexpired accounts	3,550	3,328	3,351
Budgetary Resources:			
Unobligated balance:			
1000 Unobligated balance carried forward, Oct 1	15	17	40
1001 Discretionary unobligated balance brought fwd, Oct 1	1	1	. . . .
1021 Recoveries of prior year unpaid obligations	193	. . . .	. . . .
1033 Recoveries of prior year paid obligations	8	. . . .	. . . .
1050 Unobligated balance (total)	216	17	40
Budget Authority:			
Appropriations, discretionary:			
1101 Appropriation (special or trust fund)	3,750	3,750	3,000
1137 Appropriation applied to liquidate contract authority	-3,750	-3,750	-3,000
Contract authority, mandatory:			
1600 Contract authority (Reauthorization)	3,350	3,350	3,350
Spending authority from offsetting coll., Discretionary:			
1700 Collected	1	1	1
1900 Budget authority (total)	3,351	3,351	3,351
1930 Total Budgetary Resources Available	3,567	3,368	3,391
Memorandum (non-add) entries:			
1941 Unexpired unobligated balance, end of year	17	40	40
Change in obligated balances:			
Unpaid obligations:			
3000 Unpaid obligations, brought forward, Oct 1	5,643	5,708	5,590
3010 Obligations incurred, unexpired accounts	3,550	3,328	3,351
3020 Outlays (gross)	-3,292	-3,446	-3,473
3040 Recoveries of prior year unpaid obligations, unexpired	-193	. . . .	. . . .
3050 Unpaid obligations, end of year	5,708	5,590	5,468
Memorandum (non-add) entries:			
3100 Obligated balance, start of year	5,643	5,708	5,590
3200 Obligated balance, end of year	5,708	5,590	5,468
Budget authority and outlays, net:			
Discretionary:			
4000 Budget authority, gross	1	1	1
Outlays, gross:			
4010 Outlays from new discretionary authority	292	444	451
4011 Outlays from discretionary balances	3,000	3,002	3,022
4020 Outlays, gross (total)	3,292	3,446	3,473
Offsets against gross budget authority and outlays:			
Offsetting collections (collected) from:			
4030 Federal sources	-1	. . . .	. . . .
4033 Non-federal sources	-8	-1	-1
4040 Offsets against gross budget authority and outlays (total)	-9	-1	-1

	Additional offsets against gross budget authority only:			
4053	Recoveries of prior year paid obligations, unexpired accounts	8	. . . .	. . . .
4080	Outlays, net (discretionary)	3,283	3,445	3,472
	Mandatory:			
4090	Budget authority, gross	3,350	3,350	3,350
4180	Budget authority, net (total)	3,350	3,350	3,350
4190	Outlays, net (total)	3,283	3,445	3,472
	Memorandum (non-add) entries:			
5052	Obligated balance, SOY: Contract authority	3,514	3,114	2,714
5053	Obligated balance, EOY: Contract authority	3,114	2,714	3,064
5061	Limitation on obligations (Highway Trust Funds)	3,350	3,327	3,350

Subchapter I of chapter 471, title 49, U.S. Code provides for airport improvement grants, including those emphasizing capacity development, safety and security needs; and chapter 475 of title 49 provides for grants for aircraft noise compatibility planning and programs.

Object Classification
(in millions of dollars)

Identification code: 69-8106-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Direct obligations:			
	Personnel compensation			
11.1	Full-time permanent	68	67	67
11.3	Other than full-time permanent	1	1	1
11.5	Other personnel compensation	1	1	1
11.9	Total personnel compensation	70	69	69
12.1	Civilian personnel benefits	22	22	23
21.0	Travel and transportation of persons	3	3	3
23.2	Rental payments to others	1	1	1
25.1	Advisory and assistance services	27	26	29
25.2	Other services from non-Federal sources	3	3	3
25.3	Other services from Federal sources	20	29	33
25.7	Operation and maintenance of equipment	3	3	3
26.0	Supplies and materials	1	1	1
31.0	Equipment	4	1	1
41.0	Grants, subsidies, and contributions	3,386	3,159	3,184
94.0	Financial Transfers	10	10	. . . .
99.0	Direct obligations	3,550	3.327	3,350
99.0	Reimbursable obligations	. . . .	1	1
99.9	Total new obligations, unexpired accounts	3,550	3,328	3,351

Employment Summary

Identification code: 69-8106-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
1001	Direct: Civilian full-time equivalent employment	589	593	594
2001	Reimbursable: Civilian full-time equivalent employment	. . . .	2	1

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EXHIBIT III-1

GRANTS-IN-AID FOR AIRPORTS
Summary by Program Activity
Appropriations, Obligation Limitations, and Exempt Obligations
($000)

	FY 2017 ACTUAL	FY 2018 ANNUALIZED CR	FY 2019 REQUEST
Grants-in-Aid for Airports	3,185,934	3,164,298	3,189,206
Personnel & Related Expenses	107,691	106,960	112,600
Airport Technology Research	31,375	31,162	33,194
Airport Cooperative Research	15,000	14,898	15,000
Small Community Air Service	10,000	9,932	-
TOTAL	$ 3,350,000	$ 3,327,250	$ 3,350,000
FTEs			
Direct Funded	589	593	594
Reimbursable, allocated, other	0	1	1

Program and Performance Statement

This account provides funds for planning and developing a safe and efficient national airport system to satisfy the needs of the aviation interests of the United States, with due consideration for economics, environmental compatibility, local proprietary rights and safeguarding the public investment.

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Executive Summary: Grants-in-Aid for Airports

What Is the Request and What Funds are Currently Spent on the Program?

For FY 2019, the President's Budget requests $3.35 billion to fund the Grants-in-Aid for Airports program, also known as the Airport Improvement Program (AIP). The budget will enable the FAA to continue providing capital funding to help airports preserve and maintain critical airport infrastructure. The grants-in-aid program enables FAA to advance important safety, capacity and efficiency projects, at more than 500 airports supporting commercial service and more than 2,800 general aviation airports that provide critical functions at the national, regional, and local level. The AIP also helps airports address environmental concerns for neighboring communities, which may otherwise oppose or delay airport modernization projects.

What Is this Program and Why is it Necessary?

The AIP provides grants to local and state airport authorities to help ensure the safety, capacity, efficiency, and environmental stewardship of U.S. airports. Through the AIP, the agency funds a range of activities to assist in airport development, preservation of critical facilities, economic competitiveness, and environmental issues.

The FAA identifies public-use airports for the national transportation system and the National Plan of Integrated Airport Systems (NPIAS). These public-use airports support scheduled air carrier service at more than 500 commercial service airports. In addition to the scheduled passenger and cargo service, the airport system serves a diverse range of functions at approximately 2,800 general aviation airports that support emergency medical services and disaster response, flight training, law enforcement support, agricultural activities, and business/corporate activities.

Why Do We Want/Need To Fund The Program At The Requested Level?

Every two years, as required by statute, the FAA publishes a report that looks five years into the future, identifying AIP-eligible development needs in the NPIAS. The latest NPIAS report, which was published in September 2016, identified over $32.5 billion in capital needs over the 5-year period from 2017-2021.[1] The FAA funds capital projects that support system safety, capacity, and environmental projects and the highest priority needs in the NPIAS.

What Benefits will be Provided to the American Public Through This Request?

The investment of AIP funds in the national system of airports is critical to helping maintain and improve the safety, capacity and efficiency of the U.S. system of airports. The FAA works closely with airports and the state aeronautical agencies to monitor the condition of critical airfield infrastructure, and can draw direct connections between our efforts and improvements in safety, capacity, efficiency, and reduction in environmental and community impacts. Through the AIP, the FAA helps ensure there is a safe and reliable system of airports to support the needs of the traveling public, the airlines and other aeronautical users, as well as basic community needs such as emergency medical services and disaster response, flight training, law enforcement support, agricultural activities, and business/corporate activities.

[1] Report to Congress National Plan of Integrated Airport Systems (NPIAS) 2017-2021. See https://www.faa.gov/airports/planning_capacity/npias/reports/

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Detailed Justification for Grants-in-Aid for Airports

FY 2019 Grants-in-Aid for Airports Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses			
Program Costs	3,185,934	3,164,298	3,189,206
Total	**$ 3,185,934**	**$ 3,164,298**	**$ 3,189,206**
FTE	**0**	**0**	**0**

What is this program and what does this funding level support?

For FY 2019, the President's Budget requests $3.19 billion to fund the Grants-in-Aid for Airports program (AIP).

Through AIP, the agency funds a range of activities at eligible U.S. airports supporting four key focus areas: safety, capacity, efficiency, and environmental. As required by statute (49 U.S.C. §47103) the FAA maintains the National Plan of Integrated Airport Systems (NPIAS), which identifies airports eligible for AIP funding as well as the kind and estimated costs of eligible airport development projects under the AIP. Currently, there are more than 3,300 public use airports in the NPIAS, of which approximately 531 are able to support scheduled air carrier service. In addition to the commercial serviced airports supporting scheduled passenger and cargo service, approximately 2,800 eligible airports in the NPIAS provide critical community access, support emergency medical services and disaster response, flight training, law enforcement support, agricultural activities, and business/corporate activities.

With this funding request, the FAA will continue to award AIP grants for eligible projects at NPIAS airports within four key focus areas:

Safety: Among the agency's long-term safety goals are to provide AIP funds to projects that eliminate outmoded airport conditions that contribute to accidents and enhance the margin of operating safety by ensuring that airport safety standards projects receive the highest funding priorities. This includes projects that will help reduce the risk of runway incursions; reduce the risks of injuries, fatalities and property damage when runway excursions occur; eliminate or mitigate obstructions; reduce risks associated with wildlife hazards; and other categories of safety enhancements.

Capacity and Efficiency: The FAA will continue its focus on enhancements throughout the system that will enhance capacity and increase efficiency. AIP will accomplish this by providing financial and technical support to regional and metropolitan system plans, airport master plans and environmental reviews, and by directing funding toward the preservation or construction of runways, runway extensions, and airfield reconfigurations.

Environmental: The FAA will also continue to address environmental issues and community concerns to allow airport infrastructure improvements to proceed in a timely manner, including grants to help airports complete environmental review and permitting processes as expeditiously as possible.

Although not a primary FAA focus area, the AIP does provide funding for specific types of security projects required by statute or regulation. These projects carry a high priority for AIP funding, particularly those related to protecting the airport's "secured area." This includes airport perimeter fencing, security gates, lighting and closed circuit television cameras as part of access control to the secured area. The FAA continues to support infrastructure and facility modifications that allow the Transportation Security Administration (TSA) to optimize the layout and functionality of public screening areas, as well as works with TSA to consider other capital needs to determine whether AIP can support any aspect of those needs.

What benefits will be provided to the American Public through this request and why is this program necessary?

The U.S. aviation system plays a critical role in the success, strength, and growth of the U.S. economy. Approximately 584,000 active pilots, 210,000 general aviation aircraft, and more than 7,000 air carrier aircraft rely upon the U.S. airport system. The economic impacts of the air traffic control system are well documented in FAA's report on "The Economic Impact of Civil Aviation on the US Economy," published in November 2016.[2] It states that, in 2014, aviation accounted for 5.1% of our gross domestic product, contributed $1.6 trillion in total economic activity, and supported 10.6 million jobs.[3] Since 2000, the AIP has funded infrastructure projects at 23 major airports to accommodate more than 2 million additional annual operations each year.

AIP funding in FY 2019 will support the following key infrastructure projects:

- To mitigate safety risks, enhance capacity, and increase efficiency, AIP will be used to fund reconstructed and rehabilitated runways, taxiways and aprons to preserve the nation's critical aviation infrastructure as well as mitigate the risk of foreign object debris damage to aircraft from cracked or broken pavement surfaces;
- To reduce the risk of runway incursions, one of the agency's significant safety initiatives, AIP will fund projects to reconfigure taxiways, perimeter service roads and other airport facilities; and improve marking, lighting, and signage.
- To enhance safety, AIP will fund projects to conduct wildlife hazard assessments and develop wildlife hazard management plans;
- To modernize and enhance efficiency and capacity at airports using a safety risk model. AIP will fund Safety Management Systems (SMS) manual and implementation plans to expand the use of voluntary SMS across the system; and
- To improve environmental reviews and mitigation activities, the AIP will fund projects required to achieve compliance with existing noise, air quality, and water quality laws and policies, with the goals of reducing impacts and streamlining processes.

The Grants-in-Aid for Airports program is crucial to help support the FAA's mission to provide the safest and most efficient transportation system in the world. The AIP helps assure the American Public has a safe, reliable, and efficient system of airports to support and advance U.S. economic interests as well as technology, security, and safety at all levels of consumerism from next day air deliveries to emergency support services

Safety: The AIP supports the FAA's safety focus by providing funding for safety-related development at airports that benefit U.S. aviation consumers at all levels, whether commercial service and general aviation operators and passengers, or recipients of goods transported via aircraft worldwide. For example, AIP provides funds to airports to make improvements that help reduce runway incursions caused by vehicle/pedestrian deviations or by pilot error due to complex or confusing geometry intersections, most of which were developed before modern airport design standards were established. AIP also provides support to accelerate improvements to RSAs that do not meet current standards and other similarly high priority projects that support safety through efforts to reduce the risks of air transportation-related injuries and fatalities.

Capacity and Efficiency: The AIP ensures maintenance of existing airport infrastructure as well as modernization of the national system of airports. The AIP also supports vital technical and financial assistance for planning, environmental analysis, engineering design, and the construction or rehabilitation of runways, taxiways, and aprons as well as other measures to expand capacity and make more efficient use of airports.

[2] The Economic Impact of Civil Aviation on the U.S. Economy – November 2016. See https://www.faa.gov/air_traffic/publications/media/2016-economic-impact-report_FINAL.pdf
[3] The Economic Impact of Civil Aviation on the U.S. Economy – November 2016. Page 5. See https://www.faa.gov/air_traffic/publications/media/2016-economic-impact-report_FINAL.pdf

By providing grants to airport owners and operators to maintain critical facilities, including runways, taxiways, aircraft parking areas (aprons) as well as many other airport facilities, systems and equipment, the AIP helps ensure maximum capacity and efficiency. A significant part if the FAA's safety efforts also support capacity and efficiency. For example, the AIP helps ensure that the vast majority of runways at more than 3,300 NPIAS airports are maintained in excellent, good or fair condition. This reduces system delays by assuring capacity is not compromised due to pavement safety issues.

Other AIP funded safety projects also serve to ensure system capacity and efficiency—for example, keeping runways and taxiways clear of snow, ice, and ponding water that can jeopardize aircraft directional control or braking action. Chemicals and plowing, as well as freeze-thaw cycles, all take a toll on runways, taxiways, and other paved areas, requiring environmental and engineering planning to ensure adequate drainage. Additionally, AIP grants helps fund acquisition of eligible snow removal equipment and airport environmental and engineering services, as well as pavement maintenance programs to ensure airports are maintained and operated in safe and serviceable conditions as required by statute (49 U.S.C. §47107).

Every other year, FAA is required to publish a five-year prospective analysis of AIP-eligible capital needs. The latest NPIAS, published in September 2016, identified $32.5 billion in estimated capital needs over the 5-year period from 2017-2021.[4] This funding request will contribute to the immediate airport safety, capacity, efficiency, and environmental projects identified by the FAA and airport sponsors to maintain our existing airport infrastructure as well as modernize it to support the air transportation needs of the American public.

[4] Report to Congress National Plan of Integrated Airport Systems (NPIAS) 2017-2021. See https://www.faa.gov/airports/planning_capacity/npias/reports/

GRANTS-IN-AID FOR AIRPORTS

Grants-in-Aid for Airports
($ in Thousands)

Item Title	Dollars	FTP	FTE
FY 2018 Annualized CR	**3,164,298**	**0**	**0**
Adjustments to Base	**0**	**0**	**0**
Program Level			
1. Grants-in-Aid for Airports	24,908		
Increases/Decreases	**24,908**	**0**	**0**
FY 2019 Request	**3,189,206**	**0**	**0**

Detailed Justification for Personnel and Related Expenses

FY 2019 Personnel and Related Expenses Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	87,602	87,584	88,332
Program Costs	20,089	19,376	24,268
Total	**$ 107,691**	**$ 106,960**	**$ 112,600**
FTE	**583**	**567**	**568**

What is this program and what does this funding level support?

For FY 2019, the President's Budget requests $112.6 million, 573 positions and 568 FTE's to cover the administrative expenses for the Office of Airports (ARP). The request supports ARP's legislatively directed mission of leadership to plan and develop a safe and efficient national airport system to satisfy the needs of the aviation interests of the United States, with consideration for economics, environmental compatibility, local proprietary rights, and safeguarding the public investment. (See, 49 U.S.C. §47103). The additional funding will support the following functions:

The budget includes an additional $500,000 and two positions to establish a permanent FAA Airports District Office (SJU-ADO) in San Juan, Puerto Rico. This new field office will be phased in over two years. The SJU-ADO will provide Planning, Environmental, Engineering, and Compliance services to support improvements to infrastructure at the 12 NPIAS airports in Puerto Rico and the U.S. Virgin Islands. The presence of an SJU-ADO will ensure the successful initiation and completion of critical airport infrastructure projects. These positions are critical to providing advice, guidance and support to Puerto Rico Ports Authority.

For FY 2019, $4.392 million is requested for development and upgrade to the Office of Airports' national data systems. Efforts will include hardware and software upgrades, enabling interfaces between systems, enhancement of analytical tools, and critical O&M support.

What benefits will be provided to the American Public through this request and why is this program necessary?

Congress statutorily directed the FAA to plan and develop a safe and efficient national airport system to satisfy the needs of the aviation interests of the United States, with consideration for economics, environmental compatibility, local proprietary rights, and safeguarding the public investment.

The FAA's Office of Airports has responsibility for maintaining this plan to include establishing standards for the safe planning, design, construction, operation and maintenance of the nation's airports. This is critical because the safe operation of air transportation requires nationwide, as well as international in some cases, consistency in design standards, construction standards, signage, marking, lighting and emergency response.

ARP personnel possess expertise in many professional and technical areas. ARP employees also engage in opportunities to work collaboratively across government agencies, with industry, and with affected stakeholders. Work is performed on behalf of the American public to maintain the existing national airport system as well as modernize this infrastructure to meet safety, capacity, efficiency, and environmental requirements with the goals of ensuring our system of airports supports the safest, most efficient aerospace system in the world.

New Airports District Office (ADO): ARP has been charged with overseeing the investment of Airport & Airway Trust Fund resources in our national system of airports. This responsibility is complex and requires skilled professionals with specific expertise. As projects funded with AIP become more intricate, staff time

often focuses on administering programs in areas beyond their line of sight. With limited travel budgets and staff time, the ability for ARP employees to travel to locations with frequent issues detracts from their work within their existing portfolios. ARP has devoted a significant amount of time and resources to travel and oversight of federally funded airports in the U.S. Caribbean region including the 15 AIP eligible airports in the U.S. Virgin Islands and Puerto Rico. Internal ARP budget assessments concluded the FAA's work in these areas is expanding and it would best serve the aviation tax dollar investment to establish an office in this region to focus on the needs of this developing area. The Caribbean holds tremendous economic value for the U.S.; data shows U.S. citizens are traveling to the Caribbean nearly as much as they travel to Europe. The ARP SJU ADO would complement the FAA's Office of Aviation Safety's existing Flight Standards District Office in San Juan; together, this cross functional team will serve the American public by assuring the safety, capacity, efficiency, and environmental issues in the region are addressed with a professional staff that is familiar with the locality and accessible to meet the needs of the aviation community.

GRANTS-IN-AID FOR AIRPORTS

Personnel and Related Expenses

($ in Thousands)

Item Title	Dollars	FTP	FTE
FY 2018 Annualized CR	**106,960**	**571.0**	**567.0**
Adjustments to Base			
1. Annualization of FY 2018 pay raise	416		
2. One Additonal Compensable Day	337		
3. WCF Increase	-5		
Total Adjustments to Base	**748**	**0.0**	**0.0**
Other Adjustments			
Total Other Adjustments	**0**	**0.0**	**0.0**
New or Expanded Programs			
Establishment of a permanent Puerto Rico field office	500	2.0	1.0
Increase for development and enhancement of airports national data systems	4,392		
Total Discretionary Increases	**4,892**	**2**	**1**
FY 2019 Request	**112,600**	**573.0**	**568.0**

Detailed Justification for Airport Technology Research

FY 2019 Airport Technology Research Budget Request ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	3,675	3,672	3,704
Program Costs	27,700	27,490	29,490
Total	**$ 31,375**	**$ 31,162**	**$ 33,194**
FTE	**24**	**24**	**24**

What is this program and what does this funding level support?

For FY 2019, the President's Budget requests $33.2 million and 24 positions to fund the Airport Technology Research (ATR) program. This is required to support the execution and management of a program that has 19 research program areas (RPA's) and more than 125 on-going complex projects.

The research activities will continue to support research in airport planning and design, analysis of airport safety data, airport rescue and firefighting, wildlife hazard mitigation, visual guidance, runway surface technology, airport surveillance sensors, aircraft noise issues around airport, airport pavement design, airport pavement long-term performance, and UAS integration at airports.

ATR findings are used in updating Advisory Circulars, manuals, and technical specifications that airports heavily rely on to maintain and expand their infrastructure in the safest and most efficient manner. This includes all engineering standards for airport construction projects as well as specific safety guidance and requirements to assure safe aircraft and airport operations on the ground. For example, current research projects will advance ARP's ability to maintain the highest safety standards in areas with rapidly evolving technologies such as visual guidance, airport surveillance systems, pavement testing and materials research, and airport geometry enhancements to name a few. All ATR activities are designed to support ARP's mission in to enhance the nation's system in its four focus areas: safety, capacity, efficiency, and environmental.

The success of the research is reflected in our ability to issue updated and new program guidance. For example, based on research and evaluation ARP issues performance specifications for bird radars and FOD detection systems. Each research project is sponsored by an FAA headquarters engineer that prepares the research requirements, reviews the research plan, and approves the completed deliverables.

What benefits will be provided to the American Public through this request and why is this program necessary?

The ATR provides extensive tangible and intangible benefits to the American Public in the four focus areas that advance the mission of ARP: safety, capacity, efficiency, and environmental.

Safety–related ATR programs provide fact-based assessments and complex analyses of safety and operational data to help the FAA and airport operators institute and maintain standard and proven practices at all NPIAS airports. For example, in the airport pavement research area, ATR will continue to use its facilities to test and conduct research on new pavement design and new pavement materials. The FAA will use state-of-the-art material testing laboratory methods to establish material characterization of new pavement materials. Incorporating realistic material properties and specifications through this material research and testing will improve the pavement thickness design procedure and pavement life predictions thus reducing costs and increasing pavement life. On the efficiency side, the ATR program leads to airports using the same pavement design and construction standards all around the country, optimizing construction costs by helping companies of all sizes bid on airport projects. These increases in safety and efficiency netted will provide positive impacts to the American public.

Another safety project with an environmental benefit is the ATR's work investigating the reduction or elimination of harmful chemicals that may pose either health or environmental hazards. Over the years there has been a growing concern about the potential health and environmental impact that aqueous film-forming foams (AFFF) used by aircraft rescue and firefighting departments can have at airports and surrounding communities. The main concern is certain chemicals that have been found to be toxic have accumulated in land and water around airports. This research will help test new kinds of AFFF for effectiveness without the harmful chemicals. This multi-year research will be accomplished through critical testing at a fire testing facility dedicated to this issue, which will ensure the new chemicals provide the same (if not increased) levels of fire suppression. The American public will benefit from the removal of toxins as well as the assurance that aircraft fire-fighting equipment is not compromised.

The ATR program also manages a number of research databases. In FY 2019, integration and support of the databases (bird strike, foreign object debris detection, Airport Pavement management systems) into one location will continue. This will ensure compliance with FAA standards, to improve the overall functionality of the databases, and promote public access and sharing of the data as well as enhancements to programs to advance public safety.

Aircraft noise is one of the principal obstacles to optimizing airport system capacity and reducing congestion and delays at the largest and busiest airports. In FY 2019, the ATR program will continue to research ways airports can reduce noise impacts near airports. Research projects include the continuation of creating enhanced conceptual procedure layouts for performance based navigation operations and evaluating and improving the accuracy of noise level reduction testing by analyzing and validating fixed decibel adjustment values. Public demand for a quieter environment is putting increasing pressures on our national system of airports that undermine their ability to expand and to accommodate modernization initiatives that will enhance safety, capacity and efficiency. About 30 percent of U.S. commercial service airports are in either non-attainment areas or maintenance areas for national air quality standards. ATR projects in these areas will provide distinct benefits to the American public, on the ground and in the air, with more efficient routes, quieter communities, and enhanced capacity.

The research initiatives supported by this funding are crucial to continued maintenance and enhancement of safety for the traveling public. Communities of every size throughout the nation benefit from increased accessibility and competitive access. Environmental quality benefits both the traveling public and neighboring communities by enabling airports to be well positioned to support critical infrastructure projects and by helping airports minimize their environmental effects on surrounding areas.

FAA's Research, Engineering and Development Advisory Committee's Subcommittee on Airports reviews the ATR Program every six months. The Subcommittee has members from airports, aircraft manufacturers, Air Line Pilots Association, and airport associations. The Subcommittee is briefed on both ongoing research and planned research and offers recommendations to ensure the research program is responsive to the needs of FAA and the airport community.

GRANTS-IN-AID FOR AIRPORTS

Airport Technology Research
($ in Thousands)

Item Title	Dollars	FTP	FTE
FY 2018 Annualized CR	**31,162**	**24**	**24.0**
Adjustments to Base			
1. Annualization of FY 2018 pay raise	18		
2. One Additonal Compensable Day	14		
Total Adjustments to Base	**32**	**0**	**0.0**
Other Adjustments			
Total Other Adjustments	**0**	**0**	**0.0**
Discretionary Increases			
Funding for advanced pavement materials research	2,000		
Total Discretionary Increases	**2,000**	**0**	**0.0**
FY 2019 Request	**33,194**	**24**	**24.0**

Detailed Justification for Airport Cooperative Research Program

FY 2019 Airport Cooperative Research Program ($000)

Program Activity	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request
Salaries and Expenses	167	170	172
Program Costs	14,833	14,728	14,828
Total	**$ 15,000**	**$ 14,898**	**$ 15,000**
FTE	**2**	**2**	**2**

What is this program and what does this funding level support?

The Airport Cooperative Research Program (ACRP) is an industry driven research program managed by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine. It was authorized by section 712 of Vision 100 – Century of Aviation Reauthorization Act. The Secretary of Transportation maintains a Memorandum of Agreement among DOT, FAA, and National Academy of Sciences to implement the ACRP. The Secretary also appoints the 13 members of the ACRP Oversight Committee.

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

For FY 2019, the President's Budget requests $15 million for the program. Pay inflation will be absorbed within the requested level. As with previous years, approximately 15 research topics will be funded under this request in FY 2019. ACRP is designed to address needs that are not being addressed by other federal research programs and that cannot be undertaken cost-effectively by individual airports.

What benefits will be provided to the American Public through this request and why is this program necessary?

ACRP is a national resource for the airport industry, providing valuable information, guidance and practical tools to airport owners and operators (as well as consultants and contractors) by providing industry-driven research identified as critical or crucial by airport operators, industry, and users. This community has continually submitted over 100 topics for research each year. After 11 years in operation, ACRP has engaged thousands of public- and private-sector airport practitioners, academia, consultants, advocates, and students to address the airport industry's most pressing challenges.

The 13-member ACRP Oversight Committee reviews the topics selected each year. This Committee, appointed by the Secretary of Transportation meets every six months to review progress and select additional topics to fund. This assures the aviation tax dollar is utilized in the most efficient and beneficial manner to the American public, mitigating wasteful delays, unreasonable contract terms, and unneeded proposals. The ACRP Oversight Committee selects the highest rated topics, and ensures that proposed studies will not duplicate other federal research. The TRB appoints expert technical panels for each selected project. The technical panels convert the topics into requests for proposals to select contractors to perform the research. The panels also monitor each project to ensure it stays on track and meets project deliverables.

ACRP's broad mission is to provide resources to support applied research on a wide variety of issues faced by airport practitioners, including all levels of professional staff within the airport community, from CEOs, airport managers, executive directors to mid-level managers, nonsupervisory technical and professional staff, trainees, students, and interns. These professionals represent airports, suppliers, public safety agencies, airlines, airport tenants, local and regional government authorities, industry associations, and many other stakeholders in the

airport community. Each of these practitioners has different interests and responsibilities, and each is an integral part of this cooperative research effort.

In addition to publishing reports on industry-driven research priorities, ACRP works to ensure that these products reach those who need them most. These efforts have reached several thousand stakeholders through e-videos, webinars, workshops, speaker presentations, and publications on applied results. The benefits to the American public are a more cohesive and educated cadre of airport sponsors, armed with the knowledge and tools through ACRP's efforts, to implement the AIP more consistently and compliantly, which results in a safer and more efficient national system of airports.

AIRPORT IMPROVEMENT PROGRAM
Grants-in-Aid to Airports Planned Distribution
$000

	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Budget Request	
Formula Grants				
Primary Airports	860,667	864,372	864,372	**1/**
Cargo Service Airports	111,508	110,750	111,622	
Alaska	21,345	21,345	21,345	
States (General Aviation)	637,187	632,860	637,841	
Carryover (from Formula Grants)	727,846	718,219	707,400	**2/**
Subtotal, Formula Grants	2,358,553	2,347,546	2,342,581	
Discretionary Grants				
Discretionary Set-Aside: Noise Compatibility	107,502	99,725	110,181	
Discretionary Set-Aside: Reliever	2,027	1,881	2,078	
Discretionary Set-Aside: Military Airport Program	12,286	11,397	12,592	
C/S/S/N (Capacity/Safety/Security/Noise)	139,000	128,945	142,464	
Discretionary -- AATF	46,333	42,982	47,488	
Subtotal, Discretionary Grants	307,148	284,929	314,803	
Small Airport Fund	520,234	531,823	531,823	
Total Grants	**3,185,934**	**3,164,298**	**3,189,206**	

1/ FY-2019 Primary Entitlements reflect the same forecast activity levels for FY-2018, because we do not yet have sufficient updated information to warrant any significant change.

2/ FY 2019 carryover figures are estimated based on a five-year rolling average.

The FY 2019 Budget request assumes the Passenger Facility Charge (PFC) at current maximum allowable level of $4.50 per ticket sold, under Public Law 106-181, enacted in 2000.

Passenger Facility Charge (PFC) Approved Locations
As of December 31, 2017
(Whole Dollars)
PFC APPROVED LOCATIONS

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Anchorage	AK	Ted Stevens Anchorage International	ANC	M	$3.00	10/1/2000	4/1/2030	$106,043,173
Fairbanks	AK	Fairbanks International	FAI	S	$3.00	10/1/2000	4/1/2004	
Fairbanks	AK	Fairbanks International	FAI	S	$4.50	4/1/2004	10/1/2026	$38,413,252
Juneau	AK	Juneau International	JNU	S	$3.00	10/1/1998	2/1/2001	
Juneau	AK	Juneau International	JNU	S	$4.50	8/1/2001	12/1/2026	$26,504,815
Ketchikan	AK	Ketchikan International	KTN	N	$3.00	2/1/1999	8/1/2001	
Ketchikan	AK	Ketchikan International	KTN	N	$4.50	8/1/2001	12/1/2018	$6,644,400
Sitka	AK	Sitka Rocky Gutierrez	SIT	N	$4.50	7/1/2007	9/1/2013	$1,375,000
Birmingham	AL	Birmingham - Shuttlesworth International	BHM	S	$3.00	8/1/1997	11/1/2003	
Birmingham	AL	Birmingham - Shuttlesworth International	BHM	S	$3.00	12/1/2003	10/1/2008	
Birmingham	AL	Birmingham - Shuttlesworth International	BHM	S	$4.50	10/1/2008	2/1/2031	$212,563,127
Dothan	AL	Dothan Regional	DHN	N	$3.00	2/1/1998	8/1/2001	
Dothan	AL	Dothan Regional	DHN	N	$4.50	8/1/2001	12/1/2020	$5,515,948
Huntsville	AL	Huntsville International - Carl T. Jones Field	HSV	S	$3.00	6/1/1992	9/1/2004	
Huntsville	AL	Huntsville International - Carl T. Jones Field	HSV	S	$4.50	9/1/2004	8/1/2025	$61,431,541
Mobile	AL	Mobile Regional	MOB	N	$3.00	12/1/1997	7/1/2004	
Mobile	AL	Mobile Regional	MOB	N	$3.00	3/1/2005	5/1/2013	
Mobile	AL	Mobile Regional	MOB	N	$3.00	6/1/2013	10/1/2017	
Mobile	AL	Mobile Regional	MOB	N	$4.50	10/1/2017	9/1/2018	$16,479,121
Montgomery	AL	Montgomery Regional (Dannelly Field)	MGM	N	$4.50	5/1/2005	1/1/2027	$28,599,933
Muscle Shoals	AL	Northwest Alabama Regional	MSL	GA	$3.00	6/1/1992	10/1/2003	
Muscle Shoals	AL	Northwest Alabama Regional	MSL	GA	$3.00	12/1/2004	4/1/2009	
Muscle Shoals	AL	Northwest Alabama Regional	MSL	GA	$4.50	4/1/2009	7/1/2027	$583,538
Bentonville	AR	Northwest Arkansas Regional	XNA	S	$3.00	12/1/1998	4/1/2001	
Bentonville	AR	Northwest Arkansas Regional	XNA	S	$4.50	4/1/2001	9/1/2047	$119,872,895
Fayetteville	AR	Drake Field	FYV	GA	$3.00	1/1/1996	1/1/2001	$2,221,887
Fort Smith	AR	Fort Smith Regional	FSM	N	$3.00	8/1/1994	2/1/2008	

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Fort Smith	AR	Fort Smith Regional	FSM	N	$4.50	2/1/2008	12/1/2019	$7,734,286
Little Rock	AR	Bill and Hillary Clinton National/ Adams Field	LIT	S	$3.00	5/1/1995	9/1/2001	
Little Rock	AR	Bill and Hillary Clinton National/ Adams Field	LIT	S	$4.50	9/1/2001	4/1/2020	$114,146,711
Texarkana	AR	Texarkana Regional-Webb Field	TXK	N	$3.00	2/1/1995	9/1/2001	
Texarkana	AR	Texarkana Regional-Webb Field	TXK	N	$4.50	9/1/2001	3/1/2005	
Texarkana	AR	Texarkana Regional-Webb Field	TXK	N	$4.50	7/1/2008	5/1/2014	
Texarkana	AR	Texarkana Regional-Webb Field	TXK	N	$4.50	4/1/2015	11/1/2017	$2,173,538
Pago Pago	AS	Pago Pago International	PPG	N	$3.00	7/1/1995	6/1/2000	
Pago Pago	AS	Pago Pago International	PPG	N	$4.50	9/1/2001	9/1/2005	
Pago Pago	AS	Pago Pago International	PPG	N	$4.50	6/1/2006	12/1/2020	$7,563,954
Bullhead City	AZ	Laughlin/Bullhead International	IFP	N	$2.00	5/1/2008	10/1/2012	
Bullhead City	AZ	Laughlin/Bullhead International	IFP	N	$2.00	1/1/2014	1/1/2025	$2,951,578
Flagstaff	AZ	Flagstaff Pulliam	FLG	N	$3.00	12/1/1992	9/1/2012	
Flagstaff	AZ	Flagstaff Pulliam	FLG	N	$4.50	9/1/2012	9/1/2018	$3,792,804
Mesa	AZ	Phoenix-Mesa Gateway	IWA	S	$4.50	11/1/2008	7/1/2026	$42,754,314
Peach Springs	AZ	Grand Canyon West	1G4	N	$3.00	9/1/2004	9/1/2006	
Peach Springs	AZ	Grand Canyon West	1G4	N	$3.00	6/1/2008	1/1/2024	$9,922,946
Phoenix	AZ	Phoenix Sky Harbor International	PHX	L	$3.00	4/1/1996	4/1/2002	
Phoenix	AZ	Phoenix Sky Harbor International	PHX	L	$4.50	7/1/2002	12/1/2035	$2,929,773,835
Tucson	AZ	Tucson International	TUS	S	$3.00	2/1/1998	10/1/2006	
Tucson	AZ	Tucson International	TUS	S	$4.50	10/1/2006	4/1/2027	$181,506,423
Yuma	AZ	Yuma MCAS/Yuma International	NYL	N	$3.00	12/1/1993	10/1/2005	
Yuma	AZ	Yuma MCAS/Yuma International	NYL	N	$4.50	10/1/2005	4/1/2007	
Yuma	AZ	Yuma MCAS/Yuma International	NYL	N	$4.50	11/1/2007	1/1/2023	$5,886,828
Arcata/Eureka	CA	Arcata	ACV	N	$3.00	2/1/1993	3/1/1994	
Arcata/Eureka	CA	Arcata	ACV	N	$3.00	11/1/1994	11/1/1997	

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Arcata/Eureka	CA	Arcata	ACV	N	$3.00	4/1/1998	6/1/2003	
Arcata/Eureka	CA	Arcata	ACV	N	$4.50	6/1/2003	3/1/2005	
Arcata/Eureka	CA	Arcata	ACV	N	$4.50	7/1/2005	10/1/2005	
Arcata/Eureka	CA	Arcata	ACV	N	$4.50	12/1/2005	8/1/2011	
Arcata/Eureka	CA	Arcata	ACV	N	$4.50	10/1/2011	5/1/2022	$7,073,764
Bakersfield	CA	Meadows Field	BFL	N	$3.00	6/1/1995	5/1/2002	
Bakersfield	CA	Meadows Field	BFL	N	$4.50	5/1/2002	2/1/2024	$13,781,709
Burbank	CA	Bob Hope	BUR	S	$3.00	9/1/1994	4/1/2003	
Burbank	CA	Bob Hope	BUR	S	$4.50	4/1/2003	8/1/2017	
Burbank	CA	Bob Hope	BUR	S	$3.00	8/1/2017	12/1/2017	
Burbank	CA	Bob Hope	BUR	S	$4.50	12/1/2017	3/1/2021	$245,326,075
Carlsbad	CA	McCellan-Palomar	CRQ	N	$4.50	1/1/2009	2/1/2043	$4,947,065
Chico	CA	Chico Municipal	CIC	GA	$3.00	12/1/1993	9/1/1998	
Chico	CA	Chico Municipal	CIC	GA	$3.00	6/1/1999	2/1/2001	
Chico	CA	Chico Municipal	CIC	GA	$3.00	11/1/2001	12/1/2009	
Chico	CA	Chico Municipal	CIC	GA	$4.50	12/1/2010	12/1/2014	$707,290
Crescent City	CA	Jack McNamara Field	CEC	CS	$3.00	9/1/1998	6/1/2000	
Crescent City	CA	Jack McNamara Field	CEC	CS	$3.00	1/1/2001	6/1/2003	
Crescent City	CA	Jack McNamara Field	CEC	CS	$4.50	6/1/2003	10/1/2014	
Crescent City	CA	Jack McNamara Field	CEC	CS	$4.50	12/1/2014	2/1/2021	$899,295
Fresno	CA	Fresno Yosemite International	FAT	S	$3.00	12/1/1996	12/1/2004	
Fresno	CA	Fresno Yosemite International	FAT	S	$4.50	12/1/2004	4/1/2021	$55,125,253
Imperial	CA	Imperial County	IPL	GA	$4.50	4/1/2003	4/1/2030	$892,781
Inyokern	CA	Inyokern	IYK	GA	$3.00	3/1/1993	3/1/2003	
Inyokern	CA	Inyokern	IYK	GA	$3.00	4/1/2004	10/1/2004	
Inyokern	CA	Inyokern	IYK	GA	$4.50	9/1/2006	2/1/2009	
Inyokern	CA	Inyokern	IYK	GA	$4.50	3/1/2009	3/1/2019	$994,460
Long Beach	CA	Long Beach/Daugherty Field	LGB	S	$3.00	8/1/2003	5/1/2008	
Long Beach	CA	Long Beach/Daugherty Field	LGB	S	$4.50	5/1/2008	4/1/2034	$178,418,777
Los Angeles	CA	Los Angeles International	LAX	L	$3.00	7/1/1993	1/1/1996	
Los Angeles	CA	Los Angeles International	LAX	L	$3.00	2/1/1998	7/1/2003	
Los Angeles	CA	Los Angeles International	LAX	L	$4.50	7/1/2003	6/1/2024	
Los Angeles	CA	Los Angeles International	LAX	L	$3.00	6/1/2024	1/1/2025	
Los Angeles	CA	Los Angeles International	LAX	L	$4.50	1/1/2025	1/1/2028	$4,089,043,661
Mammoth Lakes	CA	Mammoth Yosemite	MMH	N	$3.00	9/1/1995	9/1/2005	

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Mammoth Lakes	CA	Mammoth Yosemite	MMH	N	$4.50	11/1/2009	10/1/2018	$892,455
Modesto	CA	Modesto City County-Harry Sham Field	MOD	GA	$3.00	8/1/1994	3/1/2005	
Modesto	CA	Modesto City County-Harry Sham Field	MOD	GA	$4.50	8/1/2008	12/1/2015	$1,034,802
Monterey	CA	Monterey Regional	MRY	N	$3.00	1/1/1994	7/1/2003	
Monterey	CA	Monterey Regional	MRY	N	$4.50	7/1/2003	4/1/2006	
Monterey	CA	Monterey Regional	MRY	N	$4.50	5/1/2006	6/1/2018	$16,950,180
Oakland	CA	Metropolitan Oakland International	OAK	M	$3.00	9/1/1992	6/1/1999	
Oakland	CA	Metropolitan Oakland International	OAK	M	$3.00	9/1/1999	5/1/2003	
Oakland	CA	Metropolitan Oakland International	OAK	M	$4.50	5/1/2003	1/1/2027	
Oakland	CA	Metropolitan Oakland International	OAK	M	$3.00	1/1/2027	12/1/2035	$907,425,991
Ontario	CA	Ontario International	ONT	M	$3.00	7/1/1993	12/1/1996	
Ontario	CA	Ontario International	ONT	M	$3.00	7/1/1998	11/1/2007	
Ontario	CA	Ontario International	ONT	M	$4.50	11/1/2007	1/1/2013	
Ontario	CA	Ontario International	ONT	M	$2.00	1/1/2013	4/1/2016	
Ontario	CA	Ontario International	ONT	M	$4.50	4/1/2016	11/1/2024	$291,622,635
Oxnard	CA	Oxnard	OXR	GA	$4.50	1/1/2002	3/1/2011	$631,115
Palm Springs	CA	Palm Springs International	PSP	S	$3.00	9/1/1992	1/1/2002	
Palm Springs	CA	Palm Springs International	PSP	S	$4.50	1/1/2002	11/1/2035	$132,293,266
Redding	CA	Redding Municipal	RDD	N	$3.00	4/1/1997	4/1/2002	
Redding	CA	Redding Municipal	RDD	N	$4.50	4/1/2002	4/1/2007	
Redding	CA	Redding Municipal	RDD	N	$4.50	8/1/2007	2/1/2025	$4,719,848
Sacramento	CA	Sacramento International	SMF	M	$3.00	4/1/1993	1/1/2002	
Sacramento	CA	Sacramento International	SMF	M	$4.50	1/1/2002	2/1/2003	
Sacramento	CA	Sacramento International	SMF	M	$3.00	2/1/2003	9/1/2003	
Sacramento	CA	Sacramento International	SMF	M	$4.50	9/1/2003	11/1/2034	$953,252,732
San Diego	CA	San Diego International	SAN	L	$3.00	10/1/1995	8/1/2003	
San Diego	CA	San Diego International	SAN	L	$4.50	8/1/2003	3/1/2039	$1,549,293,933
San Francisco	CA	San Francisco International	SFO	L	$4.50	10/1/2001	3/1/2026	
San Francisco	CA	San Francisco International	SFO	L	$3.00	3/1/2026	2/1/2030	$2,035,673,737
San Jose	CA	Norman Y. Mineta San Jose International	SJC	M	$3.00	9/1/1992	4/1/2001	

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
San Jose	CA	Norman Y. Mineta San Jose International	SJC	M	$4.50	4/1/2001	5/1/2029	$1,067,932,847
San Luis Obispo	CA	San Luis County Regional	SBP	N	$3.00	2/1/1993	2/1/1995	
San Luis Obispo	CA	San Luis County Regional	SBP	N	$3.00	6/1/1995	9/1/2002	
San Luis Obispo	CA	San Luis County Regional	SBP	N	$4.50	9/1/2002	6/1/2011	
San Luis Obispo	CA	San Luis County Regional	SBP	N	$3.00	6/1/2011	6/1/2014	
San Luis Obispo	CA	San Luis County Regional	SBP	N	$4.50	6/1/2014	2/1/2019	$12,864,091
Santa Ana	CA	John Wayne Airport -Orange County	SNA	M	$4.50	7/1/2006	1/1/2022	$311,602,130
Santa Barbara	CA	Santa Barbara Municipal	SBA	N	$3.00	1/1/1998	11/1/2003	
Santa Barbara	CA	Santa Barbara Municipal	SBA	N	$4.50	11/1/2003	7/1/2039	$36,388,365
Santa Maria	CA	Santa Maria Public/Capt G Allan Hancock Field	SMX	N	$4.50	10/1/2007	10/1/2028	$5,380,346
Santa Rosa	CA	Charles M. Schultz - Sonoma County	STS	N	$3.00	5/1/1993	4/1/2001	
Santa Rosa	CA	Charles M. Schultz - Sonoma County	STS	N	$4.50	4/1/2001	4/1/2005	
Santa Rosa	CA	Charles M. Schultz - Sonoma County	STS	N	$4.50	5/1/2008	4/1/2013	
Santa Rosa	CA	Charles M. Schultz - Sonoma County	STS	N	$4.50	7/1/2013	4/1/2026	$10,494,854
South Lake Tahoe	CA	Lake Tahoe	TVL	GA	$3.00	8/1/1992	3/1/2007	$169,838
Stockton	CA	Stockton Metropolitan	SCK	N	$4.50	2/1/2007	8/1/2009	
Stockton	CA	Stockton Metropolitan	SCK	N	$4.50	9/1/2009	9/1/2012	
Stockton	CA	Stockton Metropolitan	SCK	N	$4.50	9/1/2013	8/1/2020	$3,534,761
Alamosa	CO	San Luis Valley Regional/Bergman Field	ALS	CS	$3.00	3/1/1997	7/1/2016	
Alamosa	CO	San Luis Valley Regional/Bergman Field	ALS	CS	$4.50	7/1/2016	7/1/2034	$714,140
Aspen	CO	Aspen-Pitkin County/Sardy Field	ASE	N	$3.00	7/1/1995	5/1/2003	
Aspen	CO	Aspen-Pitkin County/Sardy Field	ASE	N	$4.50	5/1/2003	8/1/2004	

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Aspen	CO	Aspen-Pitkin County/Sardy Field	ASE	N	$4.50	1/1/2005	6/1/2019	$15,323,529
Colorado Springs	CO	City of Colorado Springs Municipal	COS	S	$3.00	3/1/1993	8/1/2016	
Colorado Springs	CO	City of Colorado Springs Municipal	COS	S	$4.50	8/1/2016	12/1/2021	$89,661,330
Cortez	CO	Cortez Municipal	CEZ	CS	$3.00	11/1/1999	3/1/2008	
Cortez	CO	Cortez Municipal	CEZ	CS	$4.50	3/1/2008	12/1/2025	$539,150
Denver	CO	Denver International	DEN	L	$3.00	7/1/1992	4/1/2001	
Denver	CO	Denver International	DEN	L	$4.50	4/1/2001	2/1/2029	$3,217,485,200
Durango	CO	Durango-La Plata County	DRO	N	$3.00	2/1/1995	8/1/1997	
Durango	CO	Durango-La Plata County	DRO	N	$3.00	9/1/1997	3/1/2003	
Durango	CO	Durango-La Plata County	DRO	N	$4.50	6/1/2005	4/1/2011	
Durango	CO	Durango-La Plata County	DRO	N	$4.50	11/1/2011	8/1/2012	
Durango	CO	Durango-La Plata County	DRO	N	$4.50	9/1/2013	7/1/2025	$16,065,189
Eagle	CO	Eagle County Regional	EGE	N	$3.00	9/1/1993	4/1/2001	
Eagle	CO	Eagle County Regional	EGE	N	$4.50	4/1/2001	6/1/2009	
Eagle	CO	Eagle County Regional	EGE	N	$3.00	6/1/2009	7/1/2009	
Eagle	CO	Eagle County Regional	EGE	N	$4.50	7/1/2009	5/1/2036	$22,869,216
Fort Collins-Loveland	CO	Fort Collins-Loveland Municipal	FNL	CS	$3.00	10/1/1993	5/1/1999	
Fort Collins-Loveland	CO	Fort Collins-Loveland Municipal	FNL	CS	$4.50	8/1/2004	12/1/2011	
Fort Collins-Loveland	CO	Fort Collins-Loveland Municipal	FNL	CS	$4.50	2/1/2012	3/1/2015	$1,593,522
Grand Junction	CO	Grand Junction Regional	GJT	N	$3.00	4/1/1993	9/1/2006	
Grand Junction	CO	Grand Junction Regional	GJT	N	$4.50	9/1/2006	1/1/2024	$20,737,334
Gunnison	CO	Gunnison-Crested Butte Regional	GUC	N	$3.00	11/1/1993	4/1/2001	
Gunnison	CO	Gunnison-Crested Butte Regional	GUC	N	$4.50	4/1/2001	8/1/2023	$4,214,518
Hayden	CO	Yampa Valley	HDN	N	$3.00	11/1/1993	7/1/2001	
Hayden	CO	Yampa Valley	HDN	N	$4.50	7/1/2001	3/1/2019	$9,069,120
Montrose	CO	Montrose Regional	MTJ	N	$3.00	11/1/1993	8/1/2003	
Montrose	CO	Montrose Regional	MTJ	N	$4.50	8/1/2003	6/1/2006	
Montrose	CO	Montrose Regional	MTJ	N	$4.50	8/1/2006	8/1/2010	
Montrose	CO	Montrose Regional	MTJ	N	$4.50	11/1/2010	5/1/2020	$6,771,780

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Pueblo	CO	Pueblo Memorial	PUB	CS	$3.00	11/1/1993	12/1/2014	
Pueblo	CO	Pueblo Memorial	PUB	CS	$4.50	3/1/2015	4/1/2036	$1,229,111
Steamboat Springs	CO	Steamboat Springs/Bob Adams	SBS	GA	$3.00	4/1/1993	6/1/1997	$159,576
Telluride	CO	Telluride Regional	TEX	CS	$3.00	2/1/1993	4/1/2002	
Telluride	CO	Telluride Regional	TEX	CS	$4.50	4/1/2002	1/1/2019	$7,047,037
New Haven	CT	Tweed-New Haven	HVN	N	$3.00	12/1/1993	4/1/1998	
New Haven	CT	Tweed-New Haven	HVN	N	$4.50	10/1/2001	7/1/2005	
New Haven	CT	Tweed-New Haven	HVN	N	$4.50	5/1/2006	7/1/2020	$4,159,214
Windsor Locks	CT	Bradley International	BDL	M	$3.00	10/1/1993	12/1/1995	
Windsor Locks	CT	Bradley International	BDL	M	$3.00	7/1/1996	1/1/1997	
Windsor Locks	CT	Bradley International	BDL	M	$3.00	9/1/1997	8/1/2000	
Windsor Locks	CT	Bradley International	BDL	M	$4.50	5/1/2001	3/1/2020	
Windsor Locks	CT	Bradley International	BDL	M	$3.00	3/1/2020	7/1/2020	
Windsor Locks	CT	Bradley International	BDL	M	$4.50	7/1/2020	12/1/2021	$321,060,686
Wilmington	DE	New Castle County	ILG	N	$4.50	7/1/2014	5/1/2025	$1,810,089
Daytona Beach	FL	Daytona Beach International	DAB	N	$3.00	7/1/1993	8/1/2001	
Daytona Beach	FL	Daytona Beach International	DAB	N	$3.00	2/1/2002	11/1/2005	
Daytona Beach	FL	Daytona Beach International	DAB	N	$4.50	11/1/2005	3/1/2020	$29,469,817
Fort Lauderdale	FL	Fort Lauderdale/Hollywood International	FLL	L	$3.00	1/1/1995	10/1/2005	
Fort Lauderdale	FL	Fort Lauderdale/Hollywood International	FLL	L	$4.50	10/1/2005	8/1/2031	$1,842,791,412
Fort Myers	FL	Southwest Florida International	RSW	M	$3.00	11/1/1992	11/1/2003	
Fort Myers	FL	Southwest Florida International	RSW	M	$4.50	11/1/2003	12/1/2019	$322,047,603
Gainesville	FL	Gainesville Regional	GNV	N	$3.00	7/1/2000	2/1/2002	
Gainesville	FL	Gainesville Regional	GNV	N	$4.50	1/1/2003	2/1/2013	
Gainesville	FL	Gainesville Regional	GNV	N	$4.50	1/1/2014	9/1/2015	
Gainesville	FL	Gainesville Regional	GNV	N	$4.50	3/1/2016	10/1/2023	$13,769,631
Jacksonville	FL	Jacksonville International	JAX	M	$3.00	4/1/1994	5/1/2003	
Jacksonville	FL	Jacksonville International	JAX	M	$4.50	5/1/2003	3/1/2026	$363,462,178
Key West	FL	Key West International	EYW	N	$3.00	3/1/1993	8/1/1996	
Key West	FL	Key West International	EYW	N	$3.00	12/1/1997	6/1/2003	
Key West	FL	Key West International	EYW	N	$4.50	6/1/2003	7/1/2005	

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Key West	FL	Key West International	EYW	N	$4.50	10/1/2005	11/1/2018	$23,861,414
Marathon	FL	Marathon	MTH	GA	$3.00	3/1/1993	6/1/1998	$390,001
Melbourne	FL	Melbourne International	MLB	N	$3.00	5/1/1997	12/1/2009	
Melbourne	FL	Melbourne International	MLB	N	$4.50	12/1/2009	5/1/2018	$13,898,919
Miami	FL	Miami International	MIA	L	$3.00	11/1/1994	1/1/2002	
Miami	FL	Miami International	MIA	L	$4.50	1/1/2002	10/1/2037	$2,597,130,503
Naples	FL	Naples Municipal	APF	GA	$3.00	2/1/1995	2/1/2001	
Naples	FL	Naples Municipal	APF	GA	$3.00	2/1/2002	5/1/2004	$991,336
Orlando	FL	Orlando International	MCO	L	$3.00	2/1/1993	4/1/2007	
Orlando	FL	Orlando International	MCO	L	$4.50	4/1/2007	10/1/2019	
Orlando	FL	Orlando International	MCO	L	$3.00	10/1/2019	3/1/2023	
Orlando	FL	Orlando International	MCO	L	$4.50	3/1/2023	8/1/2027	
Orlando	FL	Orlando International	MCO	L	$3.00	8/1/2027	9/1/2042	$4,139,714,398
Orlando	FL	Orlando Sanford International	SFB	S	$1.00	3/1/2001	12/1/2003	
Orlando	FL	Orlando Sanford International	SFB	S	$2.00	12/1/2003	9/1/2011	
Orlando	FL	Orlando Sanford International	SFB	S	$4.00	9/1/2011	11/1/2022	$44,341,609
Panama City	FL	Northwest Florida Beaches International	ECP	S	$3.00	2/1/1994	5/1/2004	
Panama City	FL	Northwest Florida Beaches International	ECP	S	$4.50	5/1/2004	4/1/2039	$48,700,720
Pensacola	FL	Penscola Gulf Coast Regional	PNS	S	$3.00	2/1/1993	12/1/2002	
Pensacola	FL	Penscola Gulf Coast Regional	PNS	S	$4.50	12/1/2002	10/1/2031	$144,489,392
Punta Gorda	FL	Punta Gorda	PGD	S	$2.00	8/1/2017	8/1/2022	$5,225,793
Sarasota	FL	Sarasota/Bradenton International	SRQ	S	$3.00	9/1/1992	5/1/2002	
Sarasota	FL	Sarasota/Bradenton International	SRQ	S	$4.50	5/1/2002	2/1/2022	$75,384,399
St Petersburg	FL	St Petersburg-Clearwater International	PIE	S	$3.00	5/1/2005	11/1/2006	
St Petersburg	FL	St Petersburg-Clearwater International	PIE	S	$4.50	11/1/2006	2/1/2021	$32,622,319
Tallahassee	FL	Tallahassee Regional	TLH	N	$3.00	2/1/1993	10/1/2002	
Tallahassee	FL	Tallahassee Regional	TLH	N	$4.50	10/1/2002	7/1/2028	$56,306,718
Tampa	FL	Tampa International	TPA	L	$3.00	10/1/1993	6/1/2002	
Tampa	FL	Tampa International	TPA	L	$4.50	6/1/2002	10/1/2020	
Tampa	FL	Tampa International	TPA	L	$3.00	10/1/2020	10/1/2035	$1,298,745,444
Valparaiso	FL	Eglin AFB	VPS	N	$3.00	1/1/2001	6/1/2002	

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Valparaiso	FL	Eglin AFB	VPS	N	$4.50	6/1/2002	4/1/2025	$47,010,379
West Palm Beach	FL	Palm Beach International	PBI	M	$3.00	4/1/1994	7/1/2008	
West Palm Beach	FL	Palm Beach International	PBI	M	$4.50	7/1/2008	6/1/2021	$256,256,866
Albany	GA	Southwest Georgia Regional	ABY	N	$3.00	9/1/1995	6/1/1998	
Albany	GA	Southwest Georgia Regional	ABY	N	$3.00	6/1/1999	2/1/2003	
Albany	GA	Southwest Georgia Regional	ABY	N	$4.50	2/1/2003	2/1/2008	
Albany	GA	Southwest Georgia Regional	ABY	N	$4.50	7/1/2008	8/1/2016	
Albany	GA	Southwest Georgia Regional	ABY	N	$4.50	10/1/2017	3/1/2020	$2,856,060
Athens	GA	Athens/Ben Epps	AHN	GA	$3.00	8/1/1997	1/1/2002	$165,615
Atlanta	GA	Hartsfield-Jackson Atlanta International	ATL	L	$3.00	5/1/1997	4/1/2001	
Atlanta	GA	Hartsfield-Jackson Atlanta International	ATL	L	$4.50	4/1/2001	6/1/2027	$5,054,048,753
Augusta	GA	Augusta Regional @ Bush Field	AGS	N	$3.00	9/1/1999	7/1/2001	
Augusta	GA	Augusta Regional @ Bush Field	AGS	N	$4.50	7/1/2001	11/1/2027	$31,734,394
Brunswick	GA	Brunswick Golden Isles	BQK	N	$3.00	5/1/2001	11/1/2003	
Brunswick	GA	Brunswick Golden Isles	BQK	N	$4.50	11/1/2003	4/1/2017	$1,673,438
Columbus	GA	Columbus	CSG	N	$3.00	12/1/1993	9/1/1995	
Columbus	GA	Columbus	CSG	N	$3.00	8/1/2000	6/1/2003	
Columbus	GA	Columbus	CSG	N	$4.50	6/1/2003	11/1/2006	
Columbus	GA	Columbus	CSG	N	$4.50	2/1/2010	4/1/2012	
Columbus	GA	Columbus	CSG	N	$4.50	8/1/2012	3/1/2015	
Columbus	GA	Columbus	CSG	N	$4.50	3/1/2016	2/1/2020	$3,654,321
Macon	GA	Middle Georgia Regional	MCN	GA	$4.50	3/1/2002	5/1/2011	$1,052,392
Savannah	GA	Savannah/ Hilton Head International	SAV	S	$3.00	7/1/1992	4/1/2001	
Savannah	GA	Savannah/ Hilton Head International	SAV	S	$4.50	4/1/2001	2/1/2010	
Savannah	GA	Savannah/ Hilton Head International	SAV	S	$3.00	2/1/2010	5/1/2010	
Savannah	GA	Savannah/ Hilton Head International	SAV	S	$4.50	5/1/2010	2/1/2020	$80,898,227
Valdosta	GA	Valdosta Regional	VLD	N	$3.00	3/1/1993	10/1/1999	
Valdosta	GA	Valdosta Regional	VLD	N	$3.00	4/1/2000	6/1/2001	
Valdosta	GA	Valdosta Regional	VLD	N	$4.50	6/1/2001	9/1/2004	

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Valdosta	GA	Valdosta Regional	VLD	N	$3.00	2/1/2006	5/1/2006	
Valdosta	GA	Valdosta Regional	VLD	N	$3.00	11/1/2006	1/1/2007	
Valdosta	GA	Valdosta Regional	VLD	N	$3.00	8/1/2009	7/1/2010	
Valdosta	GA	Valdosta Regional	VLD	N	$4.50	6/1/2011	1/1/2014	
Valdosta	GA	Valdosta Regional	VLD	N	$4.50	4/1/2014	4/1/2016	
Valdosta	GA	Valdosta Regional	VLD	N	$4.50	7/1/2016	11/1/2016	$2,076,704
Agana	GU	Guam International	GUM	S	$3.00	2/1/1993	11/1/2002	
Agana	GU	Guam International	GUM	S	$4.50	11/1/2002	3/1/2025	$258,370,758
Hilo	HI	Hilo International	ITO	S	$3.00	2/1/2007	11/1/2008	
Hilo	HI	Hilo International	ITO	S	$4.50	11/1/2008	1/1/2010	
Hilo	HI	Hilo International	ITO	S	$4.50	2/1/2014	7/1/2026	$18,114,523
Honolulu	HI	Honolulu International	HNL	L	$3.00	10/1/2004	11/1/2008	
Honolulu	HI	Honolulu International	HNL	L	$4.50	11/1/2008	7/1/2026	$492,183,209
Kahului	HI	Kahului	OGG	M	$3.00	10/1/2004	11/1/2008	
Kahului	HI	Kahului	OGG	M	$4.50	11/1/2008	7/1/2026	$128,996,871
Kailua/Kona	HI	Kona International @ Keohole	KOA	S	$3.00	10/1/2004	11/1/2008	
Kailua/Kona	HI	Kona International @ Keohole	KOA	S	$4.50	11/1/2008	7/1/2026	$40,540,815
Lihue	HI	Lihue	LIH	S	$3.00	10/1/2004	11/1/2008	
Lihue	HI	Lihue	LIH	S	$4.50	11/1/2008	7/1/2026	$29,577,369
Burlington	IA	Southeast Iowa Regional	BRL	CS	$3.00	7/1/1997	9/1/2001	
Burlington	IA	Southeast Iowa Regional	BRL	CS	$4.50	9/1/2001	11/1/2028	$941,789
Cedar Rapids	IA	The Eastern Iowa	CID	S	$3.00	1/1/1995	6/1/2002	
Cedar Rapids	IA	The Eastern Iowa	CID	S	$4.50	6/1/2002	3/1/2004	
Cedar Rapids	IA	The Eastern Iowa	CID	S	$4.50	5/1/2004	9/1/2025	$60,866,105
Des Moines	IA	Des Moines International	DSM	S	$3.00	3/1/1994	8/1/2001	
Des Moines	IA	Des Moines International	DSM	S	$4.50	8/1/2001	10/1/2024	$95,019,992
Dubuque	IA	Dubuque Regional	DBQ	N	$3.00	1/1/1993	5/1/2001	
Dubuque	IA	Dubuque Regional	DBQ	N	$4.50	5/1/2001	2/1/2033	$7,568,350
Fort Dodge	IA	Fort Dodge Regional	FOD	CS	$3.00	3/1/1995	9/1/2001	
Fort Dodge	IA	Fort Dodge Regional	FOD	CS	$4.50	1/1/2002	4/1/2011	$484,901
Mason City	IA	Mason City Municipal	MCW	GA	$3.00	2/1/1996	10/1/2001	
Mason City	IA	Mason City Municipal	MCW	GA	$4.50	10/1/2001	4/1/2003	
Mason City	IA	Mason City Municipal	MCW	GA	$4.50	8/1/2003	12/1/2022	$1,310,907
Sioux City	IA	Sioux Gateway/Col. Bud Day Field	SUX	N	$3.00	6/1/1993	6/1/1994	

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Sioux City	IA	Sioux Gateway/Col. Bud Day Field	SUX	N	$3.00	2/1/1995	3/1/2002	
Sioux City	IA	Sioux Gateway/Col. Bud Day Field	SUX	N	$4.50	3/1/2002	1/1/2004	
Sioux City	IA	Sioux Gateway/Col. Bud Day Field	SUX	N	$4.50	11/1/2004	7/1/2021	$4,510,580
Spencer	IA	Spencer Municipal	SPW	GA	$3.00	9/1/1995	3/1/2006	$77,638
Waterloo	IA	Waterloo Regional	ALO	N	$3.00	6/1/1994	6/1/1998	
Waterloo	IA	Waterloo Regional	ALO	N	$3.00	9/1/1999	7/1/2001	
Waterloo	IA	Waterloo Regional	ALO	N	$4.50	7/1/2001	4/1/2023	$3,167,477
Boise	ID	Boise Air Terminal/ Gowen Field	BOI	S	$3.00	8/1/1994	8/1/2001	
Boise	ID	Boise Air Terminal/ Gowen Field	BOI	S	$4.50	8/1/2001	9/1/2015	$109,930,856
Hailey	ID	Friedman Memorial	SUN	N	$3.00	9/1/1993	10/1/1994	
Hailey	ID	Friedman Memorial	SUN	N	$3.00	3/1/1995	6/1/2005	
Hailey	ID	Friedman Memorial	SUN	N	$4.50	6/1/2005	7/1/2028	$6,987,776
Idaho Falls	ID	Idaho Falls Regional	IDA	N	$3.00	1/1/1993	1/1/1998	
Idaho Falls	ID	Idaho Falls Regional	IDA	N	$3.00	2/1/1998	10/1/2000	
Idaho Falls	ID	Idaho Falls Regional	IDA	N	$3.00	10/1/2000	4/1/2001	
Idaho Falls	ID	Idaho Falls Regional	IDA	N	$4.50	4/1/2001	10/1/2023	$3,968,437
Lewiston	ID	Lewiston-Nez Perce County	LWS	N	$3.00	5/1/1994	5/1/2001	
Lewiston	ID	Lewiston-Nez Perce County	LWS	N	$4.50	5/1/2001	11/1/2018	$5,422,930
Pocatello	ID	Pocatello Regional	PIH	N	$3.00	9/1/1994	5/1/2001	
Pocatello	ID	Pocatello Regional	PIH	N	$4.50	5/1/2001	8/1/2019	$2,856,131
Twin Falls	ID	Joslin Field - Magic Valley Regional	TWF	N	$3.00	11/1/1992	6/1/2001	
Twin Falls	ID	Joslin Field - Magic Valley Regional	TWF	N	$4.50	6/1/2001	6/1/2007	
Twin Falls	ID	Joslin Field - Magic Valley Regional	TWF	N	$4.50	7/1/2007	6/1/2022	$3,390,352
Belleville	IL	Scott AFB/MidAmerican	BLV	N	$3.00	11/1/2005	3/1/2047	$7,000,000
Bloomington	IL	Central Illinois Regional Airport at Bloomington-Normal	BMI	N	$3.00	11/1/1994	4/1/2001	
Bloomington	IL	Central Illinois Regional Airport at Bloomington-Normal	BMI	N	$4.50	4/1/2001	6/1/2018	$29,245,583

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Champaign/Urbana	IL	University of Illinois-Willard	CMI	N	$3.00	12/1/1995	2/1/2004	
Champaign/Urbana	IL	University of Illinois-Willard	CMI	N	$4.50	10/1/2005	6/1/2019	$7,707,325
Chicago	IL	Chicago Midway International	MDW	L	$3.00	9/1/1993	1/1/2007	
Chicago	IL	Chicago Midway International	MDW	L	$4.50	1/1/2007	11/1/2053	$2,244,468,143
Chicago	IL	Chicago O'Hare International	ORD	L	$3.00	9/1/1993	4/1/2001	
Chicago	IL	Chicago O'Hare International	ORD	L	$4.50	4/1/2001	7/1/2041	$6,926,705,514
Decatur	IL	Decatur	DEC	CS	$4.50	6/1/2006	3/1/2019	$732,628
Marion	IL	Williamson County Regional	MWA	N	$4.50	9/1/2005	4/1/2019	$509,499
Moline	IL	Quad City International	MLI	N	$3.00	12/1/1994	1/1/2002	
Moline	IL	Quad City International	MLI	N	$4.50	1/1/2002	7/1/2037	$55,655,811
Peoria	IL	General Downing - Peoria International	PIA	N	$3.00	12/1/1994	7/1/2001	
Peoria	IL	General Downing - Peoria International	PIA	N	$4.50	7/1/2001	2/1/2007	
Peoria	IL	General Downing - Peoria International	PIA	N	$4.50	2/1/2007	8/1/2008	
Peoria	IL	General Downing - Peoria International	PIA	N	$4.50	11/1/2008	9/1/2023	$28,880,056
Quincy	IL	Quincy Regional-Baldwin Field	UIN	CS	$3.00	10/1/1994	7/1/1997	
Quincy	IL	Quincy Regional-Baldwin Field	UIN	CS	$3.00	11/1/1997	6/1/2005	
Quincy	IL	Quincy Regional-Baldwin Field	UIN	CS	$3.00	11/1/2005	1/1/2008	
Quincy	IL	Quincy Regional-Baldwin Field	UIN	CS	$4.50	1/1/2008	3/1/2019	$902,993
Rockford	IL	Chicago/ Rockford International	RFD	N	$3.00	10/1/1992	10/1/1996	
Rockford	IL	Chicago/ Rockford International	RFD	N	$3.00	5/1/1997	6/1/2007	
Rockford	IL	Chicago/ Rockford International	RFD	N	$4.50	6/1/2007	3/1/2038	$16,080,225
Springfield	IL	Abraham Lincoln Capital	SPI	N	$3.00	6/1/1992	5/1/2002	
Springfield	IL	Abraham Lincoln Capital	SPI	N	$4.50	5/1/2002	7/1/2021	$8,509,863
Evansville	IN	Evansville Regional	EVV	N	$4.50	8/1/2007	11/1/2008	
Evansville	IN	Evansville Regional	EVV	N	$4.50	12/1/2008	4/1/2026	$13,705,101
Fort Wayne	IN	Fort Wayne International	FWA	N	$3.00	7/1/1993	12/1/2005	

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Fort Wayne	IN	Fort Wayne International	FWA	N	$4.50	12/1/2005	8/1/2022	$32,664,585
Indianapolis	IN	Indianapolis International	IND	M	$3.00	9/1/1993	4/1/2001	
Indianapolis	IN	Indianapolis International	IND	M	$4.50	4/1/2001	9/1/2022	
Indianapolis	IN	Indianapolis International	IND	M	$3.00	9/1/2022	10/1/2022	$524,907,605
South Bend	IN	South Bend	SBN	N	$3.00	11/1/1994	7/1/2011	
South Bend	IN	South Bend	SBN	N	$4.50	7/1/2011	7/1/2029	$40,172,802
Garden City	KS	Garden City Regional	GCK	N	$4.50	10/1/2013	10/1/2022	$770,628
Hays	KS	Hays Regional	HYS	CS	$4.50	4/1/2015	5/1/2019	$207,045
Manhattan	KS	Manhattan Regional	MHK	N	$3.00	10/1/1998	3/1/2002	
Manhattan	KS	Manhattan Regional	MHK	N	$4.50	3/1/2002	5/1/2025	$4,499,903
Topeka	KS	Topeka Regional	FOE	CS	$4.50	8/1/2007	3/1/2023	$823,720
Wichita	KS	Wichita Mid-Continent	ICT	S	$3.00	12/1/1994	5/1/2005	
Wichita	KS	Wichita Mid-Continent	ICT	S	$4.50	5/1/2005	6/1/2007	
Wichita	KS	Wichita Mid-Continent	ICT	S	$4.50	7/1/2007	9/1/2009	
Wichita	KS	Wichita Mid-Continent	ICT	S	$4.50	11/1/2010	4/1/2046	$199,528,281
Covington	KY	Cincinnati/Northern Kentucky International	CVG	M	$3.00	6/1/1994	8/1/2000	
Covington	KY	Cincinnati/Northern Kentucky International	CVG	M	$3.00	7/1/2001	8/1/2003	
Covington	KY	Cincinnati/Northern Kentucky International	CVG	M	$4.50	8/1/2003	5/1/2009	
Covington	KY	Cincinnati/Northern Kentucky International	CVG	M	$3.00	5/1/2009	1/1/2013	
Covington	KY	Cincinnati/Northern Kentucky International	CVG	M	$4.50	1/1/2013	3/1/2020	$576,424,151
Lexington	KY	Blue Grass	LEX	S	$3.00	11/1/1993	6/1/2001	
Lexington	KY	Blue Grass	LEX	S	$4.50	6/1/2001	6/1/2003	
Lexington	KY	Blue Grass	LEX	S	$3.00	8/1/2003	12/1/2003	
Lexington	KY	Blue Grass	LEX	S	$4.50	12/1/2003	2/1/2038	$100,206,268
Louisville	KY	Louisville International - Standiford Field	SDF	S	$3.00	5/1/1997	3/1/2006	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$4.50	3/1/2006	10/1/2006	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$3.00	10/1/2006	9/1/2008	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$4.50	9/1/2008	10/1/2008	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$3.00	10/1/2008	12/1/2010	

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Louisville	KY	Louisville International - Standiford Field	SDF	S	$4.50	12/1/2010	8/1/2015	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$3.00	8/1/2015	10/1/2016	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$1.00	10/1/2016	10/1/2017	
Louisville	KY	Louisville International - Standiford Field	SDF	S	$3.00	10/1/2017	5/1/2019	$117,088,021
Paducah	KY	Barkley Regional	PAH	N	$3.00	3/1/1994	5/1/2014	
Paducah	KY	Barkley Regional	PAH	N	$4.50	5/1/2014	8/1/2024	$2,121,050
Alexandria	LA	Alexandria International	AEX	N	$3.00	5/1/1999	1/1/2002	
Alexandria	LA	Alexandria International	AEX	N	$4.50	1/1/2002	12/1/2025	$12,262,615
Baton Rouge	LA	Baton Rouge Metropolitan, Ryan Field	BTR	N	$3.00	12/1/1992	10/1/2005	
Baton Rouge	LA	Baton Rouge Metropolitan, Ryan Field	BTR	N	$4.50	10/1/2005	7/1/2031	$81,359,236
Lafayette	LA	Lafayette Regional	LFT	N	$3.00	9/1/1995	9/1/1998	
Lafayette	LA	Lafayette Regional	LFT	N	$3.00	4/1/2001	4/1/2002	
Lafayette	LA	Lafayette Regional	LFT	N	$4.50	4/1/2002	1/1/2005	
Lafayette	LA	Lafayette Regional	LFT	N	$4.50	5/1/2005	4/1/2008	
Lafayette	LA	Lafayette Regional	LFT	N	$4.50	8/1/2008	12/1/2014	
Lafayette	LA	Lafayette Regional	LFT	N	$4.50	10/1/2017	1/1/2041	$33,371,033
Lake Charles	LA	Lake Charles Regional	LCH	N	$3.00	3/1/2001	5/1/2005	
Lake Charles	LA	Lake Charles Regional	LCH	N	$4.50	5/1/2005	5/1/2017	
Lake Charles	LA	Lake Charles Regional	LCH	N	$4.50	2/1/2018	10/1/2022	$4,557,531
Monroe	LA	Monroe Regional	MLU	N	$4.50	4/1/2003	9/1/2007	
Monroe	LA	Monroe Regional	MLU	N	$4.50	11/1/2008	6/1/2036	$17,759,504
New Orleans	LA	Louis Armstrong New Orleans International	MSY	M	$3.00	6/1/1993	4/1/2002	
New Orleans	LA	Louis Armstrong New Orleans International	MSY	M	$4.50	4/1/2002	2/1/2026	
New Orleans	LA	Louis Armstrong New Orleans International	MSY	M	$3.00	2/1/2026	9/1/2043	$965,553,986
Shreveport	LA	Shreveport Regional	SHV	N	$3.00	2/1/1994	11/1/2002	
Shreveport	LA	Shreveport Regional	SHV	N	$4.50	11/1/2002	9/1/2014	
Shreveport	LA	Shreveport Regional	SHV	N	$4.50	2/1/2015	2/1/2020	$29,841,354
Boston	MA	General Edward Lawrence Logan International	BOS	L	$3.00	11/1/1993	10/1/2005	

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Boston	MA	General Edward Lawrence Logan International	BOS	L	$4.50	10/1/2005	5/1/2026	$1,669,574,564
Hyannis	MA	Barnstable Municipal-Boardman/Polando Field	HYA	N	$2.00	3/1/2011	10/1/2024	$2,573,600
Vineyard Haven	MA	Martha's Vineyard	MVY	N	$4.50	10/1/2017	7/1/2021	$808,872
Nantucket	MA	Nantucket Memorial	ACK	N	$4.50	7/1/2014	5/1/2024	$6,940,740
Worcester	MA	Worcester Regional	ORH	CS	$3.00	10/1/1992	10/1/1997	
Worcester	MA	Worcester Regional	ORH	CS	$3.00	9/1/1999	12/1/2011	$1,635,753
Baltimore	MD	Baltimore/Washington International Thurgood Marshall	BWI	L	$3.00	10/1/1992	6/1/2002	
Baltimore	MD	Baltimore/Washington International Thurgood Marshall	BWI	L	$4.50	6/1/2002	6/1/2032	$1,634,224,780
Hagerstown	MD	Hagerstown Regional-Richard A Henson Field	HGR	N	$3.00	8/1/1999	3/1/2002	
Hagerstown	MD	Hagerstown Regional-Richard A Henson Field	HGR	N	$4.50	3/1/2002	8/1/2007	
Hagerstown	MD	Hagerstown Regional-Richard A Henson Field	HGR	N	$4.50	4/1/2013	4/1/2013	$429,244
Salisbury	MD	Salisbury-Ocean City Wicomico Regional	SBY	N	$3.00	2/1/2002	3/1/2008	
Salisbury	MD	Salisbury-Ocean City Wicomico Regional	SBY	N	$4.50	3/1/2008	5/1/2020	$3,937,010
Wiley Ford	MD	Greater Cumberland Reg	CBE	GA	$3.00	7/1/1994	7/1/1999	
Wiley Ford	MD	Greater Cumberland Reg	CBE	GA	$3.00	10/1/1999	6/1/2006	$144,345
Bangor	ME	Bangor International	BGR	N	$3.00	6/1/1995	9/1/2010	
Bangor	ME	Bangor International	BGR	N	$4.50	12/1/2010	5/1/2018	$16,535,603
Portland	ME	Portland International Jetport	PWM	S	$3.00	2/1/1994	2/1/2009	
Portland	ME	Portland International Jetport	PWM	S	$4.50	2/1/2009	4/1/2040	$165,807,186
Presque Isle	ME	Northern Maine Regional Airport at Presque Isle	PQI	N	$4.50	9/1/2004	6/1/2009	
Presque Isle	ME	Northern Maine Regional Airport at Presque Isle	PQI	N	$4.50	8/1/2010	6/1/2018	$599,151
Rockland	ME	Knox County Regional	RKD	N	$4.50	1/1/2012	8/1/2018	$167,250
Alpena	MI	Alpena County Regional	APN	N	$3.00	8/1/2001	12/1/2005	
Alpena	MI	Alpena County Regional	APN	N	$4.50	12/1/2005	4/1/2022	$632,191

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Detroit	MI	Detroit Metropolitan Wayne County	DTW	L	$3.00	1/1/1993	10/1/2001	
Detroit	MI	Coleman A Young Municipal	DET	GA	$3.00	1/1/2000	3/1/2004	$240,053
Detroit	MI	Detroit Metropolitan Wayne County	DTW	L	$4.50	10/1/2001	2/1/2034	$3,134,966,084
Escanaba	MI	Delta County	ESC	N	$3.00	2/1/1993	11/1/1997	
Escanaba	MI	Delta County	ESC	N	$3.00	8/1/1998	7/1/2000	
Escanaba	MI	Delta County	ESC	N	$3.00	10/1/2001	3/1/2004	
Escanaba	MI	Delta County	ESC	N	$4.50	3/1/2004	1/1/2006	
Escanaba	MI	Delta County	ESC	N	$4.50	4/1/2006	1/1/2016	$930,234
Flint	MI	Bishop International	FNT	S	$3.00	9/1/1993	10/1/2001	
Flint	MI	Bishop International	FNT	S	$4.50	10/1/2001	8/1/2020	$42,304,023
Grand Rapids	MI	Gerald R. Ford International	GRR	S	$3.00	12/1/1992	11/1/2005	
Grand Rapids	MI	Gerald R. Ford International	GRR	S	$4.50	11/1/2005	1/1/2026	$120,165,695
Hancock	MI	Houghton County Memorial	CMX	N	$3.00	7/1/1993	3/1/1996	
Hancock	MI	Houghton County Memorial	CMX	N	$3.00	7/1/1996	7/1/1999	
Hancock	MI	Houghton County Memorial	CMX	N	$3.00	10/1/1999	7/1/2005	
Hancock	MI	Houghton County Memorial	CMX	N	$4.50	7/1/2005	8/1/2016	$1,420,975
Iron Mountain Kingsford	MI	Ford	IMT	N	$3.00	9/1/1995	6/1/2004	$178,243
Ironwood	MI	Gogebic-Iron County	IWD	CS	$3.00	8/1/1993	10/1/2006	
Ironwood	MI	Gogebic-Iron County	IWD	CS	$4.50	6/1/2007	5/1/2018	$219,080
Kalamazoo	MI	Kalamazoo/Battle Creek International	AZO	N	$3.00	4/1/1997	6/1/2000	
Kalamazoo	MI	Kalamazoo/Battle Creek International	AZO	N	$3.00	1/1/2001	1/1/2005	
Kalamazoo	MI	Kalamazoo/Battle Creek International	AZO	N	$4.50	1/1/2005	8/1/2006	
Kalamazoo	MI	Kalamazoo/Battle Creek International	AZO	N	$4.50	10/1/2006	4/1/2008	
Kalamazoo	MI	Kalamazoo/Battle Creek International	AZO	N	$4.50	9/1/2008	9/1/2024	$22,503,006
Lansing	MI	Capital Region International	LAN	N	$3.00	10/1/1993	7/1/2002	
Lansing	MI	Capital Region International	LAN	N	$4.50	7/1/2002	4/1/2028	$30,496,100
Manistee	MI	Manistee County-Blacker	MBL	GA	$4.50	6/1/2008	11/1/2040	$388,986
Marquette	MI	Sawyer International	SAW	N	$3.00	12/1/1992	12/1/1996	
Marquette	MI	Sawyer International	SAW	N	$3.00	4/1/1998	7/1/2002	
Marquette	MI	Sawyer International	SAW	N	$4.50	7/1/2002	1/1/2003	
Marquette	MI	Sawyer International	SAW	N	$4.50	1/1/2003	9/1/2006	

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Marquette	MI	Sawyer International	SAW	N	$4.50	10/1/2006	5/1/2008	
Marquette	MI	Sawyer International	SAW	N	$4.50	8/1/2008	8/1/2011	
Marquette	MI	Sawyer International	SAW	N	$4.50	3/1/2012	3/1/2015	
Marquette	MI	Sawyer International	SAW	N	$4.50	5/1/2015	5/1/2017	$3,414,096
Muskegon	MI	Muskegon County	MKG	N	$3.00	5/1/1994	5/1/2004	
Muskegon	MI	Muskegon County	MKG	N	$4.50	5/1/2004	11/1/2020	$5,013,088
Pellston	MI	Pellston Regional Airport of Emmet County	PLN	N	$3.00	3/1/1993	9/1/1997	
Pellston	MI	Pellston Regional Airport of Emmet County	PLN	N	$3.00	12/1/1997	7/1/2011	
Pellston	MI	Pellston Regional Airport of Emmet County	PLN	N	$4.50	7/1/2011	9/1/2019	$2,251,435
Saginaw	MI	MBS International	MBS	N	$3.00	2/1/1997	7/1/2007	
Saginaw	MI	MBS International	MBS	N	$4.50	7/1/2007	4/1/2021	$12,023,124
Sault Ste. Marie	MI	Chippewa County International	CIU	N	$4.50	11/1/2005	7/1/2020	$1,050,115
Traverse City	MI	Cherry Capital	TVC	N	$3.00	1/1/1997	1/1/2002	
Traverse City	MI	Cherry Capital	TVC	N	$4.50	1/1/2002	10/1/2003	
Traverse City	MI	Cherry Capital	TVC	N	$4.50	10/1/2003	12/1/2010	
Traverse City	MI	Cherry Capital	TVC	N	$4.50	2/1/2011	2/1/2016	
Traverse City	MI	Cherry Capital	TVC	N	$4.50	2/1/2017	6/1/2026	$20,527,383
Bemidji	MN	Bemidji Regional	BJI	N	$3.00	11/1/1996	2/1/2002	
Bemidji	MN	Bemidji Regional	BJI	N	$4.50	2/1/2002	8/1/2005	
Bemidji	MN	Bemidji Regional	BJI	N	$4.50	6/1/2006	2/1/2022	$2,158,956
Brainerd	MN	Brainerd Lakes Regional	BRD	N	$3.00	8/1/1993	7/1/2001	
Brainerd	MN	Brainerd Lakes Regional	BRD	N	$4.50	7/1/2001	8/1/2033	$2,147,011
Duluth	MN	Duluth International	DLH	N	$3.00	10/1/1994	4/1/2002	
Duluth	MN	Duluth International	DLH	N	$4.50	4/1/2002	11/1/2004	
Duluth	MN	Duluth International	DLH	N	$4.50	4/1/2005	7/1/2020	$12,501,378
Grand Rapids	MN	Grand Rapids/Itasca County	GPZ	GA	$3.00	12/1/1997	10/1/2001	
Grand Rapids	MN	Grand Rapids/Itasca County	GPZ	GA	$4.50	10/1/2001	1/1/2007	$151,263
Hibbing	MN	Range Regional	HIB	N	$3.00	6/1/1996	7/1/2003	
Hibbing	MN	Range Regional	HIB	N	$4.50	7/1/2003	7/1/2019	$800,036
International Falls	MN	Falls International	INL	N	$3.00	12/1/1994	6/1/2002	
International Falls	MN	Falls International	INL	N	$4.50	6/1/2002	6/1/2005	

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International Falls	MN	Falls International	INL	N	$4.50	11/1/2005	3/1/2033	$1,909,923
Minneapolis	MN	Minneapolis-St Paul International/Wold-Chamberlain	MSP	L	$3.00	6/1/1992	4/1/2001	
Minneapolis	MN	Minneapolis-St Paul International/Wold-Chamberlain	MSP	L	$4.50	4/1/2001	11/1/2021	$1,747,864,449
Rochester	MN	Rochester International	RST	N	$3.00	5/1/1996	3/1/2002	
Rochester	MN	Rochester International	RST	N	$4.50	3/1/2002	4/1/2021	$11,074,911
St. Cloud	MN	St. Cloud Regional	STC	N	$3.00	2/1/2000	7/1/2002	
St. Cloud	MN	St. Cloud Regional	STC	N	$4.50	7/1/2002	3/1/2060	$4,375,081
Thief River Falls	MN	Thief River Falls Regional	TVF	GA	$4.50	6/1/2003	6/1/2023	$636,828
Columbia	MO	Columbia Regional	COU	N	$4.50	11/1/2002	3/1/2016	
Columbia	MO	Columbia Regional	COU	N	$4.50	6/1/2016	3/1/2022	$3,584,189
Joplin	MO	Joplin Regional	JLN	N	$4.50	4/1/2003	6/1/2026	$2,117,227
Kansas City	MO	Kansas City International	MCI	M	$3.00	3/1/1996	8/1/2005	
Kansas City	MO	Kansas City International	MCI	M	$4.50	8/1/2005	8/1/2019	$458,711,197
Springfield	MO	Springfield-Branson National	SGF	S	$3.00	11/1/1993	5/1/1997	
Springfield	MO	Springfield-Branson National	SGF	S	$3.00	7/1/1998	5/1/2001	
Springfield	MO	Springfield-Branson National	SGF	S	$4.50	5/1/2001	1/1/2004	
Springfield	MO	Springfield-Branson National	SGF	S	$4.50	5/1/2004	8/1/2005	
Springfield	MO	Springfield-Branson National	SGF	S	$4.50	9/1/2005	3/1/2006	
Springfield	MO	Springfield-Branson National	SGF	S	$4.50	1/1/2007	1/1/2036	$96,200,309
St Louis	MO	Lambert-St Louis International	STL	M	$3.00	12/1/1992	12/1/2001	
St Louis	MO	Lambert-St Louis International	STL	M	$4.50	12/1/2001	4/1/2026	
St Louis	MO	Lambert-St Louis International	STL	M	$3.00	4/1/2026	11/1/2026	$1,090,698,316
Rota Island	MP	Benjamin Taisacan Mangiona International	GRO	N	$4.50	1/1/2005	6/1/2021	$1,777,742
Saipan	MP	Francisco C. Ada/Saipan International	GSN	S	$4.50	1/1/2005	6/1/2021	$29,573,280
Tinian Island	MP	Tinian International	TNI	CS	$4.50	1/1/2005	6/1/2021	$1,705,526
Columbus	MS	Golden Triangle Regional	GTR	N	$3.00	8/1/1992	4/1/2001	
Columbus	MS	Golden Triangle Regional	GTR	N	$4.50	4/1/2001	12/1/2019	$4,036,108
Greenville	MS	Mid Delta Regional	GLH	GA	$3.00	10/1/1998	2/1/2003	

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Greenville	MS	Mid Delta Regional	GLH	GA	$3.00	4/1/2003	8/1/2003	
Greenville	MS	Mid Delta Regional	GLH	GA	$3.00	8/1/2003	4/1/2005	
Greenville	MS	Mid Delta Regional	GLH	GA	$4.50	4/1/2005	12/1/2005	
Greenville	MS	Mid Delta Regional	GLH	GA	$4.50	12/1/2005	8/1/2011	
Greenville	MS	Mid Delta Regional	GLH	GA	$4.50	9/1/2012	1/1/2023	$453,780
Gulfport	MS	Gulfport-Biloxi International	GPT	N	$3.00	7/1/1992	8/1/2001	
Gulfport	MS	Gulfport-Biloxi International	GPT	N	$3.00	12/1/2001	6/1/2002	
Gulfport	MS	Gulfport-Biloxi International	GPT	N	$3.00	6/1/2002	5/1/2003	
Gulfport	MS	Gulfport-Biloxi International	GPT	N	$4.50	5/1/2003	1/1/2028	$66,424,061
Hattiesburg	MS	Hattiesburg-Laurel Regional	PIB	N	$3.00	7/1/1992	6/1/2001	
Hattiesburg	MS	Hattiesburg-Laurel Regional	PIB	N	$4.50	6/1/2001	12/1/2024	$1,108,865
Jackson	MS	Jackson-Medgar Wiley Evers International	JAN	S	$3.00	5/1/1993	10/1/2003	
Jackson	MS	Jackson-Medgar Wiley Evers International	JAN	S	$4.50	10/1/2003	12/1/2030	$85,572,417
Meridian	MS	Key Field	MEI	N	$3.00	11/1/1992	8/1/1996	
Meridian	MS	Key Field	MEI	N	$3.00	3/1/1997	12/1/2001	
Meridian	MS	Key Field	MEI	N	$4.50	12/1/2001	5/1/2004	
Meridian	MS	Key Field	MEI	N	$4.50	10/1/2005	7/1/2024	$2,213,664
Tupelo	MS	Tupelo Regional	TUP	CS	$3.00	11/1/1994	4/1/2003	
Tupelo	MS	Tupelo Regional	TUP	CS	$4.50	4/1/2003	12/1/2018	$1,743,189
Billings	MT	Billings Logan International	BIL	S	$3.00	4/1/1994	9/1/2014	
Billings	MT	Billings Logan International	BIL	S	$3.00	11/1/2016	3/1/2018	$21,131,387
Bozeman	MT	Bozeman Yellowstone International	BZN	S	$3.00	8/1/1993	3/1/2009	
Bozeman	MT	Bozeman Yellowstone International	BZN	S	$4.50	3/1/2009	7/1/2028	$40,344,326
Butte	MT	Bert Mooney	BTM	N	$3.00	7/1/1994	6/1/2006	
Butte	MT	Bert Mooney	BTM	N	$3.00	7/1/2006	8/1/2007	
Butte	MT	Bert Mooney	BTM	N	$3.00	11/1/2007	3/1/2010	
Butte	MT	Bert Mooney	BTM	N	$4.50	3/1/2010	3/1/2018	$2,370,324
Great Falls	MT	Great Falls International	GTF	N	$3.00	11/1/1992	7/1/2002	
Great Falls	MT	Great Falls International	GTF	N	$4.50	7/1/2002	2/1/2022	$17,754,080
Helena	MT	Helena Regional	HLN	N	$3.00	4/1/1993	8/1/2002	
Helena	MT	Helena Regional	HLN	N	$4.50	8/1/2002	7/1/2018	$7,132,400
Kalispell	MT	Glacier Park International	GPI	N	$3.00	12/1/1993	4/1/2005	
Kalispell	MT	Glacier Park International	GPI	N	$4.50	4/1/2005	12/1/2021	$14,044,375
Missoula	MT	Missoula International	MSO	N	$3.00	9/1/1992	4/1/2001	

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Missoula	MT	Missoula International	MSO	N	$4.50	4/1/2001	11/1/2018	$23,416,623
West Yellowstone	MT	Yellowstone	WYS	CS	$4.50	6/1/2011	6/1/2025	$277,202
Asheville	NC	Asheville Regional	AVL	N	$3.00	12/1/1994	10/1/2002	
Asheville	NC	Asheville Regional	AVL	N	$4.50	10/1/2002	11/1/2006	
Asheville	NC	Asheville Regional	AVL	N	$4.50	4/1/2007	9/1/2007	
Asheville	NC	Asheville Regional	AVL	N	$4.50	10/1/2007	4/1/2024	$29,552,251
Charlotte	NC	Charlotte/Douglas International	CLT	L	$3.00	11/1/2004	8/1/2031	$1,626,829,007
Fayetteville	NC	Fayetteville Regional/Grannis Field	FAY	N	$3.00	11/1/2000	2/1/2006	
Fayetteville	NC	Fayetteville Regional/Grannis Field	FAY	N	$4.00	7/1/2009	10/1/2012	
Fayetteville	NC	Fayetteville Regional/Grannis Field	FAY	N	$4.00	3/1/2013	6/1/2013	
Fayetteville	NC	Fayetteville Regional/Grannis Field	FAY	N	$4.00	5/1/2015	8/1/2020	$9,291,259
Greensboro	NC	Piedmont Triad International	GSO	S	$4.50	9/1/2011	5/1/2022	$43,872,158
Greenville	NC	Pitt-Greenville	PGV	N	$3.00	10/1/1997	4/1/2001	
Greenville	NC	Pitt-Greenville	PGV	N	$4.50	4/1/2001	1/1/2016	
Greenville	NC	Pitt-Greenville	PGV	N	$4.50	7/1/2016	6/1/2026	$6,034,618
Jacksonville	NC	Albert J. Ellis	OAJ	N	$3.00	1/1/1996	10/1/1998	
Jacksonville	NC	Albert J. Ellis	OAJ	N	$3.00	9/1/1999	8/1/2000	
Jacksonville	NC	Albert J. Ellis	OAJ	N	$3.00	3/1/2005	1/1/2009	
Jacksonville	NC	Albert J. Ellis	OAJ	N	$3.00	2/1/2009	11/1/2011	
Jacksonville	NC	Albert J. Ellis	OAJ	N	$3.00	11/1/2011	2/1/2012	
Jacksonville	NC	Albert J. Ellis	OAJ	N	$4.50	2/1/2012	5/1/2028	$11,329,661
New Bern	NC	Coastal Carolina Regional	EWN	N	$3.00	2/1/1997	11/1/2003	
New Bern	NC	Coastal Carolina Regional	EWN	N	$4.50	11/1/2003	10/1/2025	$11,160,275
Raleigh	NC	Raleigh-Durham International	RDU	M	$3.00	4/1/2003	10/1/2004	
Raleigh	NC	Raleigh-Durham International	RDU	M	$4.50	10/1/2004	9/1/2032	$772,690,405
Wilmington	NC	Wilmington International	ILM	N	$3.00	2/1/1994	9/1/1996	
Wilmington	NC	Wilmington International	ILM	N	$3.00	6/1/1998	5/1/2003	
Wilmington	NC	Wilmington International	ILM	N	$4.50	5/1/2003	8/1/2021	$30,973,128
Bismarck	ND	Bismarck Municipal	BIS	N	$3.00	7/1/1996	7/1/1997	
Bismarck	ND	Bismarck Municipal	BIS	N	$3.00	6/1/1998	4/1/2002	
Bismarck	ND	Bismarck Municipal	BIS	N	$4.50	4/1/2002	5/1/2043	$46,701,716

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Dickinson	ND	Dickinson - Theodore Roosevelt Regional	DIK	N	$4.50	4/1/2014	6/1/2020	$714,384
Fargo	ND	Hector International	FAR	S	$3.00	1/1/1997	8/1/2002	
Fargo	ND	Hector International	FAR	S	$4.50	8/1/2002	3/1/2018	$25,911,798
Grand Forks	ND	Grand Forks International	GFK	N	$3.00	2/1/1993	8/1/1996	
Grand Forks	ND	Grand Forks International	GFK	N	$3.00	5/1/1997	4/1/2001	
Grand Forks	ND	Grand Forks International	GFK	N	$4.50	4/1/2001	6/1/2003	
Grand Forks	ND	Grand Forks International	GFK	N	$4.50	5/1/2004	10/1/2008	
Grand Forks	ND	Grand Forks International	GFK	N	$4.50	1/1/2009	9/1/2020	$10,251,697
Minot	ND	Minot International	MOT	N	$3.00	3/1/1994	7/1/1998	
Minot	ND	Minot International	MOT	N	$3.00	3/1/1999	2/1/2002	
Minot	ND	Minot International	MOT	N	$4.50	2/1/2002	10/1/2020	$16,760,900
Williston	ND	Sloulin Field International	ISN	N	$4.50	4/1/2013	2/1/2026	$2,825,713
Grand Island	NE	Central Nebraska Regional	GRI	N	$3.00	2/1/1999	4/1/2001	
Grand Island	NE	Central Nebraska Regional	GRI	N	$4.50	5/1/2001	1/1/2030	$5,248,737
Kearney	NE	Kearney Regional	EAR	N	$4.00	11/1/2005	9/1/2007	
Kearney	NE	Kearney Regional	EAR	N	$4.50	9/1/2007	7/1/2011	
Kearney	NE	Kearney Regional	EAR	N	$4.50	10/1/2011	11/1/2037	$1,749,744
Lincoln	NE	Lincoln	LNK	N	$4.50	11/1/2016	11/1/2025	$5,411,638
Omaha	NE	Eppley Airfield	OMA	M	$4.50	2/1/2018	9/1/2023	$43,013,145
Scottsbluff	NE	Western Nebraska Regional/ William B. Heilig Field	BFF	CS	$3.00	3/1/2000	3/1/2003	
Scottsbluff	NE	Western Nebraska Regional/ William B. Heilig Field	BFF	CS	$4.50	7/1/2004	7/1/2024	$1,299,534
Lebanon	NH	Lebanon Municipal	LEB	N	$3.00	8/1/1995	8/1/2002	
Lebanon	NH	Lebanon Municipal	LEB	N	$4.50	11/1/2003	5/1/2006	
Lebanon	NH	Lebanon Municipal	LEB	N	$4.50	10/1/2007	5/1/2014	
Lebanon	NH	Lebanon Municipal	LEB	N	$4.50	10/1/2014	6/1/2018	$970,751
Manchester	NH	Manchester	MHT	S	$3.00	1/1/1993	1/1/2008	
Manchester	NH	Manchester	MHT	S	$4.50	1/1/2008	12/1/2022	$189,980,151
Atlantic City	NJ	Atlantic City International	ACY	S	$3.00	10/1/1999	12/1/2005	
Atlantic City	NJ	Atlantic City International	ACY	S	$4.50	12/1/2005	4/1/2009	
Atlantic City	NJ	Atlantic City International	ACY	S	$4.50	4/1/2009	8/1/2014	
Atlantic City	NJ	Atlantic City International	ACY	S	$4.50	9/1/2014	3/1/2025	$57,765,575
Newark	NJ	Newark Liberty International	EWR	L	$3.00	10/1/1992	4/1/2006	
Newark	NJ	Newark Liberty International	EWR	L	$4.50	4/1/2006	4/1/2018	$1,363,147,651
Trenton	NJ	Trenton Mercer	TTN	N	$3.00	1/1/2001	5/1/2004	
Trenton	NJ	Trenton Mercer	TTN	N	$4.50	5/1/2004	6/1/2018	$9,645,113

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Albuquerque	NM	Albuquerque International Sunport	ABQ	M	$3.00	7/1/1996	7/1/2011	
Albuquerque	NM	Albuquerque International Sunport	ABQ	M	$4.50	7/1/2011	7/1/2018	$183,986,105
Farmington	NM	Four Corners Regional	FMN	CS	$3.00	6/1/2003	5/1/2023	$661,102
Roswell	NM	Roswell International Air Center	ROW	N	$3.00	4/1/1999	2/1/2004	
Roswell	NM	Roswell International Air Center	ROW	N	$4.50	2/1/2004	6/1/2004	
Roswell	NM	Roswell International Air Center	ROW	N	$3.00	6/1/2004	6/1/2005	
Roswell	NM	Roswell International Air Center	ROW	N	$4.50	6/1/2005	2/1/2008	
Roswell	NM	Roswell International Air Center	ROW	N	$4.50	3/1/2008	4/1/2022	$2,420,266
Elko	NV	Elko Regional	EKO	N	$3.00	9/1/1998	11/1/2003	
Elko	NV	Elko Regional	EKO	N	$4.50	11/1/2003	2/1/2021	$6,790,017
Las Vegas	NV	McCarran International	LAS	L	$3.00	6/1/1992	11/1/2004	
Las Vegas	NV	McCarran International	LAS	L	$4.50	11/1/2004	9/1/2006	
Las Vegas	NV	McCarran International	LAS	L	$3.00	9/1/2006	1/1/2007	
Las Vegas	NV	McCarran International	LAS	L	$4.00	1/1/2007	10/1/2008	
Las Vegas	NV	McCarran International	LAS	L	$4.50	10/1/2008	11/1/2053	$4,563,146,058
Reno	NV	Reno/Tahoe International	RNO	S	$3.00	1/1/1994	2/1/2001	
Reno	NV	Reno/Tahoe International	RNO	S	$4.50	8/1/2001	6/1/2002	
Reno	NV	Reno/Tahoe International	RNO	S	$3.00	6/1/2002	2/1/2003	
Reno	NV	Reno/Tahoe International	RNO	S	$4.50	2/1/2003	10/1/2004	
Reno	NV	Reno/Tahoe International	RNO	S	$3.00	10/1/2004	12/1/2004	
Reno	NV	Reno/Tahoe International	RNO	S	$3.00	12/1/2004	4/1/2005	
Reno	NV	Reno/Tahoe International	RNO	S	$4.50	4/1/2005	7/1/2007	
Reno	NV	Reno/Tahoe International	RNO	S	$3.00	7/1/2007	12/1/2007	
Reno	NV	Reno/Tahoe International	RNO	S	$4.50	12/1/2007	2/1/2020	$201,995,680
Albany	NY	Albany International	ALB	S	$3.00	3/1/1994	9/1/2009	
Albany	NY	Albany International	ALB	S	$4.50	9/1/2009	2/1/2020	$116,740,338
Binghamton	NY	Greater Binghamton/Edwin A. Link Field	BGM	N	$3.00	11/1/1993	9/1/2002	
Binghamton	NY	Greater Binghamton/Edwin A. Link Field	BGM	N	$4.50	9/1/2002	7/1/2006	
Binghamton	NY	Greater Binghamton/Edwin A. Link Field	BGM	N	$4.50	7/1/2006	2/1/2008	

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Binghamton	NY	Greater Binghamton/Edwin A. Link Field	BGM	N	$4.50	5/1/2008	10/1/2019	$9,772,810
Buffalo	NY	Buffalo Niagara International	BUF	M	$3.00	8/1/1992	8/1/2007	
Buffalo	NY	Buffalo Niagara International	BUF	M	$4.50	8/1/2007	8/1/2018	$203,522,960
Elmira	NY	Elmira/Corning Regional	ELM	N	$3.00	12/1/2004	1/1/2008	
Elmira	NY	Elmira/Corning Regional	ELM	N	$4.50	5/1/2008	1/1/2027	$10,576,492
Islip	NY	Long Island MacArthur	ISP	S	$3.00	12/1/1994	9/1/2005	
Islip	NY	Long Island MacArthur	ISP	S	$4.50	9/1/2005	5/1/2023	$80,876,182
Ithaca	NY	Ithaca Tompkins Regional	ITH	N	$3.00	1/1/1993	3/1/2009	
Ithaca	NY	Ithaca Tompkins Regional	ITH	N	$4.50	3/1/2009	12/1/2018	$7,850,987
Jamestown	NY	Chautauqua County/Jamestown	JHW	CS	$3.00	6/1/1993	8/1/2002	
Jamestown	NY	Chautauqua County/Jamestown	JHW	CS	$4.50	9/1/2004	3/1/2018	$730,945
Massena	NY	Massena International - Richards Field	MSS	CS	$3.00	4/1/1996	4/1/2061	$163,429
New York	NY	John F. Kennedy International	JFK	L	$3.00	10/1/1992	4/1/2006	
New York	NY	John F. Kennedy International	JFK	L	$4.50	4/1/2006	5/1/2018	$1,769,420,314
New York	NY	LaGuardia	LGA	L	$3.00	10/1/1992	4/1/2006	
New York	NY	LaGuardia	LGA	L	$4.50	4/1/2006	6/1/2018	$1,104,666,712
Newburgh	NY	Stewart International	SWF	N	$3.00	11/1/1995	3/1/2002	
Newburgh	NY	Stewart International	SWF	N	$4.50	3/1/2002	11/1/2005	
Newburgh	NY	Stewart International	SWF	N	$4.50	5/1/2007	9/1/2007	
Newburgh	NY	Stewart International	SWF	N	$4.50	7/1/2010	11/1/2019	$17,811,117
Niagara Falls	NY	Niagara Falls International	IAG	N	$4.50	11/1/2017	10/1/2018	$400,289
Ogdensburg	NY	Ogdensburg International	OGS	CS	$3.00	4/1/1996	7/1/2016	
Ogdensburg	NY	Ogdensburg International	OGS	CS	$4.50	7/1/2016	4/1/2022	$865,512
Plattsburgh	NY	Clinton County	PLB	N	$3.00	7/1/1993	3/1/2001	
Plattsburgh	NY	Clinton County	PLB	N	$3.00	6/1/2001	4/1/2003	$230,975
Plattsburgh	NY	Plattsburgh International	PBG	N	$4.50	1/1/2009	2/1/2043	$39,561,720
Rochester	NY	Greater Rochester International	ROC	S	$3.00	12/1/1997	9/1/2004	
Rochester	NY	Greater Rochester International	ROC	S	$4.50	9/1/2004	9/1/2027	$118,547,358
Saranac Lake	NY	Adirondack Regional	SLK	CS	$3.00	8/1/1994	9/1/2007	
Saranac Lake	NY	Adirondack Regional	SLK	CS	$4.50	2/1/2011	6/1/2033	$591,574

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Syracuse	NY	Syracuse Hancock International	SYR	S	$3.00	10/1/1995	1/1/2002	
Syracuse	NY	Syracuse Hancock International	SYR	S	$4.50	10/1/2002	8/1/2005	
Syracuse	NY	Syracuse Hancock International	SYR	S	$4.50	11/1/2005	2/1/2007	
Syracuse	NY	Syracuse Hancock International	SYR	S	$4.50	4/1/2007	8/1/2026	$126,921,592
Utica	NY	Oneida County	UCA		$3.00	8/1/1997	6/1/2010	$1,298,631
Watertown	NY	Watertown International	ART	N	$4.50	4/1/2017	4/1/2023	$605,205
White Plains	NY	Westchester County	HPN	S	$3.00	2/1/1993	12/1/2001	
White Plains	NY	Westchester County	HPN	S	$4.50	12/1/2001	5/1/2014	
White Plains	NY	Westchester County	HPN	S	$4.50	8/1/2016	11/1/2018	$58,771,838
Akron	OH	Akron-Canton Regional	CAK	S	$3.00	9/1/1992	9/1/2002	
Akron	OH	Akron-Canton Regional	CAK	S	$4.50	9/1/2002	12/1/2018	$58,809,044
Cleveland	OH	Cleveland-Hopkins International	CLE	M	$3.00	11/1/1992	3/1/2002	
Cleveland	OH	Cleveland-Hopkins International	CLE	M	$4.50	3/1/2002	9/1/2023	$590,917,465
Columbus	OH	Port Columbus International	CMH	M	$3.00	10/1/1992	4/1/2002	
Columbus	OH	Port Columbus International	CMH	M	$4.50	4/1/2002	11/1/2020	$353,675,428
Dayton	OH	James M Cox Dayton International	DAY	S	$3.00	10/1/1994	9/1/2001	
Dayton	OH	James M Cox Dayton International	DAY	S	$4.50	9/1/2001	2/1/2029	$157,279,770
Toledo	OH	Toledo Express	TOL	N	$3.00	9/1/1993	9/1/1996	
Toledo	OH	Toledo Express	TOL	N	$3.00	7/1/1997	7/1/2001	
Toledo	OH	Toledo Express	TOL	N	$4.50	7/1/2001	3/1/2023	$18,897,010
Youngstown	OH	Youngstown-Warren Regional	YNG	N	$3.00	5/1/1994	7/1/1996	
Youngstown	OH	Youngstown-Warren Regional	YNG	N	$3.00	8/1/1997	2/1/2002	
Youngstown	OH	Youngstown-Warren Regional	YNG	N	$4.50	4/1/2007	12/1/2027	$5,467,796
Lawton	OK	Lawton-Fort Sill Regional	LAW	N	$2.00	8/1/1992	1/1/1994	
Lawton	OK	Lawton-Fort Sill Regional	LAW	N	$3.00	1/1/1994	4/1/1996	
Lawton	OK	Lawton-Fort Sill Regional	LAW	N	$3.00	1/1/1998	8/1/2000	
Lawton	OK	Lawton-Fort Sill Regional	LAW	N	$4.50	6/1/2002	3/1/2004	
Lawton	OK	Lawton-Fort Sill Regional	LAW	N	$4.50	9/1/2004	10/1/2005	
Lawton	OK	Lawton-Fort Sill Regional	LAW	N	$4.50	11/1/2007	4/1/2019	$4,150,206
Oklahoma City	OK	Will Rogers World	OKC	S	$3.00	7/1/1997	4/1/2010	
Oklahoma City	OK	Will Rogers World	OKC	S	$4.50	4/1/2010	12/1/2035	$265,296,898

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Tulsa	OK	Tulsa International	TUL	S	$3.00	8/1/1992	3/1/1996	
Tulsa	OK	Tulsa International	TUL	S	$3.00	1/1/1997	8/1/2010	
Tulsa	OK	Tulsa International	TUL	S	$4.50	8/1/2010	8/1/2033	$199,417,324
Eugene	OR	Mahlon Sweet Field	EUG	S	$3.00	11/1/1993	6/1/2001	
Eugene	OR	Mahlon Sweet Field	EUG	S	$4.50	6/1/2001	7/1/2019	$35,568,797
Klamath Falls	OR	Klamath Falls	LMT	CS	$3.00	3/1/2000	4/1/2001	
Klamath Falls	OR	Klamath Falls	LMT	CS	$4.50	4/1/2001	5/1/2004	
Klamath Falls	OR	Klamath Falls	LMT	CS	$4.50	5/1/2004	12/1/2011	
Klamath Falls	OR	Klamath Falls	LMT	CS	$4.50	4/1/2012	10/1/2023	$2,132,265
Medford	OR	Rogue Valley International - Medford	MFR	N	$3.00	7/1/1993	4/1/2001	
Medford	OR	Rogue Valley International - Medford	MFR	N	$4.50	4/1/2001	8/1/2026	$34,840,357
North Bend	OR	Southwest Oregon Regional	OTH	N	$3.00	2/1/1994	8/1/2001	
North Bend	OR	Southwest Oregon Regional	OTH	N	$4.50	8/1/2001	8/1/2020	$2,900,608
Pendleton	OR	Eastern Oregon Regional at Pendleton	PDT	CS	$3.00	12/1/1995	10/1/2009	
Pendleton	OR	Eastern Oregon Regional at Pendleton	PDT	CS	$4.50	10/1/2009	5/1/2018	$495,813
Portland	OR	Portland International	PDX	L	$3.00	7/1/1992	10/1/2001	
Portland	OR	Portland International	PDX	L	$4.50	10/1/2001	3/1/2036	$1,154,650,335
Redmond	OR	Roberts Field	RDM	N	$3.00	10/1/1993	11/1/2001	
Redmond	OR	Roberts Field	RDM	N	$4.50	11/1/2001	12/1/2003	
Redmond	OR	Roberts Field	RDM	N	$4.50	12/1/2003	12/1/2006	
Redmond	OR	Roberts Field	RDM	N	$4.50	3/1/2007	7/1/2040	$33,531,050
Allentown	PA	Lehigh Valley International	ABE	N	$3.00	11/1/1992	2/1/2001	
Allentown	PA	Lehigh Valley International	ABE	N	$3.00	6/1/2001	11/1/2001	
Allentown	PA	Lehigh Valley International	ABE	N	$4.50	11/1/2001	1/1/2003	
Allentown	PA	Lehigh Valley International	ABE	N	$4.50	9/1/2003	8/1/2018	$44,975,522
Altoona	PA	Altoona-Blair County	AOO	CS	$3.00	5/1/1993	2/1/1996	
Altoona	PA	Altoona-Blair County	AOO	CS	$3.00	1/1/1997	10/1/1999	
Altoona	PA	Altoona-Blair County	AOO	CS	$3.00	7/1/2000	12/1/2008	
Altoona	PA	Altoona-Blair County	AOO	CS	$4.50	12/1/2008	7/1/2019	$716,045
Bradford	PA	Bradford Regional	BFD	CS	$3.00	8/1/1995	5/1/2003	
Bradford	PA	Bradford Regional	BFD	CS	$4.50	5/1/2003	6/1/2030	$584,559
Du Bois	PA	Dubois Regional	DUJ	CS	$3.00	6/1/1995	4/1/2001	
Du Bois	PA	Dubois Regional	DUJ	CS	$4.50	4/1/2001	11/1/2003	
Du Bois	PA	Dubois Regional	DUJ	CS	$4.50	4/1/2004	10/1/2018	$712,049

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Erie	PA	Erie International/Tom Ridge Field	ERI	N	$3.00	10/1/1992	6/1/1997	
Erie	PA	Erie International/Tom Ridge Field	ERI	N	$3.00	12/1/1997	5/1/2001	
Erie	PA	Erie International/Tom Ridge Field	ERI	N	$4.50	8/1/2003	1/1/2005	
Erie	PA	Erie International/Tom Ridge Field	ERI	N	$4.50	7/1/2005	2/1/2025	$15,928,448
Harrisburg	PA	Harrisburg International	MDT	S	$3.00	2/1/1997	1/1/2003	
Harrisburg	PA	Harrisburg International	MDT	S	$4.50	1/1/2003	7/1/2034	$136,117,114
Johnstown	PA	John Murtha Johnstown-Cambria County	JST	CS	$3.00	11/1/1993	12/1/1996	
Johnstown	PA	John Murtha Johnstown-Cambria County	JST	CS	$3.00	12/1/1997	5/1/2001	
Johnstown	PA	John Murtha Johnstown-Cambria County	JST	CS	$4.50	5/1/2001	1/1/2007	
Johnstown	PA	John Murtha Johnstown-Cambria County	JST	CS	$4.50	7/1/2007	5/1/2023	$1,085,952
Lancaster	PA	Lancaster	LNS	CS	$3.00	2/1/1995	2/1/2009	
Lancaster	PA	Lancaster	LNS	CS	$4.50	7/1/2013	2/1/2025	$695,654
Latrobe	PA	Arnold Palmer Regional	LBE	N	$3.00	3/1/1996	7/1/2013	
Latrobe	PA	Arnold Palmer Regional	LBE	N	$4.50	7/1/2013	5/1/2023	$11,127,518
Philadelphia	PA	Philadelphia International	PHL	L	$3.00	9/1/1992	4/1/2001	
Philadelphia	PA	Philadelphia International	PHL	L	$4.50	4/1/2001	2/1/2013	
Philadelphia	PA	Philadelphia International	PHL	L	$3.00	2/1/2013	3/1/2013	
Philadelphia	PA	Philadelphia International	PHL	L	$4.50	3/1/2013	5/1/2021	$1,564,269,848
Pittsburgh	PA	Pittsburgh International	PIT	M	$3.00	10/1/2001	12/1/2004	
Pittsburgh	PA	Pittsburgh International	PIT	M	$4.50	12/1/2004	11/1/2030	$503,924,164
Reading	PA	Reading Regional/Carl A Spaatz Field	RDG	GA	$3.00	12/1/1994	7/1/2008	$1,006,653
State College	PA	University Park	UNV	N	$3.00	11/1/1992	11/1/2003	
State College	PA	University Park	UNV	N	$4.50	11/1/2003	7/1/2019	$11,633,487
Wilkes-Barre	PA	Wilkes-Barre/Scranton International	AVP	N	$3.00	12/1/1993	6/1/1997	
Wilkes-Barre	PA	Wilkes-Barre/Scranton International	AVP	N	$3.00	12/1/1997	5/1/2001	
Wilkes-Barre	PA	Wilkes-Barre/Scranton International	AVP	N	$4.50	5/1/2001	1/1/2019	$20,163,680
Williamsport	PA	Williamsport Regional	IPT	N	$3.00	5/1/1997	11/1/1998	

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Williamsport	PA	Williamsport Regional	IPT	N	$4.50	11/1/2013	9/1/2028	$1,857,488
Aguadilla	PR	Rafael Hernandez	BQN	N	$3.00	3/1/1993	5/1/1996	
Aguadilla	PR	Rafael Hernandez	BQN	N	$4.50	12/1/2005	4/1/2015	$9,828,476
Ponce	PR	Mercedita	PSE	N	$3.00	3/1/1993	9/1/1998	$866,000
San Juan	PR	Luis Munoz Marin International	SJU	M	$3.00	3/1/1993	12/1/2005	
San Juan	PR	Luis Munoz Marin International	SJU	M	$4.50	12/1/2005	9/1/2027	$594,010,551
Providence	RI	Theodore Francis Green State	PVD	S	$3.00	2/1/1994	9/1/2006	
Providence	RI	Theodore Francis Green State	PVD	S	$4.50	9/1/2006	7/1/2028	$261,935,756
Charleston	SC	Charleston AFB/International	CHS	S	$4.50	3/1/2010	7/1/2039	$189,546,679
Columbia	SC	Columbia Metropolitan	CAE	S	$3.00	11/1/1993	12/1/2001	
Columbia	SC	Columbia Metropolitan	CAE	S	$4.50	12/1/2001	10/1/2028	$70,528,884
Florence	SC	Florence Regional	FLO	N	$3.00	12/1/1995	11/1/1999	
Florence	SC	Florence Regional	FLO	N	$3.00	12/1/1999	2/1/2000	
Florence	SC	Florence Regional	FLO	N	$4.50	12/1/2014	6/1/2019	$1,752,407
Hilton Head Island	SC	Hilton Head	HXD	N	$3.00	2/1/1994	6/1/2000	
Hilton Head Island	SC	Hilton Head	HXD	N	$3.00	12/1/2000	10/1/2007	
Hilton Head Island	SC	Hilton Head	HXD	N	$4.50	5/1/2012	6/1/2023	$5,934,148
Myrtle Beach	SC	Myrtle Beach International	MYR	S	$3.00	10/1/1996	8/1/2001	
Myrtle Beach	SC	Myrtle Beach International	MYR	S	$4.50	8/1/2001	8/1/2007	
Myrtle Beach	SC	Myrtle Beach International	MYR	S	$4.50	6/1/2010	1/1/2032	$119,254,552
Aberdeen	SD	Aberdeen Regional	ABR	N	$3.00	1/1/2000	1/1/2002	
Aberdeen	SD	Aberdeen Regional	ABR	N	$4.50	1/1/2002	4/1/2019	$1,753,949
Pierre	SD	Pierre Regional	PIR	CS	$4.50	2/1/2003	7/1/2009	
Pierre	SD	Pierre Regional	PIR	CS	$4.50	9/1/2009	9/1/2019	$788,346
Rapid City	SD	Rapid City Regional	RAP	N	$3.00	8/1/1997	1/1/2000	
Rapid City	SD	Rapid City Regional	RAP	N	$3.00	6/1/2000	6/1/2006	
Rapid City	SD	Rapid City Regional	RAP	N	$4.50	6/1/2006	6/1/2033	$34,628,990
Sioux Falls	SD	Sioux Falls Regional	FSD	S	$4.50	1/1/2017	4/1/2025	$17,612,920
Bristol	TN	Tri-Cities Regional TN/VA	TRI	N	$3.00	2/1/1997	7/1/2007	
Bristol	TN	Tri-Cities Regional TN/VA	TRI	N	$4.50	7/1/2007	8/1/2019	$16,374,874
Chattanooga	TN	Lovell Field	CHA	N	$3.00	7/1/1994	4/1/2001	

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Chattanooga	TN	Lovell Field	CHA	N	$4.50	4/1/2001	11/1/2004	
Chattanooga	TN	Lovell Field	CHA	N	$3.00	11/1/2004	2/1/2005	
Chattanooga	TN	Lovell Field	CHA	N	$4.50	2/1/2005	10/1/2020	$30,775,915
Jackson	TN	McKellar-Sipes Regional	MKL	GA	$4.50	10/1/2002	6/1/2025	$332,248
Knoxville	TN	McGhee Tyson	TYS	S	$3.00	1/1/1994	10/1/2003	
Knoxville	TN	McGhee Tyson	TYS	S	$4.50	10/1/2003	9/1/2023	$103,771,921
Memphis	TN	Memphis International	MEM	M	$3.00	8/1/1992	1/1/1997	$53,700,000
Nashville	TN	Nashville International	BNA	M	$3.00	1/1/1993	12/1/2009	
Nashville	TN	Nashville International	BNA	M	$4.50	12/1/2009	9/1/2010	
Nashville	TN	Nashville International	BNA	M	$3.00	9/1/2010	5/1/2015	
Nashville	TN	Nashville International	BNA	M	$4.50	5/1/2015	3/1/2020	$402,643,161
Abilene	TX	Abilene Regional	ABI	N	$3.00	1/1/1998	9/1/2002	
Abilene	TX	Abilene Regional	ABI	N	$4.50	9/1/2002	10/1/2022	$7,176,261
Amarillo	TX	Rick Husband Amarillo International	AMA	N	$4.50	1/1/2009	8/1/2023	$19,200,000
Austin	TX	Robert Mueller Municipal	AUS	M	$2.00	11/1/1993	2/1/1994	
Austin	TX	Robert Mueller Municipal	AUS	M	$3.00	2/1/1994	2/1/1995	
Austin	TX	Austin-Bergstrom International	AUS	M	$3.00	7/1/1995	4/1/2004	
Austin	TX	Austin-Bergstrom International	AUS	M	$4.50	4/1/2004	11/1/2034	$831,089,379
Beaumont/Port Arthur	TX	Jack Brooks Regional	BPT	N	$3.00	9/1/1994	3/1/2002	
Beaumont/Port Arthur	TX	Jack Brooks Regional	BPT	N	$4.50	3/1/2002	3/1/2029	$5,307,813
Brownsville	TX	Brownsville/South Padre Island International	BRO	N	$3.00	10/1/1997	5/1/2003	
Brownsville	TX	Brownsville/South Padre Island International	BRO	N	$4.50	5/1/2003	2/1/2024	$8,178,196
College Station	TX	Easterwood Field	CLL	N	$3.00	7/1/1996	4/1/2001	
College Station	TX	Easterwood Field	CLL	N	$4.50	4/1/2001	5/1/2018	$6,776,641
Corpus Christi	TX	Corpus Christi International	CRP	N	$3.00	3/1/1994	3/1/2003	
Corpus Christi	TX	Corpus Christi International	CRP	N	$4.50	3/1/2003	1/1/2027	$49,700,114
Dallas	TX	Dallas Love Field	DAL	M	$3.00	2/1/2008	2/1/2010	
Dallas	TX	Dallas Love Field	DAL	M	$4.50	2/1/2010	5/1/2024	
Dallas	TX	Dallas Love Field	DAL	M	$3.00	5/1/2024	2/1/2025	$365,106,697
Dallas-Ft Worth	TX	Dallas/Ft Worth International	DFW	L	$3.00	5/1/1994	6/1/1996	

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Dallas-Ft Worth	TX	Dallas/Ft Worth International	DFW	L	$3.00	2/1/1997	7/1/2002	
Dallas-Ft Worth	TX	Dallas/Ft Worth International	DFW	L	$4.50	7/1/2002	10/1/2038	$5,655,256,130
Del Rio	TX	Del Rio International	DRT	GA	$4.50	2/1/2010	6/1/2020	$403,739
El Paso	TX	El Paso International	ELP	S	$3.00	1/1/1997	8/1/2010	
El Paso	TX	El Paso International	ELP	S	$4.50	8/1/2010	5/1/2013	
El Paso	TX	El Paso International	ELP	S	$4.50	6/1/2013	4/1/2025	$149,793,398
Harlingen	TX	Valley International	HRL	N	$3.00	11/1/1998	12/1/2007	
Harlingen	TX	Valley International	HRL	N	$4.50	12/1/2007	7/1/2009	
Harlingen	TX	Valley International	HRL	N	$4.50	8/1/2009	4/1/2019	$24,720,749
Houston	TX	William P. Hobby	HOU	M	$3.00	11/1/2006	3/1/2015	
Houston	TX	William P. Hobby	HOU	M	$4.50	3/1/2015	9/1/2038	$736,300,640
Houston	TX	George Bush Intercontinental/ Houston	IAH	L	$3.00	12/1/2008	3/1/2015	
Houston	TX	George Bush Intercontinental/ Houston	IAH	L	$4.50	3/1/2015	1/1/2028	$1,372,445,143
Killeen	TX	Robert Gray AAF	GRK	N	$3.00	1/1/1993	11/1/1994	
Killeen	TX	Robert Gray AAF	GRK	N	$3.00	4/1/1995	5/1/2001	
Killeen	TX	Robert Gray AAF	GRK	N	$4.50	5/1/2001	8/1/2003	
Killeen	TX	Robert Gray AAF	GRK	N	$4.50	12/1/2003	1/1/2006	
Killeen	TX	Robert Gray AAF	GRK	N	$4.50	6/1/2006	5/1/2023	$13,457,960
Laredo	TX	Laredo International	LRD	N	$3.00	10/1/1993	6/1/2009	
Laredo	TX	Laredo International	LRD	N	$4.50	6/1/2009	4/1/2040	$20,779,276
Longview	TX	East Texas Regional	GGG	N	$3.00	9/1/1996	4/1/2002	
Longview	TX	East Texas Regional	GGG	N	$3.00	9/1/2002	9/1/2012	
Longview	TX	East Texas Regional	GGG	N	$4.50	9/1/2012	9/1/2023	$2,350,343
Lubbock	TX	Lubbock Preston Smith International	LBB	S	$3.00	10/1/1993	2/1/2005	
Lubbock	TX	Lubbock Preston Smith International	LBB	S	$2.00	2/1/2005	2/1/2007	
Lubbock	TX	Lubbock Preston Smith International	LBB	S	$3.00	2/1/2007	6/1/2008	
Lubbock	TX	Lubbock Preston Smith International	LBB	S	$4.50	6/1/2008	10/1/2020	$46,791,509
McAllen	TX	McAllen Miller International	MFE	N	$3.00	4/1/1998	6/1/2011	
McAllen	TX	McAllen Miller International	MFE	N	$4.50	6/1/2011	1/1/2023	$29,874,804
Midland	TX	Midland International	MAF	S	$3.00	1/1/1993	9/1/2004	
Midland	TX	Midland International	MAF	S	$4.50	9/1/2004	1/1/2014	

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Midland	TX	Midland International	MAF	S	$3.00	1/1/2014	11/1/2014	
Midland	TX	Midland International	MAF	S	$4.50	11/1/2014	10/1/2018	$44,535,527
San Angelo	TX	San Angelo Regional/Mathis Field	SJT	N	$3.00	5/1/1993	4/1/2002	
San Angelo	TX	San Angelo Regional/Mathis Field	SJT	N	$4.50	4/1/2002	10/1/2019	$5,282,162
San Antonio	TX	San Antonio International	SAT	M	$3.00	11/1/2001	10/1/2007	
San Antonio	TX	San Antonio International	SAT	M	$4.50	10/1/2007	7/1/2025	$463,710,203
Tyler	TX	Tyler Pounds Regional	TYR	N	$3.00	3/1/1994	9/1/2003	
Tyler	TX	Tyler Pounds Regional	TYR	N	$4.50	9/1/2003	10/1/2037	$11,668,802
Victoria	TX	Victoria Regional	VCT	GA	$3.00	12/1/1994	8/1/1998	
Victoria	TX	Victoria Regional	VCT	GA	$3.00	1/1/1999	1/1/2002	
Victoria	TX	Victoria Regional	VCT	GA	$4.50	1/1/2002	8/1/2016	$828,792
Waco	TX	Waco Regional	ACT	N	$3.00	11/1/1995	10/1/2001	
Waco	TX	Waco Regional	ACT	N	$4.50	10/1/2001	5/1/2018	$5,245,955
Wichita Falls	TX	Sheppard AFB/Wichita Falls Municipal	SPS	N	$4.50	10/1/2008	8/1/2058	$9,607,509
Cedar City	UT	Cedar City Regional	CDC	N	$4.50	2/1/2007	10/1/2011	
Cedar City	UT	Cedar City Regional	CDC	N	$4.50	2/1/2012	2/1/2021	$496,704
Salt Lake City	UT	Salt Lake City International	SLC	L	$3.00	12/1/1994	4/1/2001	
Salt Lake City	UT	Salt Lake City International	SLC	L	$4.50	4/1/2001	10/1/2035	$2,067,702,396
St George	UT	St George Municipal	SGU	N	$3.00	5/1/1998	9/1/2002	
St George	UT	St George Municipal	SGU	N	$4.50	6/1/2003	6/1/2031	$6,604,984
Wendover	UT	Wendover	ENV	GA	$3.00	8/1/1996	10/1/1999	$142,300
Arlington	VA	Ronald Reagan Washington National	DCA	L	$3.00	11/1/1993	5/1/2001	
Arlington	VA	Ronald Reagan Washington National	DCA	L	$4.50	5/1/2001	2/1/2023	$1,025,481,914
Chantilly	VA	Washington Dulles International	IAD	L	$3.00	1/1/1994	5/1/2001	
Chantilly	VA	Washington Dulles International	IAD	L	$4.50	5/1/2001	12/1/2038	$2,442,302,508
Charlottesville	VA	Charlottesville-Albemarle	CHO	N	$2.00	9/1/1992	10/1/1993	
Charlottesville	VA	Charlottesville-Albemarle	CHO	N	$3.00	4/1/1995	1/1/2005	
Charlottesville	VA	Charlottesville-Albemarle	CHO	N	$4.50	1/1/2005	2/1/2005	
Charlottesville	VA	Charlottesville-Albemarle	CHO	N	$4.50	2/1/2005	1/1/2010	
Charlottesville	VA	Charlottesville-Albemarle	CHO	N	$4.50	8/1/2010	12/1/2019	$16,889,053
Lynchburg	VA	Lynchburg Regional/Preston Glenn Field	LYH	N	$3.00	7/1/1995	7/1/1996	

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Lynchburg	VA	Lynchburg Regional/Preston Glenn Field	LYH	N	$3.00	9/1/2000	6/1/2002	
Lynchburg	VA	Lynchburg Regional/Preston Glenn Field	LYH	N	$4.50	6/1/2002	9/1/2031	$8,364,446
Newport News	VA	Newport News/Williamsburg International	PHF	N	$3.00	10/1/2006	7/1/2007	
Newport News	VA	Newport News/Williamsburg International	PHF	N	$4.50	7/1/2010	5/1/2031	$26,821,415
Norfolk	VA	Norfolk International	ORF	S	$3.00	5/1/1997	1/1/2010	
Norfolk	VA	Norfolk International	ORF	S	$4.50	9/1/2010	1/1/2022	$134,247,810
Richmond	VA	Richmond International	RIC	S	$3.00	5/1/1994	1/1/2005	
Richmond	VA	Richmond International	RIC	S	$4.50	1/1/2005	3/1/2025	$169,972,887
Roanoke	VA	Roanoke Regional/Woodrum Field	ROA	N	$3.00	9/1/1998	12/1/2001	
Roanoke	VA	Roanoke Regional/Woodrum Field	ROA	N	$4.50	12/1/2001	2/1/2005	
Roanoke	VA	Roanoke Regional/Woodrum Field	ROA	N	$3.00	2/1/2005	11/1/2005	
Roanoke	VA	Roanoke Regional/Woodrum Field	ROA	N	$4.50	11/1/2005	1/1/2022	$27,293,777
Staunton	VA	Shenandoah Valley Regional	SHD	CS	$3.00	12/1/2001	12/1/2006	
Staunton	VA	Shenandoah Valley Regional	SHD	CS	$4.50	6/1/2007	9/1/2022	$642,846
Charlotte Amalie	VI	Cyril E. King	STT	S	$3.00	3/1/1993	8/1/1995	
Charlotte Amalie	VI	Cyril E. King	STT	S	$3.00	12/1/1995	12/1/2002	
Charlotte Amalie	VI	Cyril E. King	STT	S	$3.00	8/1/2004	4/1/2012	
Charlotte Amalie	VI	Cyril E. King	STT	S	$4.50	4/1/2012	1/1/2019	$40,794,518
Christiansted	VI	Henry E. Rohlsen	STX	N	$3.00	3/1/1993	4/1/1996	
Christiansted	VI	Henry E. Rohlsen	STX	N	$3.00	12/1/1996	7/1/2003	
Christiansted	VI	Henry E. Rohlsen	STX	N	$3.00	10/1/2011	7/1/2016	$9,339,163
Burlington	VT	Burlington International	BTV	S	$3.00	4/1/1997	9/1/2003	
Burlington	VT	Burlington International	BTV	S	$4.50	9/1/2003	10/1/2009	
Burlington	VT	Burlington International	BTV	S	$4.50	12/1/2009	8/1/2021	$52,013,046
Bellingham	WA	Bellingham International	BLI	S	$3.00	7/1/1993	8/1/1998	
Bellingham	WA	Bellingham International	BLI	S	$3.00	3/1/1999	1/1/2000	
Bellingham	WA	Bellingham International	BLI	S	$3.00	1/1/2000	7/1/2002	

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Bellingham	WA	Bellingham International	BLI	S	$4.50	7/1/2002	6/1/2005	
Bellingham	WA	Bellingham International	BLI	S	$4.50	6/1/2005	7/1/2010	
Bellingham	WA	Bellingham International	BLI	S	$4.50	10/1/2010	10/1/2027	$38,188,548
Friday Harbor	WA	Friday Harbor	FHR	N	$3.00	2/1/2001	7/1/2016	$517,077
Moses Lake	WA	Grant County International	MWH	GA	$3.00	3/1/1999	11/1/2005	
Moses Lake	WA	Grant County International	MWH	GA	$4.50	11/1/2005	2/1/2017	$162,124
Pasco	WA	Tri-Cities	PSC	N	$3.00	11/1/1993	10/1/2001	
Pasco	WA	Tri-Cities	PSC	N	$4.50	10/1/2001	4/1/2035	$56,113,124
Port Angeles	WA	William R. Fairchild International	CLM	CS	$3.00	8/1/1993	5/1/1995	
Port Angeles	WA	William R. Fairchild International	CLM	CS	$3.00	9/1/1996	10/1/2011	
Port Angeles	WA	William R. Fairchild International	CLM	CS	$3.00	7/1/2012	4/1/2022	$1,000,156
Pullman	WA	Pullman/Moscow Regional	PUW	N	$3.00	6/1/1994	2/1/1996	
Pullman	WA	Pullman/Moscow Regional	PUW	N	$3.00	2/1/2000	1/1/2002	
Pullman	WA	Pullman/Moscow Regional	PUW	N	$4.50	1/1/2002	10/1/2005	
Pullman	WA	Pullman/Moscow Regional	PUW	N	$4.50	10/1/2005	9/1/2013	
Pullman	WA	Pullman/Moscow Regional	PUW	N	$4.50	11/1/2013	6/1/2069	$11,352,608
Seattle	WA	Seattle-Tacoma International	SEA	L	$3.00	11/1/1992	10/1/2001	
Seattle	WA	Seattle-Tacoma International	SEA	L	$4.50	10/1/2001	1/1/2043	$3,841,864,375
Spokane	WA	Spokane International	GEG	S	$3.00	6/1/1993	4/1/2003	
Spokane	WA	Spokane International	GEG	S	$4.50	4/1/2003	11/1/2020	$152,400,263
Walla Walla	WA	Walla Walla Regional	ALW	N	$3.00	11/1/1993	10/1/2001	
Walla Walla	WA	Walla Walla Regional	ALW	N	$4.50	10/1/2001	10/1/2019	$3,745,775
Wenatchee	WA	Pangborn Memorial	EAT	N	$3.00	8/1/1993	10/1/1995	
Wenatchee	WA	Pangborn Memorial	EAT	N	$3.00	6/1/1998	7/1/2002	
Wenatchee	WA	Pangborn Memorial	EAT	N	$4.50	7/1/2002	2/1/2003	
Wenatchee	WA	Pangborn Memorial	EAT	N	$4.50	5/1/2003	4/1/2010	
Wenatchee	WA	Pangborn Memorial	EAT	N	$4.50	5/1/2010	8/1/2019	$4,399,115
Yakima	WA	Yakima Air Terminal/McAllister Field	YKM	N	$3.00	2/1/1993	2/1/1999	
Yakima	WA	Yakima Air Terminal/McAllister Field	YKM	N	$3.00	5/1/1999	6/1/2000	
Yakima	WA	Yakima Air Terminal/McAllister Field	YKM	N	$3.00	6/1/2000	4/1/2011	
Yakima	WA	Yakima Air Terminal/McAllister Field	YKM	N	$4.50	4/1/2011	7/1/2019	$5,520,251

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Appleton	WI	Appleton International	ATW	N	$3.00	7/1/1994	6/1/2006	
Appleton	WI	Appleton International	ATW	N	$4.50	6/1/2006	4/1/2008	
Appleton	WI	Appleton International	ATW	N	$3.00	4/1/2008	9/1/2008	
Appleton	WI	Appleton International	ATW	N	$4.50	9/1/2008	1/1/2023	$20,417,560
Eau Claire	WI	Chippewa Valley Regional	EAU	N	$3.00	2/1/1996	12/1/2001	
Eau Claire	WI	Chippewa Valley Regional	EAU	N	$4.50	12/1/2001	1/1/2006	
Eau Claire	WI	Chippewa Valley Regional	EAU	N	$4.50	8/1/2006	6/1/2024	$2,147,974
Green Bay	WI	Green Bay - Austin Straubel International	GRB	N	$3.00	3/1/1993	3/1/2002	
Green Bay	WI	Green Bay - Austin Straubel International	GRB	N	$4.50	3/1/2002	10/1/2020	$46,299,787
La Crosse	WI	La Crosse Regional	LSE	N	$3.00	7/1/1994	4/1/2001	
La Crosse	WI	La Crosse Regional	LSE	N	$4.50	4/1/2001	4/1/2028	$12,741,825
Madison	WI	Dane County Regional - Truax Field	MSN	S	$3.00	9/1/1993	11/1/2001	
Madison	WI	Dane County Regional - Truax Field	MSN	S	$4.50	11/1/2001	10/1/2023	$92,211,569
Milwaukee	WI	General Mitchell International	MKE	M	$3.00	5/1/1995	11/1/2012	
Milwaukee	WI	General Mitchell International	MKE	M	$4.50	11/1/2012	2/1/2020	
Milwaukee	WI	General Mitchell International	MKE	M	$3.00	2/1/2020	4/1/2028	$394,620,217
Mosinee	WI	Central Wisconsin	CWA	N	$3.00	11/1/1993	9/1/2007	
Mosinee	WI	Central Wisconsin	CWA	N	$4.50	9/1/2007	10/1/2029	$17,352,124
Rhinelander	WI	Rhinelander-Oneida County	RHI	N	$3.00	1/1/1994	4/1/1996	
Rhinelander	WI	Rhinelander-Oneida County	RHI	N	$3.00	6/1/1996	9/1/2001	
Rhinelander	WI	Rhinelander-Oneida County	RHI	N	$4.50	9/1/2001	12/1/2018	$2,473,501
Beckley	WV	Raleigh County Memorial	BKW	GA	$4.50	8/1/2017	8/1/2039	$285,965
Charleston	WV	Yeager	CRW	N	$3.00	8/1/1993	11/1/2001	
Charleston	WV	Yeager	CRW	N	$4.50	11/1/2001	3/1/2021	$25,641,516
Clarksburg	WV	North Central West Virginia	CKB	N	$3.00	3/1/1994	10/1/1995	
Clarksburg	WV	North Central West Virginia	CKB	N	$4.50	4/1/2001	8/1/2002	
Clarksburg	WV	North Central West Virginia	CKB	N	$4.50	5/1/2004	5/1/2054	$3,101,233
Huntington	WV	Tri-State/Milton J. Ferguson Field	HTS	N	$3.00	12/1/1995	12/1/2008	
Huntington	WV	Tri-State/Milton J. Ferguson Field	HTS	N	$3.00	5/1/2009	6/1/2012	
Huntington	WV	Tri-State/Milton J. Ferguson Field	HTS	N	$4.50	7/1/2012	5/1/2019	$6,241,914
Lewisburg	WV	Greenbrier Valley	LWB	CS	$4.50	4/1/2011	1/1/2025	$1,104,958

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Morgantown	WV	Morgantown Municipal-Walter L. Bill Hart Field	MGW	N	$2.00	12/1/1992	1/1/1994	
Morgantown	WV	Morgantown Municipal-Walter L. Bill Hart Field	MGW	N	$2.00	12/1/1994	1/1/2002	
Morgantown	WV	Morgantown Municipal-Walter L. Bill Hart Field	MGW	N	$4.50	1/1/2002	6/1/2004	
Morgantown	WV	Morgantown Municipal-Walter L. Bill Hart Field	MGW	N	$4.50	6/1/2004	3/1/2008	
Morgantown	WV	Morgantown Municipal-Walter L. Bill Hart Field	MGW	N	$4.50	6/1/2009	1/1/2026	$1,170,454
Parkersburg	WV	Mid-Ohio Valley Regional	PKB	CS	$3.00	5/1/1999	8/1/2002	
Parkersburg	WV	Mid-Ohio Valley Regional	PKB	CS	$4.50	8/1/2003	10/1/2027	$798,612
Casper	WY	Casper/ Natrona County International	CPR	N	$3.00	9/1/1993	4/1/2001	
Casper	WY	Casper/ Natrona County International	CPR	N	$4.50	4/1/2001	6/1/2003	
Casper	WY	Casper/ Natrona County International	CPR	N	$4.50	6/1/2003	3/1/2012	
Casper	WY	Casper/ Natrona County International	CPR	N	$3.00	3/1/2012	10/1/2021	$6,506,449
Cheyenne	WY	Cheyenne Regional/Jerry Olson Field	CYS	CS	$3.00	11/1/1993	4/1/2001	
Cheyenne	WY	Cheyenne Regional/Jerry Olson Field	CYS	CS	$4.50	4/1/2001	1/1/2007	
Cheyenne	WY	Cheyenne Regional/Jerry Olson Field	CYS	CS	$4.50	1/1/2007	9/1/2012	
Cheyenne	WY	Cheyenne Regional/Jerry Olson Field	CYS	CS	$4.50	9/1/2014	9/1/2024	$1,804,637
Cody	WY	Yellowstone Regional	COD	N	$3.00	8/1/1997	7/1/2001	
Cody	WY	Yellowstone Regional	COD	N	$4.50	7/1/2001	7/1/2003	
Cody	WY	Yellowstone Regional	COD	N	$4.50	7/1/2003	4/1/2005	
Cody	WY	Yellowstone Regional	COD	N	$4.50	9/1/2005	6/1/2018	$2,224,832
Gillette	WY	Gillette-Campbell County	GCC	N	$3.00	9/1/1993	12/1/2001	
Gillette	WY	Gillette-Campbell County	GCC	N	$4.50	12/1/2001	6/1/2004	
Gillette	WY	Gillette-Campbell County	GCC	N	$4.50	1/1/2005	7/1/2018	$2,136,520
Jackson	WY	Jackson Hole	JAC	N	$3.00	8/1/1993	4/1/2001	
Jackson	WY	Jackson Hole	JAC	N	$4.50	4/1/2001	9/1/2041	$39,749,014
Laramie	WY	Laramie Regional	LAR	N	$3.00	8/1/1996	10/1/2000	
Laramie	WY	Laramie Regional	LAR	N	$3.00	12/1/2000	8/1/2001	

Associated City	State	Airport Name	LOC ID	Hub size	Level	Start Date	Expiration Date	Total PFC Approved
Laramie	WY	Laramie Regional	LAR	N	$4.50	12/1/2006	4/1/2013	
Laramie	WY	Laramie Regional	LAR	N	$4.50	6/1/2013	2/1/2024	$847,142
Riverton	WY	Riverton Regional	RIW	CS	$3.00	5/1/1995	4/1/2001	
Rock Springs	WY	Rock Springs-Sweetwater County	RKS	N	$3.00	4/1/1995	4/1/2006	
Rock Springs	WY	Rock Springs-Sweetwater County	RKS	N	$4.50	4/1/2006	11/1/2023	$2,009,268
Sheridan	WY	Sheridan County	SHR	CS	$3.00	3/1/1996	12/1/2001	
Sheridan	WY	Sheridan County	SHR	CS	$4.50	12/1/2001	9/1/2008	
Sheridan	WY	Sheridan County	SHR	CS	$4.50	10/1/2008	8/1/2035	$1,388,712
Worland	WY	Worland Municipal	WRL	CS	$4.50	1/1/2003	3/1/2008	
Worland	WY	Worland Municipal	WRL	CS	$4.50	8/1/2008	7/1/2022	$265,060
								$100,981,908,050

unique locations approved 399

NOTES:

Total PFC approved includes all the collections at the location

Letter of Intent (LOI) Commitments by Fiscal Year

State	City	Airport Name	Discretionary 2018	Entitlement 2018	Discretionary 2019	Entitlement 2019
CA	Los Angeles	Los Angeles International	11,000,000.00	0	11,000,000.00	0
FL	Fort Lauderdale	Fort Lauderdale/Hollywood International	20,000,000.00	0	20,000,000.00	0
IL	Chicago	Chicago O'Hare International	65,000,000.00	0	65,000,000.00	0
OH	Cleveland	Cleveland-Hopkins International	0	2,030,761.00	0	2,045,253.00
		Total	96,000,000.00	2,030,761.00	96,000,000.00	2,045,253.00

Letter of Intent (LOI) Commitments by Fiscal Year (Cont'd)

State	City	Airport Name	Discretionary 2020	Entitlement 2020	Discretionary 2021	Entitlement 2021
CA	Los Angeles	Los Angeles International	0	0	0	0
FL	Fort Lauderdale	Fort Lauderdale/Hollywood International	20,000,000.00	0	20,000,000.00	0
IL	Chicago	Chicago O'Hare International	65,000,000.00	0	25,000,000.00	0
OH	Cleveland	Cleveland-Hopkins International	0	2,059,960.00	0	2,074,885.00
		Total	85,000,000.00	2,059,960.00	45,000,000.00	2,074,885.00

Letter of Intent (LOI) Commitments by Fiscal Year (Cont'd)

State	City	Airport Name	Discretionary 2022	Entitlement 2022	Discretionary 2023	Entitlement 2023
CA	Los Angeles	Los Angeles International	0	0	0	0
FL	Fort Lauderdale	Fort Lauderdale/Hollywood International	10,000,000.00	0	0	0
IL	Chicago	Chicago O'Hare International	30,000,000.00	0	30,000,000.00	0
OH	Cleveland	Cleveland-Hopkins International	0	400,248.00	0	0
		Total	40,000,000.00	400,248.00	30,000,000.00	0

Letter of Intent (LOI) Commitments by Fiscal Year (Cont'd)

State	City	Airport Name	Discretionary 2024	Entitlement 2024	Discretionary 2025	Entitlement 2025
CA	Los Angeles	Los Angeles International	0	0	0	0
FL	Fort Lauderdale	Fort Lauderdale/Hollywood International	0	0	0	0
IL	Chicago	Chicago O'Hare International	30,000,000.00	0	30,000,000.00	0
OH	Cleveland	Cleveland-Hopkins International	0	0	0	0
		Total	30,000,000.00	0	30,000,000.00	0

Letter of Intent (LOI) Commitments by Fiscal Year (Cont'd)

State	City	Airport Name	Discretionary 2026	Entitlement 2026	Discretionary Beyond	Entitlement Beyond
CA	Los Angeles	Los Angeles International	0	0	0	0
FL	Fort Lauderdale	Fort Lauderdale/Hollywood International	0	0	0	0
IL	Chicago	Chicago O'Hare International	20,000,000.00	0	0	0
OH	Cleveland	Cleveland-Hopkins International	0	0	0	0
		Total	20,000,000.00	0	0	0

Letter of Intent (LOI) Commitments by Fiscal Year (Cont'd)

State	City	Airport Name			Discretionary Total	Entitlement Total
CA	Los Angeles	Los Angeles International			22,000,000.00	0
FL	Fort Lauderdale	Fort Lauderdale/Hollywood International			90,000,000.00	0
IL	Chicago	Chicago O'Hare International			360,000,000.00	0
OH	Cleveland	Cleveland-Hopkins International			0	0
		Total			472,000,000.00	8,611,107.00

3E. OTHER INFORMATION

AVIATION USER FEES

Special and Trust Fund Receipts
(in millions of dollars)

Identification code: 69-5422-0-2-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
0100	Balance, start of year	12	12	12
	Receipts:			
	Current Law:			
1110	Aviation User Fees, Overflight Fees	122	131	140
1130	Property Disposal or Lease Proceeds, Aviation User Fee	7	.....	.....
1199	Total Current Law Receipts	129	131	140
1999	Total Receipts	129	131	140
2000	Total: Balances and Receipts	141	1435	152
	Appropriations:			
	Current Law:			
2101	Aviation User Fees	-138	-140	-140
2132	Essential Air Service and Rural Airport Improvement Fund	9	9	.....
2199	Total current law appropriations	-129	-131	-140
2999	Total appropriations	-129	-131	-140
5099	Balance, end of year	12	12	12

Program and Financing
(in millions of dollars)

Identification code: 69-5422-0-2-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Obligations by program activity:			
0001	Other Collections	2	3	.....
0100	Direct program activities, subtotal	2	3	.....
0900	Total new obligations (object class 25.2)	2	3	.....
	Budgetary resources:			
	Unobligated balance:			
1000	Unobligated balance brought forward, Oct 1	9	14	11
1201	Appropriations (special or trust fund)	138	140	140
1220	Appropriations Transferred to other accounts [069-5423]	-131	-140	-140
1260	Appropriations, mandatory (total)	7	.....	.....
1900	Budget authority (total)	7	.....	.....
1930	Total budgetary resources available	16	14	11
	Memorandum (non-add) entries:			
1941	Unexpired unobligated balance, end of year	14	11	11
	Change in obligated balance:			
	Unpaid obligations:			
3000	Unpaid Obligations, brought forward, Oct 1	1	2	2
3010	New Obligations, unexpired accounts.	2	3	.....
3020	Outlays (gross)	-1	-2	.....
3050	Unpaid Obligations, end of the year	2	2	2
	Memorandum (non-add) entries:			
3100	Obligated balance, start of the year	1	2	2
3200	Obligated balance, end of the year	2	2	2
	Budget authority and outlays, net:			
	Mandatory:			
4090	Budget authority, gross	7	.....	.....
	Outlays, gross:			
4101	Outlays from mandatory balances	1	3	.....

4180	Budget authority, net (total)	7		.....
4190	Outlays, net (total)	1	3	.....

The Federal Aviation Reauthorization Act of 1996 (P.L. 104–264) authorized the collection of user fees for air traffic control and related services provided by the Federal Aviation Administration to aircraft that neither take off nor land in the United States, commonly known as overflight fees. The Budget estimates that $140 million in overflight fees will be collected in 2019.

AVIATION INSURANCE REVOLVING FUND

Program and Financing
(in millions of dollars)

Identification code: 69-4120-0-3-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Request
	Obligations by program activity:			
0801	Program administration	1	1	1
0900	Total new obligations, unexpired accounts	1	1	1
	Budget resources:			
	Unobligated balance:			
1000	Unobligated balance brought forward, Oct. 1	2,147	2,203	2,241
	Budget authority:			
	Spending authority form offsetting collections, mandatory:			
1800	Collected	57	39	57
1930	Total budgetary resources available	2,204	2,242	2,298
	Memorandum (non-add) entries:			
1941	Unexpired unobligated balance, end of year	2,203	2,241	2,297
	Change in obligated balance:			
	Unpaid obligations:			
3000	Unpaid obligations, brought forward, Oct. 1	1	1	1
3010	New Obligations, unexpired accounts	1	1	1
3020	Outlays (gross)	-1	-1	-1
3050	Unpaid obligations, end of year	1	1	1
	Memorandum (non-add) entries:			
3100	Obligated balance, start of year	1	1	1
3200	Obligated balance, end of year	1	1	1
	Budget authority and outlays net:			
	Mandatory:			
4090	Budget authority, gross	57	39	57
	Outlay, gross:			
4100	Outlays from new mandatory authority	1	1	1
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
4120	Federal Sources	-20	.....	.....
4121	Interest on Federal securities	-37	-39	-57
4130	Offsets against gross budget authority and outlays (total)	-57	-39	-57
4170	Outlays, net (mandatory)	-56	-38	-56
4180	Budget authority, net (total)	.....	.....	.....
4190	Outlays, net (total)	-56	-38	-56
	Memorandum (non-add) entries:			
5000	Total investments, SOY: Federal securities: Par value	1,872	2,210	2,247
5001	Total investments, EOY: Federal securities: Par value	2,210	2,247	2,303

The fund provides direct support for the aviation insurance program (chapter 443 of title 49, U.S. Code). In December 2014, Congress sunset part of the aviation insurance program. Specifically, Congress returned U.S. air carriers to the commercial aviation market for all of their war risk insurance coverage by ending the FAA's authority to provide war risk insurance for a premium. Pursuant to 49 USC 44305, the FAA may provide aviation insurance not available commercially, without premium, at the request of the Secretary of Defense or the head of a department, agency, or instrumentality designated by the President when the Secretary of Defense or the designated agency head agrees to indemnify the Secretary of Transportation against all losses covered by the insurance. The "non-premium" aviation insurance program is authorized through December 31, 2018.

Object Classification
(in millions of dollars)

Identification code: 69-4120-0-3-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Request
	Reimbursable obligations:			
25.2	Other Services from Non-Federal sources	1	1	1
99.9	Total new obligations, unexpired accounts	1	1	1

Employment Summary

Identification code: 69-4120-0-3-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Request
2001	Reimbursable Civilian full-time equivalent employment ..	3	3	4

ADMINISTRATIVE SERVICES FRANCHISE FUND

Program and Financing
(in millions of dollars)

Identification code: 69-4562-0-4-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Obligations by program activity:			
0801	Accounting Services	43	51	48
0804	Information Services	125	183	227
0806	Multi Media	2	3	3
0807	FLLI (formerly CMEL/Training)	10	10	8
0808	International Training	4	5	4
0810	Logistics	265	221	227
0811	Aircraft Maintenance	60	62	64
0812	Acquisition	4	4	4
0900	Total new obligations, unexpired accounts	513	539	585
	Budgetary Resources:			
	Unobligated balance:			
1000	Unobligated balance brought forward, Oct 1	260	261	269
1021	Recoveries of prior year unpaid obligations	27	7	.....
1050	Unobligated balance (total)	287	268	269
	Budget authority:			
	Spending authority from offsetting collections, discretionary:			
1700	Collected	487	540	572
1930	Total budgetary resources available	774	808	841
	Memorandum (non-add) entries:			
1941	Unexpired unobligated balance, end of year	261	269	256
	Change in obligated balances:			
	Unpaid obligations:			
3000	Unpaid obligations, brought forward, Oct 1	156	196	158
3010	New obligations, unexpired accounts	513	539	585
3020	Outlays (gross)	-446	-570	-555
3040	Recoveries of prior year unpaid obligations unexpired	-27	-7	.....
3050	Unpaid obligations, end of year	196	158	188
	.....			
	.....			
	Memorandum (non-add) entries:			
3100	Obligated balance, start of year	156	196	158
3200	Obligated balance, end of year	196	158	188
	Budget authority and Outlays, net:			
	Discretionary:			
4000	Budget authority, gross	487	540	572
	Outlays gross:			
4010	Outlays from new discretionary authority	356	367	389
4011	Outlays from discretionary balances	90	203	166
4020	Outlays, gross (total)	446	570	555
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
4030	Federal sources	-485	-538	-570
4033	Non-Federal sources	-2	-2	-2
4040	Offsets against gross budget authority and outlays (total)	-487	-540	-572
4080	Outlays, net (discretionary)	-41	30	-17
4180	Budget authority, net (total)	.....	.....	.....
4190	Outlays, net (total)	-41	30	-17

In 1997, the Federal Aviation Administration (FAA) established a franchise fund to finance operations where the costs for goods and services provided are charged to the users on a fee-for-service basis. The fund improves organizational efficiency and provides better support to FAA's internal and external customers. The activities included in this franchise fund are: training, accounting, travel, duplicating services, multi-media services, information technology, materiel management (logistics), and aircraft maintenance.

Object Classification
(in millions of dollars)

Identification code: 69-4562-0-4-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Reimbursable obligations:			
11.1	Personnel compensation: Full-time permanent	133	141	143
12.1	Civilian personnel benefits	47	50	51
21.0	Travel and transportation of persons	7	6	6
22.0	Transportation of things	4	6	6
23.3	Communications, utilities, and miscellaneous charges	12	13	13
25.2	Other services from non-Federal sources	204	219	259
26.0	Supplies and materials	98	95	98
31.0	Equipment	8	7	7
42.0	Insurance claims and indemnities	.....	2	2
99.9	Total new obligations, unexpired accounts	513	539	585

Employment Summary

Identification code: 69-4562-0-4-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
2001	Reimbursable civilian full-time equivalent employment	1,627	1,627	1,593

AIRPORT AND AIRWAY TRUST FUND

Program and Financing
(in millions of dollars)

Identification code: 69-8103-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Memorandum (non-add) entries:			
5000	Total investments, start of year: Federal securities: Par value	13,400	13,404	13,119
5001	Total investments, end of year: Federal securities: Par value	13,404	13,119	14,640

Section 9502 of Title 26, U.S. Code, provides for amounts equivalent to the funds received in the U.S. Treasury for the passenger ticket tax and certain other taxes paid by airport and airway users to be transferred to the Airport and Airway Trust Fund. In turn, appropriations are authorized from this fund to meet obligations for airport improvement grants, Federal Aviation Administration facilities and equipment, research, operations, payment to air carriers, and for the Bureau of Transportation Statistics Office of Airline Information.

The status of the fund is as follows:

Status of Funds (in millions of dollars)

Identification code: 69-8103-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Unexpended balance, start of year:			
0100	Balance, start of year	14,773	15,088	15,009
0999	Total balance, start of year	14,773	15,088	15,009
	Cash Income during the year:			
	Current law:			
	Receipts			
1110	Excise Taxes, Airport and Airway Trust Fund	15,055	15,736	16,538
1130	Grants-in-aid for Airports (Airport and Airway Trust Fund)	8	1	1
1130	Facilities and Equipment (Airport and Airway and Airport Trust Fund)	80	103	51
1130	Research, Engineering and Development (Airport and Airway Trust Fund)	9	11	11
1150	Interest, Airport and Airway Trust Fund	0	0	19
1150	Interest, Airport and Airway Trust Fund	285	283	319
1160	Grants-in-aid for Airports (Airport and Airway Trust Fund)	1	0	0
1160	Facilities and Equipment (Airport and Airway Trust Fund)	42	58	52
1160	Facilities and Equipment (Airport and Airway Trust Fund)	20	0	0
1160	Research, Engineering and Development (Airport and Airway Trust Fund)	9	11	11
1199	Income under present law	15,500	16,192	16,991
1999	Total cash income	15,500	16,192	16,991
	Cash outgo during year:			
	Current law:			
2100	Payments to Air Carriers (021-04-8301-0)	-157	-144	-116
2100	Trust Fund Share of FAA Activities (Airport and Airway Trust Fund) (021-12-8104-0)	-8,895	-9,389	-8,633
2100	Grants-in-aid for Airports (Airport and Airway Trust Fund) (021-12-8106-0)	-3,292	-3,446	-3,473

2100	Facilities and Equipment (Airport and Airway Trust Fund) (021-12-8107-0)	-2,673	-3,088	-3,028
2100	Research, Engineering and Development (Airport and Airway Trust Fund) (021-12-8108-0)	-170	-204	-163
2199	Outgo under current law (-)	-15,187	-16,271	-15,413
2999	Total Cash outgo (-)	-15,187	-16,271	-15,413
	Surplus Deficit:			
3110	Excluding interest	28	-362	1240
3120	Interest	285	283	338
3199	Subtotal, surplus or deficit	313	-79	1578
	Manual Adjustments:			
3298	Rounding adjustment	2	0	0
3299	Total adjustments	2	0	0
	Unexpended balance, end of year:			
4100	Uninvested balance (net), end of year	1684	1890	1947
4200	Airport and Airway Trust Fund	13,404	13119	14640
4999	Total balance, end of year	15,088	15,009	16,587

TRUST FUND SHARE OF FAA ACTIVITIES
(AIRPORT AND AIRWAY TRUST FUND)

Program and Financing
(in millions of dollars)

Identification code: 69-8104-0-7-402		FY 2017 Actual	FY 2018 Estimate	FY 2019 Estimate
	Obligations by program activity:			
0001	Payment to Operations	9,173	9,111	8,633
0900	Total new obligations (object class 94.0)	9,173	9,111	8,633
	Budgetary resources:			
	Appropriations, discretionary:			
	Budge authority:			
1101	Appropriations (special or trust fund)	9,173	9,111	8,633
1930	Total budgetary resources available	9,173	9,111	8,633
	Change in obligated balance:			
	Unpaid obligations:			
3000	Unpaid obligations, brought forward, Oct 1	.....	278	.....
3010	New obligations, unexpired accounts	9,173	9,111	8,633
3020	Outlays (gross)	-8,895	-	-8,633
			9,389	
3050	Unpaid obligations, end of year	278	.....	.....
	Memorandum (non-add) entries:			
3100	Obligated balance, start of year	.....	278	.....
3200	Obligated balance, end of year	278	.....	.....
	Budget authority and outlays, net:			
	Discretionary:			
4000	Budget authority, gross	9,173	9,111	8,633
	Outlays, gross:			
4010	Outlays from new discretionary authority	8,895	9,111	8,633
4011	Outlays from discretionary balances	.....	278	.....
4020	Outlays, gross (total)	8,895	9,389	8,633
4180	Budget authority, net (total)	9,173	9,111	8,633
4190	Outlays, net (total)	8,895	9,389	8,633

For 2019, the Budget proposes $9,931 million for Federal Aviation Administration Operations, of which $8,633 million would be provided from the Airport and Airway Trust Fund.

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FAA ADMINISTRATIVE PROVISIONS - REQUESTED

Sec. 110. The Administrator of the Federal Aviation Administration may reimburse amounts made available to satisfy 49 U.S.C. 41742(a)(1) from fees credited under 49 U.S.C. 45303 and any amount remaining in such account at the close of that fiscal year may be made available to satisfy section 41742(a)(1) for the subsequent fiscal year.

- In order to satisfy 49 U.S.C. 41742(a)(1), at the beginning of each fiscal year FAA makes available to the Essential Air Services (EAS) program funding from the Facilities & Equipment (F&E) account. This provision ensures that the F&E account is reimbursed from the over-flight fees collected and is needed in order to continue the practice in FY 2019.

Sec. 111. Amounts collected under section 40113(e) of title 49, United States Code, shall be credited to the appropriation current at the time of collection, to be merged with and available for the same purposes of such appropriation.

- As authorized under 49 USC 40113(e), the FAA may provide safety-related training and operational services to foreign aviation authorities with or without reimbursement. While FAA generally enforces a prepayment policy for reimbursable goods and services provided to foreign countries or international organizations, many have laws or regulations similar to the U.S. that prohibit advance payments. In those instances, FAA often receives payments for services provided during a fiscal year after that year has ended. This provision allows FAA to use the funds for additional technical assistance work that cannot be prepaid, instead of returning the funds to a lapsed appropriation.

Sec. 112. None of the funds in this Act shall be available for paying premium pay under subsection 5546(a) of title 5, United States Code, to any Federal Aviation Administration employee unless such employee actually performed work during the time corresponding to such premium pay.

- The provision stems from past legal action taken by air traffic controllers to receive premium pay for a full shift, even if only part of the shift was eligible for premium pay. The FAA recommends retaining this provision as a GP that would apply to all FAA accounts. FAA also recommends keeping this provision for FY 2019 in order to minimize potential payroll liability.

Sec. 113. None of the funds in this Act may be obligated or expended for an employee of the Federal Aviation Administration to purchase a store gift card or gift certificate through use of a Government-issued credit card.

- This provision prohibits FAA employees from using a government-issued credit card to purchase a store gift card or gift certificate. FAA recommends retaining this provision as a GP that would apply to all FAA accounts.

Sec. 114. None of the funds in this Act may be obligated or expended for retention bonuses for an employee of the Federal Aviation Administration without the prior written approval of the Assistant Secretary for Administration of the Department of Transportation.

- The FY 2019 budget proposes to retain the provision that all FAA retention bonuses continue to be approved by the Assistant Secretary for Administration.

SEC. 115. Notwithstanding any other transfer restriction under this Act, not to exceed 10 percent of any appropriation made available for the current fiscal year for the Federal Aviation Administration by this Act or provided by previous appropriations Acts may be transferred between such appropriations for the Federal Aviation Administration, but no such appropriation except as otherwise specifically provided, shall be increased by more than 10 percent by any such transfer: Provided, That funds transferred under this section shall be treated as a reprogramming of funds under section 404 of this Act and shall not be available for obligation unless the Committees on Appropriations of the Senate and the House of Representatives are notified 15 days in advance of such transfer: Provided further, That any transfer from an amount made available for obligation as discretionary grants-in-aid for airports pursuant to section 47117(f) of title 49, United States Code shall be deemed as obligated for grants-in-aid for airports under part B of subtitle VII

of title 49, United States Code for the purposes of complying with the limitation on incurring obligations in this appropriations Act or any other appropriations Act under the heading "Grants-in-Aid for Airports."

- The FY 2019 budget requests additional budget flexibility. While the FAA has long benefited from the ability to seek congressional approval to reprogram limited amounts within budget accounts contained in Section 404(a), there has traditionally been no flexibility at the account level. This new authority in Section 404(b) will allow the FAA to request the transfer of up to 10 percent of any appropriation across accounts, provided that no account is increased by more than 10 percent. Such a transfer would be subject to approval by both congressional Committees on Appropriations.

FEDERAL AVIATION ADMINISTRATION

OPERATIONS

ESTIMATES		APPROPRIATIONS	
2008	[1]8,725,783,000	2008	[2]8,740,000,000
2009	[3]8,998,461,700	2009	[4]9,046,167,000
2010	[5]9,335,798,000	2010	[6,7]9,351,400,000
2011	[8]9,793,000,000	2011	[9]9,516,172,000
2012	[10]9,823,000,000	2012	[11]9,653,395,000
2013	[12]9,517,948,000	2013	[13]9,653,395,000
		2013 Sequester (P.L.112-240)	[14]-485,623,489
		2013 Rescission (P.L. 113-6)	[15]-19,307,790
2014	[16]9,707,000,000	2014	[17]9,651,422,000
2015	[18]9,750,000,000	2015	[19]9,740,700,000
2016	[20]9,915,000,000	2016	[21]9,909,724,000
2017	[22]9,994,352,000	2017	[23]10,025,852,000
2018	[24]9,890,886,000	2018	[26]TBD
2019	[25]9,931,312,000		

[1] Includes $6,243,027,000 from Airport and Airway Trust Fund. FAA did not request funding for this account in FY 2008. Funding was requested in the proposed Safety and Operations and Air Traffic Organization accounts. The Operations amount is shown here for comparative purposes.
[2] Includes $6,397,061,000 from the Airport and Airway Trust Fund.
[3] Includes $6,280,973,000 from Airport and Airway Trust Fund. FAA did not request funding for this account in FY 2009. Funding was requested in the proposed Safety and Operations and Air Traffic Organization accounts. The Operations amount is shown here for comparative purposes.
[4] Includes $5,238,005,000 from Airport and Airway Trust Fund. Also includes $3.7 million transfer from the U.S. Department of State.
[5] Includes $6,207,798,000 from the Airport and Airway Trust Fund.
[6] Includes $4,000,000,000 from the Airport and Airway Trust Fund.
[7] Includes $1,300,000 transfer from the U.S. Department of State.
[8] Includes $6,064,000,000 from the Airport and Airway Trust Fund
[9] Reflects a rescission of $19,066,000 per P.L. 112-55. Includes $4,549,882,000 from Airport and Airway Trust Fund. Also includes $2.3 million transfer from the U.S. Department of State
[10] Includes $4,958,000,000 from the Airport and Airway Trust Fund
[11] Includes $5,060,694,000 from the Airport and Airway Trust Fund
[12] Includes $6,721,000,000 from the Airport and Airway Trust Fund
[13] Reflects funding at the FY 2012 funding level pursuant to P.L. 113-6, Consolidated and Further Continuing Appropriations Act, 2013.
[14] FY 2013 funds sequestered pursuant to the Budget Control Act of 2011 as Amended by The American Taxpayer Relief Act of 2012 (P.L. 112-240).
[15] Reflects a 0.20 percent across-the-board rescission per P.L. 113-6.
[16] Includes $6,484,000,000 from the Airport and Airway Trust Fund
[17] Includes $6,495,208,000 from the Airport and Airway Trust Fund.
[18] Includes $9,040,850,000 from the Airport and Airway Trust Fund.
[19] Includes $8,595,000,000 from the Airport and Airway Trust Fund.
[20] Includes $8,547,000,000 from the Airport and Airway Trust Fund.
[21] Includes $7,922,000,000 from the Airport and Airway Trust Fund.
[22] Includes $7,608,000,000 from the Airport and Airway Trust Fund.
[23] Includes $9,173,000,000 from the Airport and Airway Trust Fund.
[24] Includes $8,100,000,000 from the Airport and Airway Trust Fund
[25]Includes $8,632,721,000 from the Airport and Airway Trust Fund
[26] FAA is operating under continuing resolution through February 8, 2018 per P.L. 115-120

FEDERAL AVIATION ADMINISTRATION

FACILITIES AND EQUIPMENT (AIRPORT AND AIRWAY TRUST FUND)

	ESTIMATES	APPROPRIATIONS
2008	[1]2,461,566,000	2,513,611,000
2009	[2]2,723,510,000	2,742,095,000
2009 Supplemental (P.L.111-5)		[3]200,000,000
2010	2,925,202,000	[4]2,928,315,000
2011	2,970,000,000	[5]2,730,731,000
2012	[6]3,120,000,000	2,730,731,074
2013	2,850,000,000	[7]2,730,731,074
2013 Supplemental (P.L. 113-2)		[8]30,000,000
2013 Sequester (P.L.11-240)		[9]-141,642,505
2013 Rescission (P.L. 113-6)		[10]-5,461,462
2014	2,777,798,000	2,600,000,000
2015	2,603,700,000	2,600,000,000
2016	2,855,000,000	2,855,000,000
2017	2,838,000,000	2,855,000,000
2018	2,766,200,000	[11]TBD
2019	2,766,572,000	

[1] FAA did not request funding for this account in FY 2008. Funding was requested in the proposed Safety and Operations and Air Traffic Organization accounts. The Facilities and Equipment amount is shown here for comparative purposes.
[2] FAA did not request funding for this account in FY 2009. Funding was requested in the proposed Safety and Operations and Air Traffic Organization accounts. The Facilities amount is shown here for comparative purposes.
[3] American Recovery and Reinvestment Act Supplemental per P.L. 111-5, from the General Fund.
[4] Reflects $7,888,294 rescission of prior year authority per P.L. 111-226.
[5] Reflects a rescission of $5,472,000 per P.L. 112-55.
[6] Includes $250,000,000 of mandatory General Fund from the Administration's Infrastructure proposal.
[7] Reflects funding at the FY 2012 funding level pursuant to P.L. 113-6, Consolidated and Further Continuing Appropriations Act, 2013.
[8] Hurricane Sandy Emergency Supplemental, P.L. 113-2
[9] FY 2013 funds sequestered pursuant to the Budget Control Act of 2011 as Amended by The American Taxpayer Relief Act of 2012 (P.L. 112-240). Includes $2,770,000 in offsetting collections.
[10] Reflects a 0.20 percent across-the-board rescission per P.L. 113-6.
[11] FAA is operating under continuing resolution through February 8, 2018 per P.L. 115-120

FEDERAL AVIATION ADMINISTRATION

RESEARCH, ENGINEERING, AND DEVELOPMENT (AIRPORT AND AIRWAY TRUST FUND)

ESTIMATES		APPROPRIATIONS	
2007	130,000,000	2007	130,234,000
2008	[1]140,000,000	2008	146,828,000
2009	[2]171,028,000	2009	171,000,000
2010	180,000,000	2010	190,500,000
2011	190,000,000	2011	[3]169,660,000
2012	190,000,000	2012	167,556,000
2013	180,000,000	2013	[4]167,556,000
		2013 Sequester (P.L.112-240)	[5]-8,429,072
		2013 Rescission (P.L. 113-6)	[6] -335,112
2014	166,000,000	2014	158,792,000
		2014 Rescission	[7]-26,183,998
2015	156,750,000	2015	156,750,000
2016	166,000,000	2016	166,000,000
2017	167,500,000	2017	176,500,000
2018	150,000,000	2018	[8]TBD
2019	74,406,000		

[1] Includes $122,867,000 from the Airport and Airway Trust Fund and $17,133,000 from the General Fund.
[2] Includes $156,003,000 from the Airport and Airway Trust Fund and $15,025,000 from the General Fund.
[3] Reflects a $340,000 rescission per P.L. 112-55.
[4] Reflects funding at the FY 2012 funding level pursuant to P.L. 113-6, Consolidated and Further Continuing Appropriations Act, 2013.
[5] FY 2013 funds sequestered pursuant to the Budget Control Act of 2011 as Amended by The American Taxpayer Relief Act of 2012 (P.L. 112-240).
[6] Reflects a 0.20 percent across-the-board rescission per P.L. 113-6.
[7] Reflects a $26,183,998 rescission, per P.L. 113-76.
[8] FAA is operating under continuing resolution through February 8, 2018 per P.L. 115-120

FEDERAL AVIATION ADMINISTRATION

GRANTS-IN-AID FOR AIRPORTS
(LIQUIDATION OF CONTRACT AUTHORIZATION)
(AIRPORT AND AIRWAY TRUST FUND)

ESTIMATES		APPROPRIATIONS	
2008	4,300,000,000	2008	4,399,000,000
2009	3,600,000,000	2009	3,600,000,000
		2009 Supplemental	[1]1,100,000,000
2010	3,000,000,000	2010	3,000,000,000
2011	3,550,000,000	2011	3,550,000,000
2012	3,600,000,000	2012	3,435,000,000
2013	3,400,000,000	2013	3,435,000,000
2014	3,200,000,000	2014	3,200,000,000
2015	3,200,000,000	2015	3,200,000,000
2016	3,500,000,000	2016	3,600,000,000
2017	3,500,000,000	2017	3,750,000,000
2018	3,000,000,000	2018	[2]TBD
2019	3,000,000,000		

[1] American Recovery and Reinvestment Act Supplemental, per P.L. 111-5, from the General Fund.
[2] FAA is operating under continuing resolution through February 8, 2018 per P.L. 115-120

FEDERAL AVIATION ADMINISTRATION

GRANTS-IN-AID FOR AIRPORTS
LIMITATION ON OBLIGATIONS
(AIRPORT AND AIRWAY TRUST FUND)

ESTIMATES		APPROPRIATIONS	
2008	(2,750,000,000)	2008	(3,514,500,000)
2009	(2,750,000,000)	2009	(3,514,500,000)
2010	(3,515,000,000)	2010	(3,515,000,000)
2011	(3,515,000,000)	2011	(3,515,000,000)
2012	(2,424,000,000)	2012	(3,350,000,000)
2013	(2,424,000,000)	2013	[1](3,343,300,000)
2014	(2,900,000,000)	2014	(3,350,000,000)
2015	(2,900,000,000)	2015	(3,350,000,000)
2016	(2,900,000,000)	2016	(3,350,000,000)
2017	(2,900,000,000)	2017	(3,350,000,000)
2018	(3,350,000,000)	2018	[2]TBD
2019	(3,350,000,000)		

1 Reflects funding at the FY 2012 funding level pursuant to P.L. 113-6, Consolidated and Further Continuing Appropriations Act, 2013, minus the 0.20% across-the-board rescission.

2 FAA is operating under continuing resolution through February 8, 2018 per P.L. 115-120

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SECTION 4. RESEARCH
DEVELOPMENT & TECHNOLOGY

EXHIBIT IV-1
DEPARTMENT OF TRANSPORTATION
BUDGET AUTHORITY
($ in Thousands)

	FEDERAL AVIATION ADMINISTRATION	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request	Applied	Development
A.	**Research, Engineering and Development**	**176,500**	**175,301**	**74,406**	**74,406**	
A11	**Improve Aviation Safety**	**105,370**	**104,718**	**43,935**	**43,935**	
a.	Fire Research and Safety	7,425	7,394	4,867	4,867	
b.	Propulsion and Fuel Systems	2,074	2,058	555	555	
c.	Advanced Materials/Structural Safety	6,500	6,451	2,300	2,300	
d.	Aircraft Icing/Digital System Safety	5,102	5,079	7,684	7,684	
e.	Continued Airworthiness	9,269	9,214	4,969	4,969	
f.	Aircraft Catastrophic Failure Prevention Research	1,528	1,517			
g.	Flightdeck/Maintenance/System Integration Human Factors	7,305	7,274	5,052	5,052	
h.	System Safety Management	6,500	6,463	799	799	
I.	Air Traffic Control/Technical Operations Human Factors	6,165	6,157	1,436	1,436	
j.	Aeromedical Research	8,535	8,514	3,875	3,875	
k.	Weather Program	15,476	15,346	6,580	6,580	
l.	Unmanned Aircraft Systems Research	20,035	19,872	3,318	3,318	
m.	NextGen - Alternative Fuels for General Aviation	7,000	6,947			
m.	Commercial Space Transportation Safety	2,456	2,432	2,500	2,500	
A12	**Improve Efficiency**	**22,243**	**22,066**	**8,647**	**8,647**	
	Joint Planning and Development Office (JPDO)					
a	NextGen - Wake Turbulence	8,609	8,540	3,519	3,519	
b	NextGen - Air Ground Integration Human Factors	8,575	8,504	1,336	1,336	
c	NextGen - Weather Technology in the Cockpit	4,059	4,031	1,525	1,525	
	NextGen - Flight Data Exchange			1,035	1,035	
d	NextGen - Information Security	1,000	991	1,232	1,232	
A13	**Reduce Environmental Impact**	**43,187**	**42,834**	**19,166**	**19,166**	
a.	Environment and Energy	16,013	15,893	11,588	11,588	
b.	NextGen - Environmental Research - Aircraft Technologies, Fuels, and Metrics	27,174	26,941	7,578	7,578	
A14	**Mission Support**	**5,700**	**5,683**	**2,658**	**2,658**	
a.	System Planning and Resource Management	2,288	2,282	1,480	1,480	
b.	William J. Hughes Technical Center Laboratory Facility	3,412	3,401	1,178	1,178	
B.	**Facilities & Equipment**	**199,460**	**208,100**	**223,889**		**223,889**
a.	Advanced Technology Development and Prototype	24,800	26,800	33,000		33,000
b.	Plant	32,200	31,000	33,000		33,000
c.	Center for Advanced Aviation System Development (CAASD)	60,000	57,000	57,000		57,000
d.	NextGen Research & Development	82,460	93,300	100,889		100,889
C.	**Grants-In-Aid for Airports, Airport Technology**	**46,375**	**46,060**	**48,194**	**48,194**	
a.	Airport Technology Research	31,375	31,162	33,194	33,194	
b.	Airport Cooperative Research	15,000	14,898	15,000	15,000	
D.	**Operations**	**10,547**	**10,461**	**4,494**		**4,494**
E.	**Commercial Space Transportation Safety**	**0**	**0**	**0**		
	Subtotal, Research and Development Total	**400,682**	**408,922**	**317,983**	**122,600**	**195,383**
	Subtotal , Facilities (F) Total	**32,200**	**31,000**	**33,000**	**0**	**33,000**
	TOTAL FAA	**432,882**	**439,922**	**350,983**	**122,600**	**228,383**

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SECTION 5. NEXTGEN

Next Generation Air Transportation System (NextGen)

For FY 2019, the President's Budget requests a total of $952.6 million for the Next Generation Air Transportation System.

INTRODUCTION

NextGen is not a single program, rather a transformative change in the management and operation of how we fly. Much of the transformative change that NextGen is making is called Trajectory Based Operations (TBO). NextGen encompasses many programs, systems, and procedures, at different levels of maturity, and supports investments to develop and deploy capabilities in addition to new infrastructure. Some are being deployed now; some are in development and nearing deployment with additional capabilities being defined as the technology necessary for them becomes available. This is an exciting time due to fact there is a confluence of NextGen capabilities coming together that are making TBO a reality for all of our stakeholders. The FAA is working closely with the NextGen Advisory Committee (NAC), made up of industry stakeholders, to bring the vision of TBO to pass.

The FAA has made significant progress and is now moving several significant programs out of development and into baseline and operational programs such as Data Communications (Data Comm), Time-Based Flow Management (TBFM), Automatic Dependent Surveillance-Broadcast (ADS-B), Terminal Flight Data Manager (TFDM) and System Wide Information Management (SWIM). In addition, significant strides have been made in integrating Unmanned Aircraft Systems (UAS) into the National Airspace System. Our stakeholders are beginning to experience the benefits of NextGen investments, and we have already provided the several significant capabilities to the aviation community.

The benefits are highlighted in NextGen's accomplishments below.

- Data Communications. The NextGen Data Comm program is making pilot and controller exchanges more efficient and reliable. The effort enables air traffic controllers to send text-based departure clearance instructions to flight crews of equipped aircraft instead of speaking over the radio. As part of the NextGen Priorities, FAA has enabled text-based departure clearances (DCL) for equipped aircraft at 55 airports almost two and half years ahead of schedule. Seven additional airports have been added to receive the DCL capability. One of these seven has been completed, with the rest to follow soon. Additionally, initial flight trials at Kansas City Air Route Traffic Control Center (ARTCC) for initial En Route Data Comm have proven successful.
- Time Based Flow Management. TBFM uses Time Based Metering to optimize use of National Airspace capacity. TBFM provides departure decision support for departures into En Route airspace and arrival metering to destination airports. It determines specific time of arrival for points in an aircraft's route, resulting in a systemic and efficient flow of aircraft to the terminal airspace, beginning hundreds of miles away. The TBFM capability will be expanded over the next few years with the introduction of the Terminal Sequence and Spacing (TSAS) tool, with the first deployment in 2019 followed by a phased deployment of eight additional sites at some of the largest airports in the country. TSAS is an air traffic control tool that enables aircraft to fly and remain on optimized, fuel-efficient descents all the way to the runway.
- Satellite-Based Surveillance and Navigation via the Automatic Dependent Surveillance-Broadcast (ADS-B). The FAA completed the baseline deployment of the ground stations in 2014. ADS-B has now been integrated into all En Route automation platforms, which control high-altitude traffic. Similar system upgrades in our terminal radar approach control facilities are also on track and will be completed by 2019. As of January 2018, 35,103 general aviation aircraft and 1,576 commercial aircraft have been equipped with ADS-B avionics. General aviation pilots in properly equipped aircraft have subscription-free access to traffic and weather nation-wide. The FAA is working with industry to resolve barriers delaying operators from equipping with ADS-B Out avionics to meet the ADS-B mandate by January 1, 2020.
- Terminal Flight Data Manager. The Terminal Flight Data Manager (TFDM) will revolutionize how the agency manages traffic on the airport surface. The technology represents a significant modification to tower automation by providing real-time updates on the intent and movement of aircraft on the airport surface. This information helps for making the operation more predictable which results in minimizing

taxi-time and maximizing the use of available airport capacity. The FAA awarded the TFDM contract this past June. The TFDM Team has accomplished early implementation of system components (Electronic Flight Strips, Electronic Data Exchange and the Surface Visualization Tool) at five sites before the full system deployment to 89 sites starts in 2020.

- Unmanned Aircraft Systems. The FAA collaborates internally and maintains extensive partnerships across government, industry, and academia to develop integrated plans that support the development of regulations, policies, procedures, guidance, and standards for UAS operations. Extensive applied research activities are underway in the form of flight tests, modeling and simulation, technology evaluations, risk assessments, and data gathering and analysis in support of the safe integration of UASs in the NAS. Accomplishments to date include the release of the Part 107 rule which allows for safe, routine civil operation of small Unmanned Aircraft Systems in the NAS and the certification of pilots. The FAA is developing the Low Altitude Authorization and Notification Capability (LAANC) to provide small UAS operators near real-time processing of airspace notifications and automatic approval of requests that are below approved altitudes in controlled airspace. A LAANC prototype is being evaluated in the field which includes 10 Air Traffic facilities and nearly 50 airports. The FAA is working with the National Aeronautics and Space Administration (NASA) to develop and implement a low altitude traffic management system known as UAS Traffic Management (UTM) for small UASs. The FAA is also maturing the Concept of Operations and identifying NAS requirements to support integrated UAS operations that are managed by the air traffic management system.

- Data Standards and Information Management. The FAA has developed standards to enable information sharing among various users and stakeholders, allowing for better coordination, situational awareness, and collaborative decision making. These standards address flight, weather, and aeronautical information and are updated annually in collaboration with industry and the international community, including the International Civil Aeronautical Organization and International Air Transport Association. Through SWIM, this data is collected, managed, and disseminated to support NAS operations.

The FY 2019 requested funding will allow the FAA to continue the on-going development and implementation of operational improvements to safely and efficiently operate the NAS, which encompass the deployment of new systems, technologies, and procedures that will help reduce delays, expand air traffic system capacity, and mitigate aviation's impact on the environment while ensuring the highest levels of safety. The entire NextGen portfolio totals $952.6 million distributed among Facilities & Equipment (F&E) programs ($832.6 million), Research, Engineering & Development (RE&D) programs ($19.5 million) and Operations activities ($100.5 million).

The FY 2019 funding will be used to achieve the NextGen goals that have the largest benefits and the biggest need by focusing the deployment on enhancements at "optimal" sites and delivering ready capabilities now. The FAA's investments are consistent with the *NextGen Priorities Joint Implementation Plan*[1] report delivered to Congress in November 2016 and updated every two years.

Table 1 below shows the Budget Line Items (BLIs) and detailed funding and program requirements can be found in the budget narrative, Section 3. Table 2, located on the last page of this section, gives the section and page number of the specific locations. Line item detail for each account is shown in the table below.

[1] https://www.faa.gov/nextgen/media/NG_Priorities_Joint_Implementation_Plan.pdf

NextGen Program Summary

	FY 2017 Actual ($M)	FY 2018 Annualized CR ($M)	FY 2019 Request ($M)
Facilities and Equipment	**$900.4**	**$907.5**	**$832.6**
NextGen - Separation Management Portfolio	$32.8	$13.5	$16.6
NextGen – Traffic Flow Management Portfolio	$0.0	$10.8	$14.0
NextGen - Improved Surface	$2.0	$0.0	$0.0
NextGen - On Demand NAS Portfolio	$11.5	$12.0	$20.5
NextGen - Improved Multiple Runway Operations Portfolio	$6.5	$0.0	$0.0
NextGen - NAS Infrastructure Portfolio	$17.7	$17.5	$13.5
NextGen – Support (NIEC, Test Bed) Portfolio	$12.0	$12.0	$12.8
NextGen - System Safety Management Portfolio	$17.0	$16.2	$14.7
NextGen – Unmanned Aircraft System (UAS)	$0.0	$18.5	$14.0
NextGen – Enterprise, Concept Development, Human Factors and Demonstration Portfolio	$0.0	$9.0	$9.5
Performance Based Navigation and Metroplex Portfolio	$17.5	$20.0	$20.0
NextGen - Communications in Support of NextGen	$232.0	$178.1	$113.9
En Route Automation Modernization (ERAM) - System Enhancements	$78.0	$86.3	$102.1
System - Wide Information Management (SWIM)	$43.8	$50.1	$58.8
ADS - B NAS Wide Implementation	$154.8	$139.2	$123.7
Collaborative Air Traffic Management (CATMT) Portfolio	$13.8	$9.0	$17.7
Terminal Flight Data Manager (TFDM)	$42.2	$90.4	$119.3
Tactical Time Based Flow Management (TBFM)	$50.6	$40.5	$21.2
Next Generation Weather Processor (NWP)	$27.8	$35.5	$24.7
NAS Voice System (NVS)	$48.4	$68.8	$43.2
SBS Advanced Surveillance Enhanced Procedural Separation	$0.0	$5.3	$0.0
Flight Interfacility Data Interface (FIDI) Modernization	$13.0	$0.0	$0.0
Aeronautical Information Management Program (AIM)	$10.4	$6.2	$6.8
Cross Agency NextGen Management	$2.0	$1.0	$1.0
Activity 5 F&E PCBT - NextGen Staffing*	$66.6	$67.9	$64.8
Research Engineering and Development (RE&D)	**$76.4**	**$75.7**	**$19.5**
NextGen - Alternative Fuels for General Aviation	$7.0	$6.9	$0.0
NextGen- Flight Deck Data Exchange Requirements	$0.0	$0.0	$1.0
NextGen- Information Security	$1.0	$1.0	$1.2
NextGen - Wake Turbulence	$8.6	$8.5	$3.5
NextGen - Air Ground Integration	$8.5	$8.5	$1.3
NextGen - Weather in the Cockpit	$4.1	$4.0	$1.5
NextGen - Environmental Research, Aircraft Technologies, Fuels and Metrics	$27.2	$26.9	$7.6
Unmanned Aircraft Systems Research	$20.0	$19.9	$3.3
Operations	**$97.7**	**$98.2**	**$100.5**
NextGen Staffing	$33.0	$33.6	$31.2
NextGen Unmanned Aircraft System	$51.1	$50.8	$50.8
Performance Based Navigation (PBN) Activities	$13.7	$13.8	$18.5
Total NextGen Programs (Totals may not add due to rounding)	**$1,074.5**	**$1,081.4**	**$952.6**

NextGen's Planned Accomplishments – Building on Investments

In FY 2019 NextGen plans to build upon the past achievements particularly in the areas of data communication, networkable voice communication and air traffic management. The FY 2019 funding will support implementation of the following NextGen capabilities:

- Data Communications. The FAA is increasing its focus on the way information is transferred between the cockpit and air traffic control facilities. The use of voice communication is labor intensive, time consuming, and limits the ability of the NAS to effectively meet future traffic demand. Data Comm is allowing controllers and pilots to communicate with digitally delivered written messages. The next steps for Data Comm will be adding benefits like in-flight rerouting with initial En Route services in high altitude airspace, which will be available at all 20 En Route centers by 2021.

- Time-Based Flow Management. NextGen capabilities will provide a number of improvements to terminal area operations that save fuel, increase predictability and minimize holding patterns, delaying vectors and other such maneuvers. The time-based flow management tool monitors departure demand and identifies departure slots, provides distributed, electronic communication that enables software based communication for departure time negotiation instead of phone based communication. It analyzes flights approaching an airport from hundreds of miles away, across air traffic control facility boundaries, and calculates scheduled arrival times to reduce low altitude delays and holding. To

increase the benefit and usage of performance based procedures in the busiest terminals, the tool will provide arrival sequence and spacing guidance to allow the aircraft to fly the fuel efficient procedure, while maintaining runway throughput. These NextGen advances will support controllers in overcoming obstacles to implementing Performance Based Navigation (PBN) and improve the flow of arrival traffic by efficiently maximizing the use of existing capacity, saving fuel and reducing emissions.

- NAS Voice System. Future air traffic operations as envisioned by NextGen will require a new flexible, networkable voice communications system with flexible networking capabilities. NAS Voice System (NVS) is a Voice Over Intranet Protocol system that will carry the ground portion of voice communications digitally over the secure FAA Telecommunications Infrastructure. NVS software is being tested by the developers in preparation for testing at the FAA Technical Center in 2018. Initial FAA operational testing and evaluation using NVS for communication with aircraft in the NAS will occur at three sites in 2019: Seattle Center, Seattle Terminal Radar Approach Control (TRACON), and Seattle-Tacoma International Airport. After the evaluation phase, NVS will first roll out to 20 En Route centers between 2020 and 2025.

- Terminal Flight Data Manager (TFDM). TFDM will provide an integrated approach to maximize the efficient collection, distribution, and update of data, including flight information in the terminal area, the status of airspace around an airport and airport surface data to improve access to information necessary for safe and efficient ATC. The tool will consist of Electronic Flight Data/Electronic Flight Strips, system interfaces with EFD, and Departure Scheduler.

Unmanned Aircraft Systems

Safe, efficient, and timely integration of UAS into the NAS poses challenges to FAA and the aviation industry. UAS often use new or novel technologies to achieve unique operational capabilities that challenge the expectations of current NAS users. Integrating UAS in the NAS will potentially affect the entire system, as a result of the various sizes of the aircraft, which can range from less than a foot to the size of a commercial jet. UAS operations have increased dramatically in both the public and civil sectors. This proliferation introduces greater operational risk and exposure to the users of the NAS. The FY 2019 work to support integration of UAS into the NAS spans the RE&D, F&E, and Operations appropriations and totals approximately $73.2 million for contract and personnel compensation costs.

F&E funding requested supports the overall analysis and planning for the development, integration, and subsequent implementation of emerging UAS enabling technologies. These activities are essential to the FAA's objective of integrating UAS operations into the NAS. The proliferation of UAS 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. This program will continue to identify and mature concepts and capabilities to facilitate the safe and timely integration of UAS into the NAS. In addition, the funding requested will allow the FAA to develop and implement a UAS Flight Information Management (FIM) to effectively support the management of UAS operations by providing a means for UAS operators to notify the FAA prior to operating in the NAS. A joint NASA/FAA Research Transition Team (RTT) effort was established to ensure that UTM research and development needed for NextGen implementation is identified, quantified, conducted, and effectively transferred. The joint NASA/FAA RTT will develop the UTM concept, the prototype for FIMS and support the establishment of the UTM system pilot program.

The RE&D request will further FAA efforts by studying safety implications of new aircraft operational concepts and technology and supporting the development of new and modified regulatory standards. UAS specific technical issues, such as detect and avoid, datalink aircraft control and communication with air traffic control, small UAS low altitude traffic management and electronic identification and tracking requirements, will require research efforts to promote the ultimate integration of these systems into the NAS. Incorporation of new technologies is needed and may include communications, surveillance, and automation changes to support continued evolution of UAS in the NAS. Challenges associated with integrating UAS in the NAS include the inability of UAS to comply with traditional see and avoid requirements, unique communication needs, procedures in the event that the operator loses contact with the unmanned aircraft, and other issues which dictate that concept engineering activities address all aspects associated with UAS integration.

The FAA is adapting services and regulatory approaches in order to integrate UAS operations into the National Airspace System in a timely fashion and with the same level of safety and efficiency as other legacy operations. These activities include reviewing and approving applications and waiver requests for specific UAS operations and maintaining the IT systems and tools that support the application process. FAA will analyze the results of research and develop standards to protect safety. As new standards are implemented, FAA will train its workforce, continue educating and coordinating with stakeholder groups, and work with law enforcement agencies, airports, and other government agencies (Federal, state and local) to ensure public safety and security.

Successful integration of UAS into the NAS provides benefits to both public and civil users. Studies indicate benefits when UAS are used in missions related to agriculture, search and rescue, border protection and pipeline monitoring among other applications. These public and civil users, as well as the general public and commercial and general aviation, benefit from the work being conducted under this program since it leads to safe UAS integration.

FAA Stakeholder Collaboration to Achieve NextGen Benefits

Radio Technical Commission for Aeronautics (RTCA) is a private, not for profit association, comprised of representatives from industry, government and academia that develop technical guidance and standards used by the Federal government regulatory authorities. From time to time, when the FAA has a unique and immediate need for input from the aviation community on a specific issue, they will ask RTCA to establish a Task Force. In 2009, the RTCA Task Force Five was convened to make recommendations to the FAA as to how to efficiently transition to the Next Generation Air Transportation System. As a by-product of this collaboration, the NextGen Advisory Committee (NAC) was formed. The NAC identifies high-benefit, high-readiness NextGen capabilities for implementation in the near term. The NAC meetings have enabled the FAA and industry to reach agreement on all of the high-priority, high-readiness capabilities, with the FAA committing to specific site implementation plans and industry ensuring operator preparedness to take full advantage of NextGen benefits. This has been a contributing factor in the FAA's successful optimization of NextGen investments.

In November 2016, the FAA delivered the *NextGen Priorities Joint Implementation Plan*[1] to Congress, which outlined a plan to implement a number of high-priority NextGen capabilities in four focus areas described below: Multiple Runway Operations, Performance Based Navigation, Surface Operations and Data Sharing, and Data Communications. A new plan is developed every two years and includes a three-year window of joint implementation planning, implementation, and industry commitments.

The FAA and industry jointly updated NextGen priorities commitments through 2019 and codified those in the NextGen Priorities Joint Implementation Rolling Plan, 2017-2019. The latest plan provides additional focus to surface management through the deployment of the TFDM contract, as well as additional focus to optimizing PBN through TBFM enhancements. The FAA and industry have completed 141 of 143 milestones on time with more than 60 completed ahead of schedule, ranging from large-scale Metroplex airspace redesigns to targeted tasks such as merging data streams among the FAA and airline operators. These priorities are providing tangible benefits to industry.

- Multiple Runway Operations (MRO): The efficiency of parallel runways, particularly those that are closely spaced, has been limited by a variety of factors that influence safety risk, including collision avoidance and the interplay of wake vortices (also known as wake turbulence) with nearby aircraft. MRO capabilities improve access to these runways and can increase basic runway capacity and throughput by reducing aircraft separation based on improved wake categorization standards. Improved access will enable more arrivals and/or departures during instrument meteorological conditions, which will increase efficiency and reduce flight delays. These commitments are a subset of the FAA's overall programs and activities to address these issues.

- Performance Based Navigation: The FAA is moving to a PBN NAS and has published the *PBN NAS Navigation Strategy 2016*, which was coordinated with and endorsed by the NAC. With PBN, the FAA delivers new routes and procedures that primarily use satellite-based navigation and onboard aircraft

[1] https://www.faa.gov/nextgen/media/NG_Priorities_Joint_Implementation_Plan.pdf

equipment to navigate with greater precision and accuracy. PBN provides a basis for to design and implement repeatable flight paths and airspace redesign that increases access to airspace near obstacles and terrain. Benefits include shorter and more-direct flight paths, improved airport arrival rates, enhanced controller productivity, increased safety due to repeatable and predictable flight paths, more-stabilized approaches, fuel savings and a reduction in aviation's environmental impact. These commitments are a subset of the overall series of PBN activities that the FAA plans to implement.

- Surface Operations and Data Sharing: Some of the greatest NextGen efficiencies can be gained when aircraft are still on the ground, at the gate and when connecting the surface to the En Route airspace. The FAA commits to implementing surface improvements through the deployment of TFDM, by exchanging more data with more stakeholders, and by completing feasibility assessments of other capabilities of interest. The goal of these enhancements is to measurably increase predictability and provide actionable and measurable surface efficiency improvements. These commitments are a subset of the overall series of programs and activities. The FAA plans to improve operations in these domains.

- Data Communications: The Data Comm program will provide digital communications services between pilots and air traffic controllers as well as enhanced air traffic control information to airline operations centers. Data Comm will provide a data interface between ground automation and the flight deck for controller and pilot communications for safety-of-flight clearances, instructions, traffic flow management, flight crew requests and reports. Data Comm is critical to the success of NextGen, enabling efficiencies not possible with the current voice system. These services will enhance safety by reducing communication errors, increase controller productivity by reducing communication time between controllers and pilots, and increase airspace capacity and efficiency while reducing delays, fuel burn and carbon emissions.

These are capabilities that will provide significant near-term benefits to NAS users. The commitments for CY 2017-2019 are listed in the table below.

Focus Area	CY 2017	CY 2018	CY 2019
Multiple Runway Operations	Wake Recategorization: Miami International Airport (MIA) Q2; Minneapolis-St. Paul International Airport (MSP) Q2; Washington Dulles International Airport (IAD) Q3; McCarran International Airport (LAS) Q4; and Phoenix Sky Harbor International Airport (PHX) Q4 Amend Dependent Runway Separation Order 7110.308A San Francisco International Airport (SFO) Triple Independent Parallel Operations: Q3 at ATL and IAD Amend National Standards for Vertical Navigation (VNAV) for Simultaneous Independent Parallel Approaches Dependent Parallel Operations for Runways Greater than 4,300 Feet: Q1 CY2017 at Louisville International Airport (SDF), Phoenix Sky Harbor Airport (PHX), Cincinnati/Northern Kentucky International Airport (CVG) and Memphis International Airport (MEM) Feasibility Assessment - Removal of VNAV Requirement for Simultaneous Independent Parallel Approaches Benefits Assessment to Upgrade RECAT Sites to Phase II	Wake Recategorization: PHL Q4; SAT Q4; HNL Q4; DTW Q4; and SEA Q4 Assessment of Time Based Wake Separation Concept for use Q4	Wake Recategorization: BOS Q4; and DFW Q4

Focus Area	CY 2017	CY 2018	CY 2019
Performance Based Navigation	Metroplex CLT Metroplex LAS Design Start Advanced RNP Advisory Circular 90-105; Assess Potential demo sites; Design Guidance New Vertical Guidance Criteria and Location Guidance Established on Required Navigation Performance (EoR) SEA Review Feasibility Assessment: EoR RF (DEN, IAH) and EoR TF (CLT, ATL, SDF, DFW) (Industry) Boeing to provide data on their utility and usability GYY (Industry) JetBlue to provide data on their utility and usability BOS EoR (RF Duals + Triples) Required Navigation Performance 1 Departures at BUR; SNA EoR Independent/Dependent Operations Capacity Analysis (Industry) PBN Lead Operator Roles Redefined EDO Feasibility Assessment EoR If 5.9.7 is Achieved and Applicable; Begin EoR Operations with Modified RF Procedures at DEN EoR Site Selection Decision Single Site Implementations HND, AUS (2 sites) TBFM GIM-S (3 sites) EDO Authorization to Operate DFW, ATL (2 sites) EoR Feasibility Assessment: Concurrent use of Track to Fix and Radius to Fix (Industry) American to provide data on utility and usability CTL (Industry) Delta to provide data on their utility and usability ATL (Industry) FedEx to provide data on utility and usability EFVS IND	TBFM Decision Support Tools - Integrated Departure Arrival Capability (IDAC) (1 site Q4) Southwest to provide data on their utility and usability AUS OPD (Q2) EoR RF/TF to xLS Safety Analysis (Q2) EoR If Favorable Outcome of Independent Duals/Triples Safety Analysis; Develop and Approve Document Change Proposal (DCP) to 7110.65 paragraph 5.9.7 (Q2) EoR If 5.9.7 is Achieved and Applicable; Begin EoR Operations with Modified RF Procedures IAH (Q2) (Industry) Delta Airlines to provide data on their utility and usability ATL EDO(Q2) (Industry) Delta Airlines to provide data on their utility and usability DFW EDO (Q2) (Industry) NBAA to provide data on their utility and usability for HND RNAV SID (Q2) (Industry) Southwest Airlines to provide data on their utility and usability for DEN RF (Q3) (Industry) United Airlines to provide data on their utility and usability IAH RF (Q3)	TBFM Decision Support Tools - Integrated Departure Arrival Capability (IDAC) (4 sites Q4) TBFM Decision Support Tools - Terminal Sequencing and Spacing (TSAS) (Q4) EoR Dependent Operations Safety Assessment (Q1) (Industry) NBAA to provide data on their utility and usability LAS (Q4)
Surface Operations and Data Sharing	(Industry) Lead Operator, American Airlines to provide data for Charlotte Surface Departure Management (Industry) Flight Operators Conduct Outreach to Facilitate Data Sharing participation from Additional Flight Operators	(Industry) Data Sharing: Additional Airports Providing Data (Q2)	

Focus Area	CY 2017	CY 2018	CY 2019
	(Industry) Data Sharing: Airports Supplement Actual In Block Time (AIBT), Actual Off Block Time (AOBT), Actual Take Off Time (ATOT), Actual Landing Time (ALDT) FAA to Increased Data Sharing providing Surface Surveillance MLAT CAT 10 data (MA and Incidental NMA) to Industry via SWIM Surface Departure Management Demonstration Charlotte (ATD-2) (Industry) Data Sharing: Flight Operators Provision of specific examples of desired TFM data not currently available via SWIM		
Data Communications (Data Comm)	Implementation Framework for non-VHF Digital Link (VDL) Mode 2 media (Pre-Implementation) (Industry) Implementation Framework for non-VHF Digital Link (VDL) Mode 2 media (Industry)		IOC for Initial En Route Services (Q3) (Industry) Airlines to Equip 1,900 Aircraft (Q4)

NextGen Staffing

The NextGen initiatives crosscut FAA's organizational structures and lines of business. Based on the crosscutting structure, FAA tracks and reports NextGen dedicated staffing levels. The NextGen dedicated staffing is defined as employees who spend 50 percent or more of their time on NextGen-related activities.

The table below shows our updated NextGen "dedicated" staffing levels.

Appropriation/Organization	FY 2017 Actual			FY 2018 Annualized CR			FY 2019 Request		
	FTP Positions	EOY	FTE	FTP Positions	EOY	FTE	FTP Positions	EOY	FTE
Facilities and Equipment (F&E)									
ANG:									
F&E Activity 5, Personnel & Related Expenses - NextGen Staffing (Various Programs/Projects)	298	298	298	290	290	290	280	280	280
ATO:									
F&E Activity 5, Personnel & Related Expenses - NextGen Staffing (Various Programs/Projects)	54	54	54	54	54	54	60	60	60
AFN:									
F&E Activity 5, Personnel & Related Expenses - NextGen Staffing (Various Programs/Projects)	45	45	45	37	37	37	37	37	37
AVS:									
F&E Activity 5, Personnel & Related Expenses - NextGen Staffing (Various Programs/Projects)	30	30	30	46	46	46	46	46	46
Subtotal, NextGen F&E	**427**	**427**	**427**	**427**	**427**	**427**	**423**	**423**	**423**
Research, Engineering & Development (R,E&D)									
ANG:									
NextGen – Wake Turbulence; Air Ground Integration; Self Separation; Weather in the Cockpit	12	12	12	17	17	17	6	6	6
APL:									
NextGen – Environmental Research, Aircraft Technologies, Fuels and Metrics	4	4	4	5	5	5	2	2	2
Subtotal, NextGen R,E&D	**16**	**16**	**16**	**22**	**22**	**22**	**8**	**8**	**8**
Operations									
ANG: NextGen Staffing	52	52	52	41	41	41	37	37	37
ATO: NextGen Staffing	64	64	64	57	57	57	60	60	60
AVS: NextGen Staffing	75	75	75	100	100	100	85	85	85
AFN: NextGen Staffing	13	13	13	9	9	9	13	13	13
AOC: NextGen Staffing	1	1	1	0	0	0	1	1	1
APL: Integrate Environmental Performance into NextGen; Environmental/Noise Studies	8	8	8	4	4	4	4	4	4
Subtotal, NextGen Operations	**213**	**213**	**213**	**211**	**211**	**211**	**200**	**200**	**200**
Total NextGen Staffing	**656**	**656**	**656**	**660**	**660**	**660**	**631**	**631**	**631**
ANG	362	362	362	348	348	348	323	323	323
ATO	118	118	118	111	111	111	120	120	120
AVS	105	105	105	146	146	146	131	131	131
APL	12	12	12	9	9	9	6	6	6
AFN	58	58	458	46	46	46	50	50	50
AOC	1	1	1	0	0	0	1	1	1

NextGen Benefits

The FAA and its partners continue to make significant progress in the modernization of our air traffic infrastructure and transformation of our operation. NextGen improvements and increased operator equipage are resulting in more and more benefits to airlines, passengers, the FAA, and other users. Continued success demands industry collaboration and operator equipage to compliment air traffic management modernization.

Over the last 16 months, the Joint Assessment Team (created by the NAC) has evaluated four NextGen capabilities across seven sites. These joint FAA/Industry assessments have improved Industry's confidence

in the quantification of achieved benefits as well as providing important insights on how NextGen implementations may be improved. Continuing to communicate, collaborate, and, when feasible, vet our assumptions on historical and future benefits with the aviation industry through the NAC will play an important role in the success of NextGen.

Next Generation Air Transportation System (NextGen)
Budget Narrative Reference Guide
NextGen Index of Programs

Specific funding and program requirements can be found as indicated below in Table 2.

		FY 2019 Request	Page
	Facilities and Equipment (F&E)	**($M)**	**Section 3B**
1A04	NextGen – Separation Management Portfolio	$16.6	25
1A05	NextGen – Traffic Flow Management Portfolio	$14.0	28
1A06	NextGen – On Demand NAS Portfolio	$20.5	31
1A07	NextGen – NAS Infrastructure Portfolio	$13.5	36
1A08	NextGen – Support Portfolio	$12.8	39
1A09	NextGen – Unmanned Aircraft System (UAS)	$14.0	41
1A10	Enterprise, Concept Development, Human Factors and Demonstration Portfolio	$9.5	43
2A01	En Route Automation Modernization System Enhancements and Tech Refresh	$102.1	45
2A11	System-Wide Information Management (SWIM)	$58.8	63
2A12	ADS-B NAS Wide Implementation (ADS-B)	$123.7	66
2A12	Collaborative Air Traffic Management (CATMT) Portfolio	$17.7	69
2A14	Time Based Flow Management (TBFM) Portfolio	$21.2	70
2A15	Next Generation Weather Processor (NWP)	$24.7	72
2A17	Data Communications in Support of NextGen	$113.9	76
2B12	National Airspace System Voice System (NVS)	$43.2	100
2B16	Terminal Flight Data Manager (TFDM)	$119.3	108
2B19	Performance Based Navigation and Metroplex Portfolio	$20.0	113
3A09	NextGen – System Safety Management Portfolio	$14.7	170
4A09	Aeronautical Information Management Program (AIM)	$6.8	195
4A10	Cross Agency NextGen Management	$1.0	196
5A01	Personnel and Related Expenses - NextGen Staffing	$64.8	197
	Total, Facilities and Equipment	**$832.6**	
	Research, Engineering, and Development		**Section 3C**
A11k	Unmanned Aircraft Systems Research	$3.3	51
A12a	NextGen – Wake Turbulence	$3.5	57
A12b	NextGen – Air/Ground Integration Human Factors	$1.3	60
A12c	NextGen – Weather Technology in the Cockpit	$1.5	63
A12d	NextGen- -Information Security	$1.2	67
A12e	NextGen – Flight Deck Data Exchange Requirements	$1.0	70
A13b	NextGen – Environmental Research, Aircraft Technologies, Fuels and Metrics	$7.6	76
	Total, Research, Engineering, and Development	**$19.5**	
	Operations		**Section 3A**
	NextGen Staffing	$31.2	ANG/ATO
	Unmanned Aircraft Systems	$50.8	ANG/ATO
	Performance Based Navigation (PBN) Metroplex Activities	$18.5	ANG/ATO
	Total, Operations	**$100.5**	
	Total, NextGen Programs	**$952.6**	

(Totals may not add due to rounding)

SECTION 6. CAPITAL INVESTMENT PLAN

Federal Aviation Administration
Abbreviated National Airspace System Capital Investment Plan
for Fiscal Years 2019 – 2023

Background

In anticipation of an enacted full-year appropriation, the Federal Aviation Administration (FAA) believes that similar language to Public Law (P.L.) 115-31, will be enacted for FY 2018 that requires the Secretary of Transportation to submit a five-year Capital Investment Plan (CIP) for FAA's Facilities and Equipment (F&E) appropriation for FY 2019 through 2023. This Abbreviated National Airspace System (NAS) CIP submission meets this requirement and is included in the FY 2019 President's Budget. Assuming new legislation is enacted before publication of the full FY 2019-2023 CIP, it will be referenced and included within that document.

Previous legislation: The Consolidated Appropriations Act, 2017 became Public Law 115-31 on May 5, 2017 and provides the appropriation amounts and other direction for the Federal Aviation Administration within DIVISION K—TRANSPORTATION, HOUSING AND URBAN DEVELOPMENT, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017 under Title I—Department of Transportation. FAA's Facilities and Equipment appropriation includes the following language: *Provided further, That no later than March 31, the Secretary of Transportation shall transmit to the Congress an investment plan for the Federal Aviation Administration which includes funding for each budget line item for fiscal years 2018 through 2022, with total funding for each year of the plan constrained to the funding targets for those years as estimated and approved by the Office of Management and Budget.*

Summary

The Abbreviated CIP fulfills the Secretary's commitment; complies with the language in the Consolidated Appropriations Act, 2017 (P.L. 115-31); and describes the planned investments for the NAS for the next five years. This Abbreviated CIP contains the following information:

- Highlights of information and programs contained in the FY 2019-2023 CIP.
- A five-year funding table by budget line item for FY 2019 through FY 2023.
- Information for Major Capital Programs with a total F&E investment cost of more than $100 million or those that involve significant impact, complexity, risk, sensitivity, safety, or security issues.

Following submission of the FY 2019 President's Budget with the Abbreviated CIP, the full annual CIP for FY 2019-2023 with supporting program detail will be published at
http://www.faa.gov/air_traffic/publications/cip

Important Factors Affecting Planning for the Future

Access to a reliable worldwide aviation network is essential to the health of the U.S. economy. Both domestic and international commerce rely heavily on ready access to aviation services for carrying passengers and freight to the cities around the world which helps to sustain economic growth. According to a study on *The Economic Impact of Civil Aviation on the U.S. Economy* [1], published in November 2016 by the Air Traffic Organization's Office of Performance Analysis, economic activity attributed to civil aviation-related goods and services during 2014 totaled $1.6 trillion, generating 10.6 million jobs, and $447 billion in earnings. In total, U.S. aviation contributed 5.1 percent to the U.S. Gross Domestic Product (GDP). Other aviation related economic activity highlighted in the November 2016 report includes:

- Air carriers operating in U.S. airspace transported 871.8 million passengers with over 1,230.8 billion revenue passenger miles.
- In support of commercial activities, more than 64.1 billion revenue ton-miles of freight passed through U.S. airports.
- It's estimated that commercial airline operations enabled $310 billion of visitor expenditures on goods and services.
- Civil aircraft manufacturing, a top U.S. net exporter, had a positive trade balance of $59.9 billion.

Key Considerations in Capital Planning

The air traffic control infrastructure is a complex system made up of several thousand components that control air traffic approaching, landing and departing from airports. This includes: 21 Air Route Traffic Control Centers (ARTCC) that house the automation equipment used by air traffic controllers to control en route air traffic; over 500 Air Traffic Control Towers (ATCT); and 167 Terminal Radar Approach Control (TRACON) facilities. This daily flow of air traffic is dependent upon several hundred surveillance and weather radars, navigation systems for en route and airport approach guidance, and thousands of radios that allow pilots and air traffic controllers to be in continuous contact during an aircraft's flight.

Building a balanced portfolio of capital investments to sustain and modernize the NAS requires significant time to develop, plan, and prioritize program outcomes. Proposed capital investments must include a lifecycle cost estimate, be approved by FAA senior management, prioritized against other agency priorities, and then receive the requested funding through the Congressional budget process to execute the program requirements as planned. Program schedules for new systems must also include sufficient lead time to demonstrate compliance with all FAA reliability and safety standards before they can be approved for operation in the NAS. To be successful program offices require the resources and personnel to fully define requirements and interdependencies with other programs, complete business case development and investment analysis, and manage risk during execution to deliver planned outcomes on schedule.

Addressing real-time changes in air traffic demand and anticipated future growth may require increases in available NAS capacity, efficiency, reliability, and system flexibility. Other variables impacting capital planning include: periodic changes in economic conditions; schedules of ongoing capacity expansion

[1] Sources: Air Traffic Organization, Office of Performance Analysis, "The Impact of Civil Aviation on the U.S. Economy," November 2016; Matthew Russell, "Economic Productivity in the Air Transportation Industry: Multifactor and Labor Productivity Trends, 1990-2014," *Monthly Labor Review*, March 2017.

projects at major airports; and sustainment needs for mission critical ATC systems, facilities, and other NAS infrastructure. By statute, each year of the CIP must balance to the most recent F&E funding target for that year as issued to FAA by the Office of Management and Budget. In the CIP development process, the FAA allocates the F&E targets for each year between capital programs that support ongoing development and deployment of NextGen and those programs that sustain and modernize legacy ATC systems and infrastructure. This approach ensures that current NAS performance and safety standards are maintained throughout the transition to NextGen.

NextGen will incrementally introduce new technologies, capabilities, and procedures to improve management and efficiency of air traffic control. Some legacy equipment, such as communication, navigation, and surveillance systems must remain in operation to supplement or backup NextGen capabilities. Many current buildings that house existing ATC equipment will still be needed for the NextGen systems. To sustain the high level of NAS reliability and availability required to ensure the safety and efficiency of flight, continued investment in the maintenance and improvement of these buildings and other legacy infrastructure is required.

Key investments in air traffic control systems that support the current and future operation of the NAS are:

- **En route Automation** – The En Route Automation Modernization (ERAM) platform will require technology refresh to replace a large subset of system equipment that is near the end of its service life;
- **Terminal Automation** – Older Standard Terminal Automation Replacement Systems (STARS) have reached their end-of-life and key components must be replaced to maintain the operation of the systems;
- **Navigation/Landing** – The Wide Area Augmentation System program will continue to augment the Global Positioning System to support the implementation of improved procedures that are dependent on satellite navigation capabilities. Aging Instrument Landing Systems and other Navigation aids will be replaced if systems become unsupportable due to parts obsolescence; and
- **Surveillance/Weather** – Modernization of en route, and terminal primary and secondary surveillance radars will be implemented to upgrade or replace older, unsupportable systems. Weather sensing and processing equipment will also be modernized.

Planning for the Future through NextGen Investments

NextGen is the ongoing transformation of the NAS to ensure that future capacity, safety, and environmental requirements will be met by the FAA. The NextGen vision and goals are supported by many capital programs that collectively will fundamentally change the way air traffic is managed by combining new technologies for surveillance, navigation, and communications with automation system enhancements, workforce training, procedural changes, and airfield development. These improvements will also facilitate the integration of commercial space and the operation of unmanned aircraft systems into the NAS.

NextGen advances will enable precise monitoring of aircraft both on the ground and in flight; allow direct routes for travel between cities; improve decision support to strategically manage traffic flows on busy routes; and leverage precision navigation to improve utilization of existing airspace and runway capacity. More information concerning the vision, benefits, and implementation details and can be found in the NextGen Implementation Plan which is available for review at http://www.faa.gov/nextgen/library/

Nextgen is already delivering benefits and with planned funding focused on the full delivery of remaining base infrastructure and new applications delivering increased capacity and efficiency providing greater access and flexibility for users to choose route options that best meet their needs. Major initiatives are

focused on the transformation to Trajectory Based Operations and the integration of new entrants into the NAS.

Some of the larger NextGen programs that will deliver future NextGen Operational Improvements are:

- **En Route Automation Modernization (ERAM)** – ERAM Enhancements 2 and 3 include improvements in separation management, trajectory prediction, and human interface capabilities to improve the delivery of air traffic services today and to continue the evolution of NextGen trajectory-based operations, (BLI 2A01);
- **System Wide Information Management (SWIM)** – SWIM provides the standards, hardware and software to enable information management and data sharing required to support NextGen and provides for additional infrastructure and capabilities to strengthen the overall NAS information system security posture, (BLI 2A11);
- **Automatic Dependent Surveillance – Broadcast (ADS-B) NAS Wide Implementation (ADS-B)** – ADS-B provides more accurate and timely surveillance data needed to allow direct routing and conflict free routes and supports services that provide ADS-B surveillance data for aircraft operating in a large area without access to traditional radar coverage, (BLI 2A12);
- **Collaborative Air Traffic Management Technologies (CATMT)** – CATMT Work Package 4 (WP4) and WP5 will improve the demand predictions used by Traffic Flow Management System to determine whether there is sufficient NAS resource capacity, as well as provide controller tools to assist with routing departures given convective weather and traffic volume constraints, (BLI 2A13);
- **Time Based Flow Management (TBFM)** – TBFM WP3 focuses on expanding the airspace in which controllers can use the Integrated Departure/Arrival Capability and implementing Terminal Sequencing and Spacing to provide efficient sequencing and runway assignment, (BLI 2A14);
- **NextGen Weather Processor** – This program will establish a common weather processing platform which will provide improved weather products and support more efficient operations and replace the legacy FAA weather processor systems, (BLI 2A15);
- **Data Communications in support of NextGen** – Data Comm provides data link communications between controllers and pilots to facilitate information transfer, reduce workload, and minimize potential errors in communication of flight plan adjustments, (BLI 2A17);
- **National Airspace System Voice System (NVS)** – NVS will provide a nationwide network of digital voice switches for terminal and en route air traffic facilities. These new systems will provide voice switch configuration flexibility, (BLI 2B12);
- **Terminal Flight Data Manager (TFDM)** – TFDM is the surface management solution for NextGen. TFDM will deliver NextGen decision support capabilities for the airport surface, integrating flight, surface surveillance, and traffic management information in order to improve operational predictability and efficiency at airports, (BLI 2B16); and
- **Aeronautical Information Management (AIM) Programs** – AIM provides digital aeronautical information to NAS users. Future AIM Segments will incorporate additional types of aeronautical information in a digital format for machine to machine exchange with NAS Automation systems, (BLI 4A09).

Conclusion

The capital programs support the development, acquisition, implementation, and sustainment of the systems and services that provide the infrastructure, technology, and capabilities for the NAS. For FY 2019-2023, the CIP represents a balanced portfolio for the sustainment of current NAS infrastructure, capabilities, and system enhancements, and provides for the continued implementation of NextGen.

Estimated Funding by Budget Line Item (dollars in Millions)

The following table shows funding by BLI with dollars in millions for the capital programs in the FY 2019 to FY 2023 time frame. The funding levels in this table reflect policy levels assumed in the President's Budget. The Administration has proposed to shift FAA's air traffic control function to a non-governmental, non-profit organization in 2021. Under this proposal, the non-governmental, non-profit organization would manage and invest in those capital programs that support air traffic control starting in 2021.

BLI Number	Capital Budget Line Item (BLI) Program	FY 2019 Budget	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.	FY 2023 Est.
	Activity 1: Engineering, Development, Test and Evaluation	**$166.9**	**$179.5**	**$204.2**	**$219.0**	**$204.8**
1A01	Advanced Technology Development and Prototyping (ATDP)	$33.0	$35.0	$34.1	$34.2	$30.0
1A02	William J. Hughes Technical Center Facilities	$21.0	$20.0	$20.0	$20.0	$20.0
1A03	William J. Hughes Technical Center Infrastructure Sustainment	$12.0	$10.0	$10.0	$10.0	$10.0
1A04	NextGen – Separation Management Portfolio	$16.6	$21.5	$26.6	$41.2	$43.5
1A05	NextGen – Traffic Flow Management (TFM) Portfolio	$14.0	$11.0	$13.0	$18.0	$11.0
1A06	NextGen – On Demand NAS Portfolio	$20.5	$29.5	$35.5	$29.6	$26.3
1A07	NextGen – NAS Infrastructure Portfolio	$13.5	$15.5	$25.0	$26.0	$26.0
1A08	NextGen – Support Portfolio	$12.8	$10.0	$11.0	$11.0	$9.0
1A09	NextGen – Unmanned Aircraft Systems (UAS)	$14.0	$17.0	$20.0	$20.0	$20.0
1A10	NextGen – Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio	$9.5	$10.0	$9.0	$9.0	$9.0
	Activity 2: Procurement and Modernization of Air Traffic Control Facilities and Equipment	**$1,681.2**	**$1,669.3**	**$1,619.9**	**$1,620.3**	**$1,644.7**
	A. En Route Programs	**$689.1**	**$658.5**	**$610.2**	**$628.5**	**$635.2**
2A01	NextGen – En Route Automation Modernization (ERAM) – System Enhancements and Technology Refresh	$102.1	$96.6	$73.2	$82.7	$92.0
2A02	En Route Communications Gateway (ECG)	$1.7	$2.8	$2.9	$0.0	$0.0
2A03	Next Generation Weather Radar (NEXRAD)	$5.5	$4.0	$6.1	$5.4	$7.5
2A04	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements	$88.1	$82.6	$82.7	$82.8	$82.6
2A05	Air Traffic Management (ATM)	$6.2	$19.9	$25.2	$28.0	$23.8
2A06	Air/Ground Communications Infrastructure	$10.5	$7.9	$8.0	$8.1	$7.9
2A07	Air Traffic Control En Route Radar Facilities Improvements	$6.6	$6.3	$6.4	$6.5	$6.3
2A08	Voice Switching Control System (VSCS)	$11.4	$11.7	$12.1	$12.4	$13.0
2A09	Oceanic Automation System	$17.5	$13.6	$10.0	$10.0	$10.0
2A10	Next Generation Very High Frequency Air/Ground Communications System (NEXCOM)	$50.0	$50.0	$50.0	$50.0	$50.0
2A11	NextGen – System-Wide Information Management (SWIM)	$58.8	$42.6	$28.5	$32.2	$40.0
2A12	NextGen – Automatic Dependent Surveillance - Broadcast (ADS-B) NAS Wide Implementation	$123.7	$123.5	$135.0	$135.0	$137.0
2A13	NextGen – Collaborative Air Traffic Management Technologies Portfolio	$17.7	$24.3	$15.0	$5.6	$17.0
2A14	NextGen – Time Based Flow Management (TBFM) Portfolio	$21.2	$36.3	$44.8	$46.9	$25.0
2A15	NextGen – Next Generation Weather Processor (NWP)	$24.7	$16.0	$6.2	$25.0	$25.0
2A16	Airborne Collision Avoidance System X (ACAS X)	$7.7	$6.9	$5.1	$0.0	$0.0
2A17	NextGen – Data Communication in support of NextGen	$113.9	$89.6	$72.1	$64.0	$66.1

BLI Number	Capital Budget Line Item (BLI) Program	FY 2019 Budget	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.	FY 2023 Est.
2A18	Offshore Automation	$14.0	$15.0	$20.0	$25.0	$30.0
2A19	En Route Improvements	$1.0	$2.0	$2.0	$2.0	$2.0
2A20	Commercial Space Integration	$7.0	$7.0	$5.0	$7.0	$0.0
	B. Terminal Programs	**$522.7**	**$552.1**	**$549.8**	**$538.9**	**$559.7**
2B01	Terminal Doppler Weather Radar (TDWR) – Provide	$4.5	$2.2	$0.0	$0.0	$0.0
2B02	Standard Terminal Automation Replacement System (STARS)	$66.9	$51.3	$41.9	$50.0	$50.0
2B03	Terminal Automation Modernization / Replacement Program (TAMR Phase 3)	$9.0	$0.0	$0.0	$0.0	$0.0
2B04	Terminal Automation Program	$8.5	$9.0	$9.0	$9.0	$10.0
2B05	Terminal Air Traffic Control Facilities – Replace	$19.2	$14.0	$70.0	$107.0	$140.0
2B06	ATCT/Terminal Radar Approach Control (TRACON) Facilities – Improve	$95.9	$92.6	$77.7	$47.7	$42.6
2B07	Terminal Voice Switch Replacement (TVSR)	$9.6	$6.0	$6.0	$6.0	$5.0
2B08	NAS Facilities OSHA and Environmental Standards Compliance	$41.9	$42.0	$42.0	$42.0	$42.0
2B09	Airport Surveillance Radar (ASR-9)	$12.8	$12.6	$17.1	$14.3	$17.1
2B10	Terminal Digital Radar (ASR-11) Technology Refresh	$1.0	$4.4	$4.4	$4.4	$4.4
2B11	Runway Status Lights (RWSL)	$2.0	$3.5	$3.5	$5.0	$5.0
2B12	NextGen – National Airspace System Voice System (NVS)	$43.2	$116.6	$105.5	$106.6	$113.9
2B13	Integrated Display System (IDS)	$19.5	$24.0	$34.2	$45.0	$50.0
2B14	Remote Monitoring and Logging System (RMLS)	$18.1	$16.4	$15.6	$16.7	$0.0
2B15	Mode S Service Life Extension Program (SLEP)	$15.4	$25.2	$19.2	$8.3	$10.3
2B16	NextGen – Terminal Flight Data Manager (TFDM)	$119.3	$112.8	$78.7	$47.9	$39.4
2B17	NAS Voice Recorder Program (NVRP)	$14.0	$14.5	$17.0	$21.0	$22.0
2B18	Integrated Terminal Weather System (ITWS)	$2.1	$0.0	$0.0	$0.0	$0.0
2B19	NextGen – Performance Based Navigation & Metroplex Portfolio	$20.0	$5.0	$8.0	$8.0	$8.0
	C. Flight Service Programs	**$25.8**	**$16.8**	**$5.9**	**$3.6**	**$3.3**
2C01	Aviation Surface Weather Observation System	$11.0	$3.0	$0.0	$0.0	$0.0
2C02	Future Flight Services Program (FFSP)	$10.1	$10.1	$2.0	$0.0	$0.0
2C03	Alaska Flight Service Facility Modernization (AFSFM)	$2.7	$2.8	$2.9	$2.9	$2.8
2C04	Weather Camera Program	$1.1	$0.0	$0.0	$0.0	$0.0
2C05	Juneau Airport Wind System (JAWS) – Technology Refresh	$1.0	$1.0	$1.0	$0.7	$0.5
	D. Landing and Navigation Aids Programs	**$160.1**	**$161.1**	**$173.9**	**$183.8**	**$186.0**
2D01	VHF Omnidirectional Radio Range (VOR) Minimum Operating Network (MON)	$15.0	$18.0	$17.3	$19.4	$19.4
2D02	Wide Area Augmentation System (WAAS) for GPS	$96.3	$93.6	$99.5	$98.5	$96.8
2D03	Instrument Flight Procedures Automation (IFPA)	$1.4	$1.1	$0.0	$0.0	$0.0
2D04	Runway Safety Areas – Navigation Mitigation	$2.0	$1.4	$0.0	$0.0	$0.0

BLI Number	Capital Budget Line Item (BLI) Program	FY 2019 Budget	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.	FY 2023 Est.
2D05	NAVAIDS Monitoring Equipment	$3.0	$0.0	$0.0	$0.0	$0.0
2D06	Legacy Navigation Aids Portfolio	$42.4	$47.0	$57.1	$65.9	$69.8
	E. Other ATC Facilities Programs	**$283.5**	**$280.8**	**$280.3**	**$265.7**	**$260.7**
2E01	Fuel Storage Tank Replacement and Management	$25.7	$22.0	$22.0	$22.0	$22.0
2E02	Unstaffed Infrastructure Sustainment	$51.1	$50.3	$47.1	$46.7	$42.7
2E03	Aircraft Related Equipment Program	$13.0	$13.0	$13.0	$9.0	$9.0
2E04	Airport Cable Loop Systems – Sustained Support	$10.0	$10.0	$10.0	$10.0	$10.0
2E05	Alaskan Satellite Telecommunication Infrastructure (ASTI)	$16.3	$4.3	$4.0	$0.0	$0.0
2E06	Facilities Decommissioning	$9.0	$10.0	$10.0	$10.0	$10.0
2E07	Electrical Power Systems – Sustain/Support	$140.8	$140.0	$140.0	$140.0	$140.0
2E08	Energy Management and Compliance (EMC)	$2.4	$6.2	$6.2	$0.0	$0.0
2E09	Child Care Center Sustainment	$1.0	$1.5	$1.0	$1.0	$1.0
2E10	FAA Telecommunications Infrastructure 2	$6.7	$11.5	$15.0	$15.0	$15.0
2E11	Data, Visualization, Analysis and Reporting System (DVARS)	$4.5	$4.5	$4.5	$4.5	$4.5
2E12	Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration	$3.0	$4.0	$4.0	$4.0	$3.0
2E13X	Independent Operational Assessment	$0.0	$3.5	$3.5	$3.5	$3.5
	Activity 3: Non-Air Traffic Control Facilities and Equipment	**$201.9**	**$189.0**	**$202.3**	**$179.8**	**$147.1**
	A. Support Programs	**$186.6**	**$174.0**	**$187.3**	**$164.8**	**$132.1**
3A01	Hazardous Materials Management	$29.8	$31.0	$31.0	$31.0	$31.0
3A02	Aviation Safety Analysis System (ASAS)	$18.9	$19.7	$21.5	$22.0	$19.1
3A03	National Airspace System (NAS) Recovery Communications (RCOM)	$12.2	$12.0	$12.0	$12.0	$12.0
3A04	Facility Security Risk Management	$18.6	$15.0	$14.9	$12.1	$0.0
3A05	Information Security	$16.0	$17.8	$18.5	$18.2	$17.0
3A06	System Approach for Safety Oversight (SASO)	$25.4	$23.1	$23.7	$25.4	$23.0
3A07	Aviation Safety Knowledge Management Environment (ASKME)	$6.0	$5.3	$8.4	$9.8	$12.0
3A08	Aerospace Medical Equipment Needs (AMEN)	$14.1	$13.8	$19.9	$5.0	$0.0
3A09	NextGen – System Safety Management Portfolio	$14.7	$15.0	$15.0	$15.0	$15.0
3A10	National Test Equipment Program	$5.0	$3.0	$3.0	$3.0	$3.0
3A11	Mobile Assets Management Program	$2.2	$1.5	$2.0	$2.0	$0.0
3A12	Aerospace Medicine Safety Information System (AMSIS)	$16.1	$13.8	$11.7	$7.8	$0.0
3A13	Tower Simulation System (TSS) Technology Refresh	$0.5	$0.0	$0.0	$0.0	$0.0
3A14	Logistics Support System and Facilities (LSSF)	$7.1	$3.0	$5.7	$1.5	$0.0

BLI Number	Capital Budget Line Item (BLI) Program	FY 2019 Budget	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.	FY 2023 Est.
	B. Training, Equipment and Facilities	**$15.3**	**$15.0**	**$15.0**	**$15.0**	**$15.0**
3B01	Aeronautical Center Infrastructure Modernization	$14.3	$14.0	$14.0	$14.0	$14.0
3B02	Distance Learning	$1.0	$1.0	$1.0	$1.0	$1.0
	Activity 4: Facilities and Equipment Mission Support	**$227.0**	**$229.6**	**$232.1**	**$232.5**	**$252.0**
4A01	System Engineering and Development Support	$38.0	$38.0	$38.0	$38.0	$38.0
4A02	Program Support Leases	$47.0	$50.0	$50.0	$50.0	$50.0
4A03	Logistics and Acquisition Support Services	$11.0	$11.0	$11.0	$11.0	$11.0
4A04	Mike Monroney Aeronautical Center Leases	$20.2	$20.6	$21.1	$21.5	$22.0
4A05	Transition Engineering Support	$17.0	$16.0	$15.0	$15.0	$15.0
4A06	Technical Support Services Contract (TSSC)	$23.0	$23.0	$23.0	$23.0	$23.0
4A07	Resource Tracking Program (RTP)	$6.0	$8.0	$8.0	$8.0	$8.0
4A08	Center for Advanced Aviation System Development (CAASD)	$57.0	$57.0	$60.0	$60.0	$60.0
4A09	NextGen – Aeronautical Information Management Program	$6.8	$5.0	$5.0	$5.0	$25.0
4A10	NextGen – Cross Agency NextGen Management	$1.0	$1.0	$1.0	$1.0	$0.0
	Activity 5: Personnel Compensation, Benefits and Travel	**$489.6**	**$499.2**	**$508.1**	**$515.0**	**$518.0**
5A01	Personnel and Related Expenses	$489.6	$499.2	$508.1	$515.0	$518.0
	Note: BLI numbers with X represent outyear programs not requested in the FY 2019 President's Budget. Note: The funding levels in this table reflect policy levels assumed in the President's Budget. The Administration has proposed to shift FAA's air traffic control function to a non-governmental, non-profit organization in 2021. Under this proposal, the non-governmental, non-profit organization would manage and invest in those capital programs that support air traffic control starting in 2021.					
	Total Year Funding	**$2,766.6**	**$2,766.6**	**$2,766.6**	**$2,766.6**	**$2,766.6**
	Targets	**$2,766.6**	**$2,766.6**	**$2,766.6**	**$2,766.6**	**$2,766.6**

Information for Major Capital Programs

Because of the criticality of on-budget and on-time acquisitions to the efficient transition to NextGen, the Government Accountability Office (GAO) was directed to determine the status of Air Traffic Organization's performance in acquiring ATC systems.

In response to a prior GAO recommendation to identify regular reporting to Congress and the public on FAA's overall performance in acquiring ATC systems, the table below provides the most recent information on FAA's major capital programs.

FAA's major programs are defined as those classified as Acquisition Category (ACAT) 1, 2, 3, or are of strategic importance to the agency. These are typically programs with total F&E costs greater than $100 million and/or those that have significant impact, complexity, risk, sensitivity, safety, or security issues. For more information on ACATs see: http://fast.faa.gov/NFFCA_Acquisition_Categories.cfm .

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Rebaseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Automatic Dependent Surveillance Broadcast (ADS-B) – Baseline Services & Applications FY14 - 20 ACAT 1	May-12	Sep-20	$960.4				Sep-20	$971.5	Current Estimate vs. Original Baseline: The $11.1M (-1.2% variance) is associated with additional funds provided to support the General Aviation (GA) aircraft incentive program to address "key barriers" to ADS-B out equipage identified by the Equip 2020 team.
Collaborative Air Traffic Management Technologies (CATMT) Work Package 4 (WP4) ACAT 3 New Investment (NI)	Jun-17	Sep-22	$78.6				Sep-22	$78.6	NOTE: New Addition. Final Investment Decision (FID) approved by the JRC in Jun-17.
Common Support Services (CSS) Weather (Wx) ACAT 1	Mar-15	Aug-22	$120.1				Aug-22	$120.1	
Data Communications (Data Comm) Segment 1, Phase 1 (S1P1) ACAT 1	May-12	May-19	$741.4				May-19*	$718.7	Current Estimate vs. Original Baseline: *The FAA completed the Controller Pilot Data Link Communications (CPDLC) Departure Clearance (DCL) deployment waterfall in Dec 2016, 29 months ahead of the original baseline of May 2019 and under budget. There are remaining activities to be performed under this phase of the Data Comm program, to include: executing the remaining portion of the equipage initiative, delivering pre-planned air traffic control and flight deck enhancements, and continuing industry outreach and coordination.
Data Communications (Data Comm) Segment 1, Phase 2 (S1P2), Initial En Route Services ACAT 1	Oct-14	Feb-21	$816.7				Feb-21	$816.7	

FAA Capital Programs
Current Information for Major Programs

	Original Baseline			Rebaseline			Current Estimate		
Programs	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	Comments
Data Communications (Data Comm) Segment 1, Phase 2 (S1P2), Full En Route Services ACAT 1 New Investment	Aug-16	Dec-23	$421.4				Dec-23	$421.4	There is no funding requested in the Facilities and Equipment (F&E) budget for this program after FY17.
En Route Automation Modernization (ERAM) Enhancements 2 ACAT 1	Dec-16	Dec-23	$253.6				Sep-26	$253.6	**Current Estimate vs. Original Baseline:** The schedule delay of 33 months (-39.3% variance) is associated with budgetary actions that impacted the program since the approval of their Final Investment Decision (FID) in Dec-16. Starting with the FY18 President's Budget, the program's funding was reduced significantly. In addition, due to lower outyear funding targets the program funding profile has been extended two (2) years to FY25.
ERAM Technology Refresh 2 ACAT 4TR	Dec-16	Sep-20	$279.2				Sep-20	$279.2	
Facility Security and Risk Management (FSRM) 2 ACAT 2	Jun-11	Sep-22	$182.5				Sep-22	$182.5	

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Rebaseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Logistics Center Support System (LCSS) ACAT 2	Apr-10	Apr-14	$67.4	Apr-14	Apr-16	$79.4	Mar-20	$104.1	Rebaseline vs. Original Baseline: The schedule delay of 24 months (-50% variance) and cost increase of $12M (-17.8% variance) is associated with the following factors: 1) Business processes developed during the Business Process Reengineering (BPR) phase did not address system interactions between functional areas; 2) delays in developing interfaces with legacy systems; 3) complexity of the tool integration required for interfaces; and 4) changes in contract and program management. In Apr-14, the JRC approved a Baseline Change Decision (BCD) for LCSS. Current Estimate vs Rebaseline: The program is projected to be completed in Mar-20 (-65.3% variance) with an estimated cost at completion of $104.1M (-31.1% variance). The schedule and cost increases are associated with 1) user and system requirements that were identified after the Initial Operational Capability (IOC) remain to be developed; 2) workarounds as a result of unmet requirements that did not have documentation to support the remaining development; 3) related work processes and system interfaces that were not fully defined or documented that resulted in additional requirements to be developed to meet user needs; 4) efforts to stabilize defects found during initial production.
NAS Voice System (NVS) Demonstration and Qualification Phase ACAT 1	Sep-14	Mar-20	$294.2				Mar-21*	$299.2*	Current Estimate vs Original Baseline: The schedule delay of 12 months (-13% variance) and cost increase of $5M (-1.7% variance) is associated with contractor performance related to system stability and software development. *The program is working with the vendor to verify the cost and schedule estimates. These estimates are preliminary and will be updated over the next year.

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Rebaseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Next Generational Weather Processor (NWP) ACAT 1	Mar-15	Aug-22	$189.3				Aug-22	$189.3	
Next Generation Air-to-Ground Communication System (NEXCOM) - Segment 2, Phase 1 ACAT 2	Sep-11	Sep-18	$285.9				Sep-18	$285.9	
NEXCOM - Segment 2, Phase 2 ACAT 2 NI	Aug-17	Dec-26	$334.2				Dec-26	$334.2	NOTE: New Addition. Final Investment Decision (FID) approved by the JRC in Jun-17.

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Rebaseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Runway Status Lights (RWSL) ACAT 1	Jan-10	Oct-15	$327.4	Jul-13	Sep-17	$366.7	Jun-19	$366.7	Rebaseline vs. Original Baseline: In Jul-13 the JRC approved a BCD for the RWSL program. The JRC determined to minimize the cost exposure to the baseline, deployment will be limited to the 16 airports that have been fully committed and San Francisco International for a total of 17 airports. This results in a reduction of 6 airports (26.1% variance) from the original 23 airports approved at the FID in Jan-10. The cost increase ($39.3M, -12% variance) and schedule delay (23 months, -26.1% variance) are attributed to the following factors: (1) construction plans changed due to costlier techniques by Airport Authorities; (2) limited runway/taxiway surface availability to meet installation schedules; (3) requirement changes that included increases in the light count, the switch from incandescent lights to LED, and the increased supportability for these requirements; (4) costly duct bank and shelter installations; (5) under estimation of site and depot spares costs; and (6) additional engineering development for supportability enhancements. Current Estimate vs. Rebaseline: The 21 month schedule delay (-18.9%) is attributed to the addition of Boston, Dallas/Ft. Worth, and San Deigo Airports to the baseline. These 3 locations currently have prototype systems and were included in the original baseline. These airports have committed to a work share agreement with the FAA to upgrade the prototypes to baseline systems. The work share agreements will allow the FAA to complete the work at the 3 airports with no impact to the rebaseline budget.

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Rebaseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
System Approach for Safety Oversight (SASO) Phase 2B Segment 1A ACAT 3 NI	Feb-16	May-23	$135.7				May-23	$135.6	
System Wide Information Management (SWIM) Segment 2B ACAT 2	Oct-15	Sep-21	$119.6				Sep-21	$119.6	
Standard Terminal Automation Replacement System (STARS) Technology Refresh/Sustainment 2 ACAT 4TR	Sep-17	May-22	$102.1				May-22	$102.1	NOTE: New Addition. FID approved by JRC in Sep-17.
Terminal Automation Modernization and Replacement (TAMR), Phase 3, Segment 2 (P3 S2) ACAT 2	Sep-12	Aug-19	$462.5				Aug-19	$496.8	Current Estimate vs. Original Baseline: The current cost increase of $34.3M (-7.4% variance) is associated with the impact of higher prime costs.
Terminal Automation Modernization and Replacement (TAMR), Phase 1 Technology Refresh ACAT 2	Sep-12	Feb-20	$531.5				Feb-20	$531.5	

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Rebaseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Rebaseline APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Terminal Flight Data Manager (TFDM) ACAT 1 NI	Jun-16	Sep-28	$795.2				Sep-28	$795.2	
Time Based Flow Management (TBFM) WP3 ACAT 3NI	Apr-15	Sep-22	$188.3				Sep-22	$188.3	
Wide Area Augmentation System (WAAS) Phase IV, Segment 1 - Dual Frequency Operations (DFO) ACAT 1	May-14	Sep-19	$603.2				Sep-19	$603.2	

FAA Capital Programs
Major Programs with Completed Acquisition Phase

Programs	Original Baseline			Rebaseline			Actual Results		Comments
	Original APB Date	Completion Date	Budget $M	Rebaselin e-APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
ERAM System Enhancements and Technology Refresh (SETR) ACAT 1	Sep-13	Sep-17	$152.9				Sep-17	$133.2	Actual Result vs. Original Baseline: The program completed on schedule and under budget.
System Wide Information Management (SWIM) Segment 2A ACAT 2	Jul-12	Dec-17	$120.2				Dec-17	$113.5	Actual Result vs. Original Baseline: The program completed on schedule and under budget.