

NATIONAL AIRSPACE SYSTEM CAPITAL INVESTMENT PLAN

FY2018–2022



Produced by FAA Communications • 2017-03-14 428



**Federal Aviation
Administration**

Administrator's Preface:

The National Airspace System (NAS) Capital Investment Plan, or CIP, provides the agency's annual update to a rolling five-year plan for all FAA programs funded by the Facilities and Equipment (F&E) appropriation. The F&E funded programs support the development, acquisition, implementation, and sustainment of the systems and services that provide the infrastructure, technology, and capabilities of the NAS. The first year of program funding shown in the CIP is aligned to the F&E request in the corresponding President's Budget submission; i.e., FY 2018 for this year's CIP. Each of the next four years of F&E program funding in the CIP are aligned in total to the F&E outyear targets issued annually to the FAA by the Office of Management and Budget (OMB).

This year's FY 2018-2022 NAS CIP includes F&E funding targets of \$2.766 billion per year. This five year CIP represents a balance between sustainment and enhancement of the current system and safety capabilities of the NAS and the implementation of the Next Generation Air Transportation System (NextGen).

The FY 2018-2022 NAS CIP provides program information on the scope, objectives, and schedule of FAA's capital programs. The world class services provided by the NAS support the continued growth of aviation services which annually contribute more than 5% to the U.S. Gross Domestic Product. With the implementation of NextGen and the additional capabilities it provides, the safety and efficiency of the NAS will be further improved in providing benefits to both the aviation service providers and their customers.

I hope the FY 2018-2022 NAS CIP provides you with an understanding of the importance of the capital programs to FAA's mission and the delivery of the systems and services needed to meet the current and future demands of the NAS.

Sincerely,

A handwritten signature in black ink, appearing to read 'Michael P. Huerta', enclosed within a circular scribble.

Michael P. Huerta,
Administrator

Table of Contents

1	CAPITAL INVESTMENT PLAN OVERVIEW.....	1
1.1	Statutory Requirements	1
1.2	The Joint Resources Council (JRC)	2
1.3	Strategic Priorities and the CIP.....	3
2	KEY CONSIDERATIONS IN CAPITAL PLANNING	4
2.1	Economic Considerations.....	4
2.2	Air Travel Demand	5
2.3	Airport Expansion Projects	6
2.4	Sustaining and Improving Infrastructure and System Performance	7
2.5	NAS Resiliency	8
2.6	Planning for the Future through NextGen Investments	9
3	AVIATION SAFETY.....	10
4	NEXTGEN OPERATIONAL IMPROVEMENTS SUPPORTED BY BUDGET PORTFOLIOS.....	10
4.1	Relationship of Operational Improvements to NextGen Portfolios and Budget Line Items (BLIs)	11
4.2	NextGen Operational Improvement Descriptions	15
4.3	NextGen Portfolio Descriptions and their supporting Capital Programs	23
4.3.1	Separation Management Portfolio	23
4.3.2	Traffic Flow Management (TFM) Portfolio	24
4.3.3	On-Demand NAS Portfolio.....	24
4.3.4	NAS Infrastructure Portfolio.....	25
4.3.5	NextGen Support Portfolio at WJHTC	25
4.3.6	Unmanned Aircraft Systems (UAS)	25
4.3.7	Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio ...	26
4.3.8	Performance-Based Navigation & Metroplex Portfolio	26
4.3.9	System Safety Management Portfolio	27
4.3.10	Cross Agency NextGen Management.....	27

5	ENTERPRISE ARCHITECTURE INFRASTRUCTURE ROADMAPS	28
5.1	Automation Roadmaps	29
5.1.1	Air Traffic Management and Air Traffic Control	31
5.1.2	Air Traffic Support and Oceanic Air Traffic Control	36
5.1.3	Flight Services and Aeronautical / Information Support	39
5.2	Communication Roadmaps	43
5.2.1	Telecom and Other Communications	44
5.2.2	Voice Switches and Recorders	47
5.2.3	Air-to-Ground Voice and Oceanic Communications	49
5.2.4	Air-to-Ground Data Communications	51
5.2.5	Messaging Infrastructure	53
5.3	Surveillance Roadmaps	54
5.3.1	En Route Surveillance	55
5.3.2	Terminal Surveillance	57
5.3.3	Surface, Approach and Cross Domain Surveillance	60
5.4	Navigation Roadmaps	63
5.4.1	Precision Approach & Safety and Enhancements	64
5.4.2	Infrastructure and En Route/Terminal/Non-Precision Approach	67
5.5	Weather Roadmaps	70
5.5.1	Weather Sensors	71
5.5.2	Weather Dissemination, Processing, and Display	75
6	FACILITIES	77
7	NAS AND MISSION SUPPORT	79
8	ESTIMATED FUNDING BY BUDGET LINE ITEM (BLI)	81
9	INFORMATION FOR MAJOR CAPITAL PROGRAMS	86
10	CONCLUSION	92
11	APPENDICES	93
12	ACRONYMS & ABBREVIATIONS (INCLUDES APPENDICES)	94

List of Figures and Tables:

Figure 2-1	Air Travel Demand Relative to GDP	5
Figure 5-1	Infrastructure Roadmap Legend	29
Figure 5-2	Air Traffic Management and Air Traffic Control Roadmap	31
Figure 5-3	Air Traffic Support and Oceanic Air Traffic Control Roadmap.....	36
Figure 5-4	Flight Services and Aeronautical / Information Support Roadmap.....	39
Figure 5-5	Telecom and Other Communications Roadmap	44
Figure 5-6	Voice Switches and Recorders Roadmap	47
Figure 5-7	Air-to-Ground Voice and Oceanic Communications Roadmap	49
Figure 5-8	Air-to-Ground Data Communications Roadmap	52
Figure 5-9	Messaging Infrastructure Roadmap	53
Figure 5-10	En Route Surveillance Roadmap	55
Figure 5-11	Terminal Surveillance Roadmap.....	57
Figure 5-12	Surface, Approach and Cross Domain Surveillance Roadmap	60
Figure 5-13	Precision Approach & Safety and Enhancements Roadmap	64
Figure 5-14	Infrastructure and En Route/Terminal/Non-Precision Approach Roadmap.....	67
Figure 5-15	Weather Sensors Roadmap	71
Figure 5-16	Weather Dissemination, Processing, and Display Roadmap	75
Table 3-1	Aviation Safety Programs	10
Table 4-1	NextGen Operational Improvements (OIs) by Portfolio & Budget Line Item	14
Table 4-2	Separation Management Programs	24
Table 4-3	Traffic Flow Management Programs	24
Table 4-4	On-Demand NAS Programs	25
Table 4-5	NAS Infrastructure Programs	25
Table 4-6	NextGen Support Portfolio Program	25
Table 4-7	Unmanned Aircraft Systems (UAS) Programs	26
Table 4-8	Enterprise, Concept Development, Human Factors, & Demonstrations Programs ..	26
Table 4-9	Performance Based Navigation & Metroplex Programs	27
Table 4-10	System Safety Management Programs	27
Table 4-11	Cross Agency NextGen Management.....	27
Table 6-1	Facility Programs	79
Table 7-1	NAS and Mission Support Programs	80

Federal Aviation Administration – National Airspace System Capital Investment Plan for Fiscal Years 2018–2022

1 Capital Investment Plan Overview

The Federal Aviation Administration (FAA) National Airspace System (NAS) Capital Investment Plan (CIP) identifies and describes the capital investments required to sustain and modernize the infrastructure, systems, services, and procedures required for the safe and efficient operation of the NAS. The funding for the capital programs included and described in the CIP are constrained to the Facilities and Equipment (F&E) dollars requested in the President’s Budget and to the outyear F&E targets for the following four years that are issued and updated annually by the Office of Management and Budget (OMB).

The FY 2018–2022 CIP Overview includes brief descriptions of the Next Generation Air Transportation System (NextGen) Operational Improvements (OIs) in Section 4 and brief descriptions of all systems and programs that appear on the NAS Enterprise Architecture Roadmaps (EA) in Section 5. Full program descriptions of all the CIP programs are available in Appendix B.

The CIP Overview, Appendices A and B, and previous publications of the CIP are available online at http://www.faa.gov/air_traffic/publications/cip.

1.1 Statutory Requirements

The requirements for the annual publication of the CIP are prescribed by the following statutes.

1. H.R 244 - 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. For FAA’s Facilities and Equipment appropriation, the following direction is provided regarding the Five Year Capital Investment Plan for the National Airspace System for FY 2018-2022: “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.”
2. 49 U.S. Code, section 44501 Plans and Policy, requires FAA to prepare and publish a national airways system plan that reads: “The Administrator of the Federal Aviation Administration shall review, revise, and publish a national airways system plan, known as the Airway Capital Investment Plan, before the beginning of each fiscal year.”

The plan shall set forth—

- (1) for a 10-year period, the research, engineering, and development programs and the facilities and equipment that the Administrator considers necessary for a system of airways, air traffic services, and navigation aids that will—
 - (A) meet the forecasted needs of civil aeronautics;
 - (B) meet the requirements that the Secretary of Defense establishes for the support of the national defense; and
 - (C) provide the highest degree of safety in air commerce

In compliance with the requirements of P.L. 115-31 cited above, an Abbreviated CIP consisting of a brief introduction; planned funding for each CIP program by Budget Line Item (BLI) for FY 2018-2022 in Section 8; and a current status of the major CIP programs in Section 9 was included in the FAA's FY 2018 President's Budget submission to Congress in May of 2017.

The CIP provides a brief summary of each system and program shown on the NAS Enterprise Architecture Roadmaps in Section 5 which provide a 10 or more year timeline for each system in the NAS in compliance with section 44501 of 49 USC referenced above.

The CIP is an integral part of the FAA's near, mid, and long-term planning and budgeting process. The most recent CIP program descriptions are used as the baseline for the F&E budget formulation and justification process for the next budget year. Specifically, the program descriptions from the FY 2018-2022 CIP will be used as the basis for development of the FY 2019 F&E budget request and the FY 2019-2023 CIP. By integrating the F&E budget formulation process with the preparation and publication of the CIP, the accuracy and consistency of capital program information contained in the budget request with the program descriptions provided in the CIP is assured.

The multi-year view of the CIP helps to define the expected lead times for program acquisition planning. This includes scheduling and preparation of the required artifacts for investment decision briefings to the Joint Resources Council (JRC) as required by FAA's Acquisition Management System (AMS). Typical AMS milestones include Investment Analysis Readiness Decision (IARD), Initial Investment Decision (IID), and Final Investment Decision (FID). This investment planning and scheduling information may also help interdependent CIP programs to plan and schedule approval, acquisition, and deployment of related systems, equipment, or capabilities into the NAS.

The CIP development process also supports update of the NAS Enterprise Architecture (EA) Infrastructure Roadmaps to ensure that the program information shown on the roadmaps is consistent with the information in both the President's Budget and the CIP. The roadmaps included in this plan were current as of January 2017. To view the most recent version of the roadmaps see: <http://faa.gov/nextgen/delivering/nasea> .

1.2 The Joint Resources Council (JRC)

In accordance with the AMS, the JRC is responsible for approval of all acquisition programs. The JRC consists of senior level representatives from FAA's lines of business and provides executive level review, approval, and oversight of the F&E programs included in the CIP.

The JRC responsibilities related to the CIP programs include:

- Approval of the FAA investment portfolio each year as part of the F&E budget submission process;
- Annual review and approval of the FAA's Enterprise Architecture Roadmaps;
- Reviews and approves program requests for investment decisions such as IARD, IID, and FID, and oversees the execution and reporting of acquisition programs;
- Approves and establishes baselines for all required AMS program documents including the program requirements document, acquisition program baseline, business case, and the Implementation Strategy and Planning Document;
- Makes acquisition program baseline change decisions that alter program performance, cost, and schedule baselines during solution implementation for investment programs;
- Conducts quarterly acquisition program reviews to manage ongoing investment programs, including operational assets.

1.3 Strategic Priorities and the CIP

The FAA Administrator has established a strategic framework to define where the agency will focus its efforts. This framework includes high-level Strategic Priorities, as well as Priority Initiatives and related Performance Metrics that will measure how well FAA achieves the priorities. The four Strategic Priorities are:

- **Make aviation safer and smarter** – There is an imperative to be smarter about how FAA ensures aviation safety because the aviation industry is growing more complex. At the same time, FAA has more safety data than we have ever had before. This provides an opportunity to be more proactive about safety and constantly raise the bar.
- **Deliver benefits through technology and infrastructure** – The NextGen gives FAA the opportunity to redefine the National Airspace System for the future and prove that benefits can be delivered to the users of the system. FAA also needs to safely integrate new types of user technologies into the airspace, as well as rebalance existing services and modernize our infrastructure, which will enable us to reduce our costs and become more efficient in the long run.
- **Enhance global leadership** – Aviation is a global industry. FAA has to continue to be a world leader in aviation and set the safety standard for others to measure against. FAA needs to be at the table to shape international standards to improve aviation safety and efficiency around the world.
- **Empower and innovate with the FAA's people** – The FAA's employees are the ultimate driver behind its success, and FAA needs the best and brightest talent with the appropriate leadership and technical skills to transform the FAA and the aviation system as a whole.

The FAA Strategic Priorities help guide the selection of the capital programs to be included in the CIP to support NAS sustainment and modernization through new or improved systems and

procedures to meet these priorities and the operating demands on the NAS both now and in the future. Performance Metrics with a target level of achievement have been identified to define progress towards the accomplishment of each Strategic Priority. Each capital program is mapped to the primary Strategic Priority it supports and aligned to the Performance Metric to which it best contributes. The alignment of each CIP program to a Strategic Priority and an associated Performance Metric is shown in Appendix A. A description of how each program contributes to the Performance Metric is found in Appendix B within the section titled Relationship to Performance Metric.

2 Key Considerations in Capital Planning

Building a portfolio of capital investments to sustain and modernize the NAS requires significant time to develop, plan, and prioritize program outcomes that may take years to execute and implement. Meeting real-time changes in air traffic demand and future growth may require significant increases in available NAS capacity, efficiency, predictability, and system flexibility. Other considerations include adjustments due to periodic changes in economic conditions; the schedules of ongoing capacity expansion projects at major airports; and the sustainment needed for mission critical Air Traffic Control (ATC) systems, facilities, and other NAS infrastructure. All capital investments must develop a lifecycle cost estimate, be JRC approved, prioritized against other agency priorities, and then funded through the Congressional budget process to meet their approved schedule requirements. Program schedules for new systems must also include sufficient lead time to demonstrate compliance with all NAS reliability and safety standards before they can become operational.

By statute, FAA's total capital investments planned for each year must balance to the latest F&E funding targets issued by OMB. In this process, the JRC must allocate planned funds between the capital programs supporting the ongoing development and deployment of NextGen capabilities with those required to sustain the legacy ATC systems and NAS infrastructure. This approach ensures that current NAS performance levels and safety standards are maintained before, during, and after the transition to NextGen.

2.1 Economic Considerations

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 to help sustain economic growth. According to a study on "[The Economic Impact of Civil Aviation on the U.S. Economy](#)," 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 for 2014 highlighted in this report includes:

- Air carriers operating in U.S. airspace transported 871.8 million passengers with over 1,230.8 billion Revenue Passenger Miles (RPM).

- 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.

2.2 Air Travel Demand

Historically, demand for air travel is heavily influenced by changes in the economy. Figure 2-1 depicts the total percentage change in RPM and GDP (in constant 2009 dollars) since 1977. Over the last 38 years, passenger demand for air travel (RPM) has grown at a faster rate than the economy (GDP) as shown below.

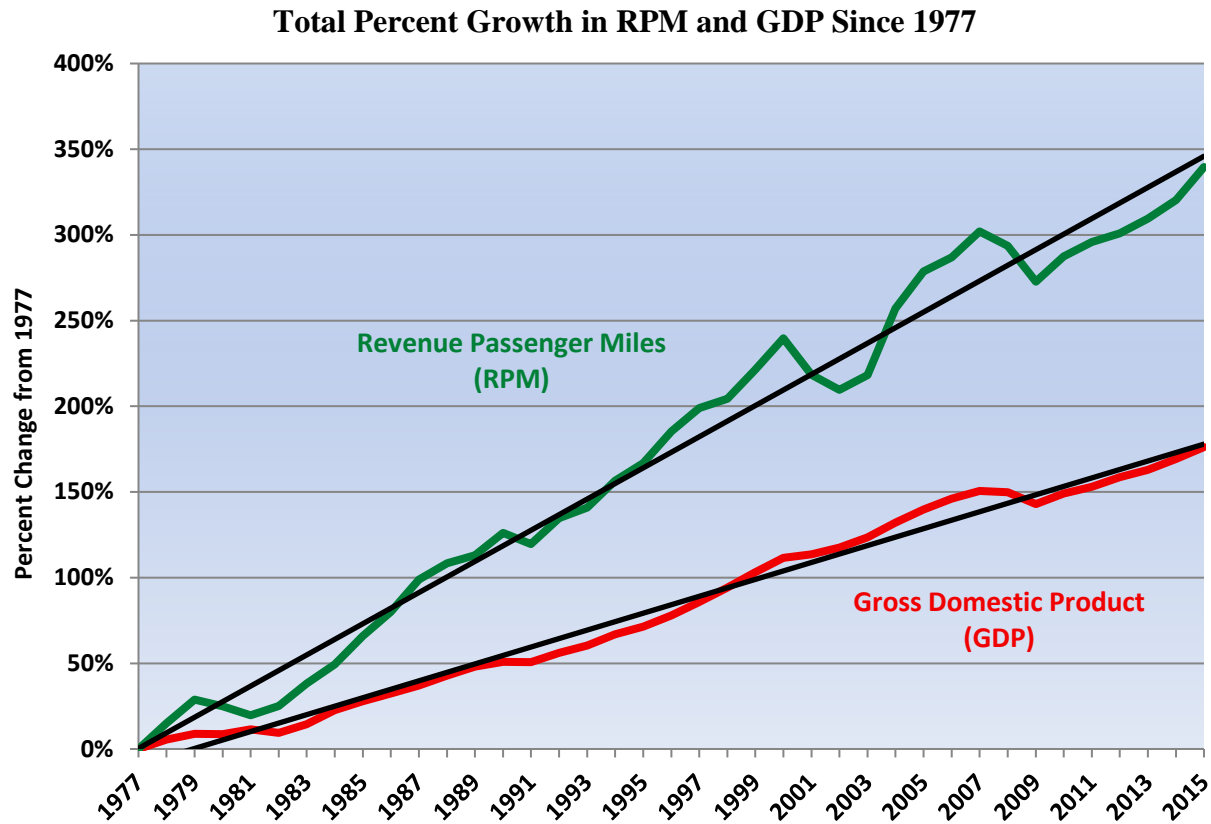


Figure 2-1 Air Travel Demand Relative to GDP¹

The U.S. inflation-adjusted, i.e. real, economic output long-term growth trend supports the continuing increases in air travel. Recent economic data shows that GDP is continuing to grow and the trend lines in figure 2-1 suggest there continues to be a corresponding increase in the demand for air travel, as measured by RPM.

¹ Sources: U.S. Department of Commerce, Bureau of Economic Analysis and U.S. Department of Transportation, Bureau of Transportation Statistics

According to the latest [FAA Aerospace Forecast for Fiscal Years 2017-2037](https://www.faa.gov/data_research/aviation/aerospace_forecasts/) (see https://www.faa.gov/data_research/aviation/aerospace_forecasts/), overall system RPMs are projected to increase by 2.4 percent a year from fiscal year 2017 to 2037. During this period, U.S. carrier passenger traffic is projected to grow by 1.9 percent a year and commercial operations by 1.5 percent a year. The difference in the forecast increase for U.S. passenger traffic compared to commercial operations will be accommodated through larger aircraft with more seats per aircraft mile and higher load factors.

2.3 Airport Expansion Projects

Enhancing capacity and efficiency at large, congested airports is critical to overall NAS performance because delays at the large hub airports often propagate to other airports throughout the system. In fiscal year 2015, the 30 large hub airports handled about 73 percent of airline enplanements. The combined total of 61 large and medium hubs supported about 88% of all U.S. passenger enplanements. Delays at large and medium hubs affect a significant number of passengers waiting to depart, as well as passengers waiting to board aircraft at the delayed flight's destination.

Additional F&E investments are often required when airport authorities, in coordination with the FAA, build new, extended, or realigned runways to enhance safety, capacity and or efficiency. New charted flight procedures are normally needed to fully utilize the new runway infrastructure. Approach lights and visibility sensors must be positioned to ensure reliable access during inclement weather conditions to runways that have a precision approach capability. Airspace sectors around the airports may need to be reconfigured to accommodate new approach and departure patterns. Upgraded surveillance systems may be needed to cover the new departure and approach patterns, as well as expanded surface movement areas. In some cases, additional controller positions may be needed to manage reconfigured surface traffic. In other cases, air traffic control facilities, such as control towers, must be relocated to support new or relocated airport infrastructure. In effect, the development of new or reconfigured airfield infrastructure can trigger multiple F&E investments in order to maintain safe and efficient operations at the airport.

Some examples of recent airport expansion and improvement projects include:

- September 2014, Fort Lauderdale/Hollywood International Airport completed a multi-year project to extend its south parallel runway, 10R/28L, to an overall length of 8,000 feet to accommodate a wider range of aircraft and sustained parallel runway operations by air carrier aircraft.
- April 2015, Philadelphia International Airport formally initiated the extension of Runway 9R/27L to 12,000 feet in order to accommodate larger aircraft capable of flying long-haul international routes.

- October 2015, Chicago O'Hare International Airport completed and opened a new 7,500-foot runway, 10R/28L. Then in 2016, Chicago O'Hare International Airport began construction on runway 9C/27C; the airport's sixth parallel runway, which is expected to open in 2020.

2.4 Sustaining and Improving Infrastructure and System Performance

The air traffic control system requires very high reliability and availability. Aircraft operating in controlled airspace and while on the airport surface must maintain safe separation from other aircraft. To ensure safe separation, reliable communication, navigation and surveillance systems are required. Each system operating in the NAS has a high level of redundancy to support system reliability and availability to minimize service disruptions. Before these systems reach the end of their service life, planning for their replacement must be well underway to reduce the risk of performance degradation or outages in the event that replacement parts become obsolete or are otherwise difficult to obtain.

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 168 Terminal Radar Approach Control (TRACON) facilities. This daily flow of air traffic is dependent on 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.

NextGen will incrementally replace and upgrade much of this equipment as new technologies and procedures are introduced to improve efficiency in 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 also 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.

As of July 2017, the air traffic control infrastructure had a repair backlog estimated at \$4.3B in unfunded requirements to sustain its facilities. Goals, objectives, strategies, processes, and priorities have been established to address this challenge. Nine systemic issues have been identified across the Air Traffic Organization (ATO) that includes Fire Life Safety, Fall Protection, Guyed Towers, Arc Flash, Power Cable, Engine Generators, Fuel Storage Tanks, ARTCC Chiller replacement, and ARTCC Critical Essential Power System replacement. As requested in the FY 2018 President's Budget, the ATC Facilities Sustainment Strategic Plan focuses on the following budget line items for sustaining the NAS.

- Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements, BLI 2A04;
- Air Traffic Control En Route Radar Facilities Improvements, BLI 2A07;
- Terminal Air Traffic Control Facilities – Replace, BLI 2B05;

- ATCT/ Terminal Radar Approach Control (TRACON) Facilities – Improve, BLI 2B06;
- NAS OSHA and Environmental Standards Compliance, BLI 2B08;
- Fuel Storage Tank Replacement and Management, BLI 2E01;
- Unstaffed Infrastructure Sustainment, BLI 2E02;
- Facilities Decommissioning, BLI 2E06;
- Electrical Power Systems – Sustain/Support, BLI 2E07;
- Energy Management and Compliance (EMC), BLI 2E08;
- Hazardous Materials Management, BLI 3A01;
- Facility Security Risk Management, BLI 3A04; and
- Mobile Assets Management Program, BLI 3A11.

In addition to air traffic control infrastructure, the FAA has several other facilities that support the NAS. The Mike Monroney Aeronautical Center (MMAC) includes facility space used for Air Operations, Engineering, Training (Radar/Navigational Aids (Nav aids)), NAS Logistics, Airmen/Aircraft registration, Civil Aeromedical Institute (CAMI), Safety, and Business Services.

The William J. Hughes Technical Center supports research, test and evaluation of safety systems and new equipment. The infrastructure at these locations requires building system and telecommunications replacement.

Key investments in air traffic control systems that support the current and future operation of the NAS are:

- **Terminal Automation** – Older terminal systems must be upgraded to accept Automatic Dependent Surveillance-Broadcast (ADS-B) position reporting and modernized to a common automation platform to support NextGen and reduce maintenance costs;
- **En route Automation** – The En Route Automation Modernization (ERAM) platform will require continuing enhancements to support implementation of many NextGen operational enhancements;
- **Navigation/Landing** – The Wide Area Augmentation System (WAAS) program will continue to augment the Global Positioning System (GPS) to support the implementation of improved procedures that are dependent on satellite navigation capabilities. Aging Instrument Landing Systems (ILSs) and other Navigation aids (Nav 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.

More details on these programs, systems, and infrastructure are provided in section 5, Enterprise Architecture Infrastructure Roadmaps.

2.5 NAS Resiliency

As a direct result of the Chicago ARTCC sabotage incident in 2014, exhaustive reviews have highlighted several high risk areas in the NAS. The NAS Resiliency Assessment program was established to identify and address vulnerabilities that could severely impact NAS operations.

Identifying and assessing the programs critical to ensuring resiliency will result in the development of specialized programmatic and technical recommendations to target investments to improve the resiliency of critical NAS services at Tier 1 facilities. These are the facilities, systems and services whose interruption would result in less than 90% of normal operating rates for more than 24 hours at core Airports and/or 96 hours for the En Route ATC domain. Funding for NAS Resiliency activities has been requested within the programs for the relevant systems, facilities, and infrastructure to be addressed.

2.6 Planning for the Future through NextGen Investments

NextGen is the name of the ongoing transformation of the NAS to ensure that future safety, capacity, 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. Having achieved many of the milestones needed for this transformation FAA is already realizing benefits from NextGen. More information concerning the vision, benefits, and implementation details can be found in the [NextGen Implementation Plan](http://www.faa.gov/nextgen/library/) at <http://www.faa.gov/nextgen/library/>.

Development of NextGen Operational Improvements (OIs) can include concept development, modeling changes in ATC performance, safety analyses, demonstration of new capabilities, international coordination, standards development, and other pre-implementation activities. When a new concept is developed and adopted, the improvement may be implemented through procedural changes, system enhancements, airspace changes, training, and upgrades to aircraft avionics as necessary. The CIP programs support the activities leading up to the initial investment decisions for implementation. When fully developed, a program solution is baselined for acquisition and implementation. More information on the NextGen OIs can be found in section 4.

Some of the larger NextGen programs that provide the foundation for the introduction of new NextGen OIs are:

- **En Route Automation Modernization (ERAM) – Enhancements 2 and 3 and Sustainment 2 and 3** – These programs will be upgrading the ERAM software to support NextGen OIs and provides replacement hardware for the ERAM system (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. This includes Common Support Services – Weather (CSS-Wx) which provides access for NAS users to a unified aviation weather picture (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 (BLI 2A12);
- **NextGen Weather Processor (NWP)** – This program will establish a common weather processing platform which will provide improved weather products and support more efficient operations (BLI 2A16);
- **Data Communications in support of NextGen** – Data Comm provides data link communications between controller and pilot to facilitate information transfer, reduce workload and minimize potential errors in communication of flight plan adjustments (BLI 2A18);
- **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 required to support facility backup (BLI 2B12); and
- **Aeronautical Information Management (AIM) Program** – AIM provides digital aeronautical information to NAS users (BLI 4A09).

3 Aviation Safety

The Aviation Safety (AVS) organization sets, oversees, and enforces safety standards for all parts of the aviation industry impacting every facet of domestic and international civil aviation safety. AVS is responsible for the certification, production approval, and continued airworthiness of aircraft and avionics as well as the certification of pilots, mechanics, and others in safety-related positions.

Capital investments that support Aviation Safety are listed below.

BLI #	CIP Title	CIP #
3A02	Regulation and Certification Infrastructure for System Safety (RCISS) – Segment 3	A17.01-03
3A06	System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1a	A25.02-02
3A06	System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1b	A25.02-03
3A07	Aviation Safety Knowledge Management Environment (ASKME) – Segment 2	A26.01-01
3A07	Aviation Safety Knowledge Management Environment (ASKME) – Segment 3	A26.01-02
3A08	Aerospace Medical Equipment Needs (AMEN) – Phase 2	M53.01-02
3A08	Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Wind & Wave Evacuation Survival Facility (WIWAVES)	M53.02-01
3A12	Aerospace Medicine Safety Information System (AMSIS) – Segment 1	A35.01-01

Table 3-1 Aviation Safety Programs

4 NextGen Operational Improvements Supported by Budget Portfolios

Planning the future systems architecture of the air traffic control system, requires establishing performance goals regarding the NAS improvements to be achieved. These goals are defined by

the Operational Improvements (OIs) that describe specific operational performance enhancements to be realized through the NextGen investments. The table below lists the NextGen OIs and shows the corresponding NextGen portfolios and Budget Line Items (BLIs) from which these investments will be made. The OIs included in this section are targeted for development and implementation within the FY 2018-2022 timeframe.

The NextGen concept development and implementation work is focused on expanding and realizing NextGen through the development and implementation of the transformational NextGen systems which deliver improved services to users, by seamlessly integrating data to ensure that the FAA and stakeholders have a common understanding of current and future NAS status, improving strategic planning and increasing flexibility, and by meeting new challenges such as cybersecurity and incorporating new entrants.

4.1 Relationship of Operational Improvements to NextGen Portfolios and Budget Line Items (BLIs)

The relationship between the OIs, the NextGen Portfolios, and the BLIs is displayed in the following table and shows each OI to the corresponding portfolios and the BLIs from which they are funded. The NextGen Portfolios are identified across the top of the table with the BLI number shown in parenthesis. On the left side of the table are the OI numbers and titles. The check marks to the right of an OI denote the portfolios to which the development or implementation work contributes. A description of each OI is provided in section 4.2 following the table on the next page. In section 4.3, a description of each development portfolio is provided.

For information on the implementation portfolios, Collaborative Air Traffic Management Technologies (CATMT), Time-Based Flow Management (TBFM), and Terminal Flight Data Manager (TFDM), please refer to the Enterprise Architecture Infrastructure Automation Roadmaps in Section 5.1. For CATMT and TBFM, see section 5.1.1 Air Traffic Management and Air Traffic Control. For TFDM, see section 5.1.2 – Air Traffic Support and Oceanic Air Traffic Control.

NextGen Operational Improvements (OIs) by Portfolio & Budget Line Item

OI Number	OI Title	Separation Management (1A05)	Traffic Flow Management (1A06)	On-Demand NAS (1A07)	NAS Infrastructure (1A08)	Unmanned Aircraft Systems (1A10)	Enterprise Concept Development, Human Factors, & Demonstrations (1A11)	Collaborative Air Traffic Management Technologies (2A14)	Time-Based Flow Management (2A15)	Terminal Flight Data Manager (2B16)	Performance-Based Navigation & Metroplex (2B19)	System Safety Management (3A09)
101102	Provide Full Flight Plan Constraint Evaluation with Feedback		✓					✓				
101103	Provide Interactive Flight Planning from Anywhere		✓					✓				
101202	Flight Management with Trajectory			✓	✓	✓						
101203	UAS Flight Information					✓						
102118	Relative Spacing Using Interval Management	✓										
102137	Automation Support for Separation Management	✓					✓					
102138	Enhanced Non-Federal Advisory and Sequencing Services for Class D		✓									
102141	Improved Parallel Runway Operations	✓										
102144	Wake Turbulence Mitigation for Arrivals: CSPRs	✓										
102145	Single Runway Arrival Wake Mitigation	✓										
102146	Flexible Routing	✓										
102151	Single Runway Departure Wake Mitigation	✓										
102152	Dynamic, Pair-wise Wake Turbulence Separation	✓										
102154	Wake Re-Categorization	✓										
102157	Improved Parallel Runway Operations with Airborne Applications	✓										
102158	Automated Support for Initial Trajectory Negotiation				✓							
102159	CSPR Paired Departure Wake Mitigation	✓										

OI Number	OI Title	Separation Management (1A05)	Traffic Flow Management (1A06)	On-Demand NAS (A107)	NAS Infrastructure (1A08)	Unmanned Aircraft Systems (1A10)	Enterprise Concept Development, Human Factors, & Demonstrations (1A11)	Collaborative Air Traffic Management Technologies (2A14)	Time-Based Flow Management (2A15)	Terminal Flight Data Manager (2B16)	Performance-Based Navigation & Metroplex (2B19)	System Safety Management (3A09)
102160	Advanced Automation Support for Separation Management	✓										
103119	Initial Integration of Weather Information into NAS Automation and				✓							
103123	Full Integration of Weather Information into NAS Automation and				✓							
103210	Aircraft Collision Avoidance for New Aircraft Types				✓							
103305	On-Demand NAS Information			✓								
103306	Tailored Delivery of On-Demand NAS Information			✓	✓							
104102	Optimized Oceanic Trajectories via Interactive Planning	✓	✓					✓				
104115	Current Tactical Management of Flow in En Route for Arrivals and			✓								
104117	Improved Management of Arrival/Surface/Departure Flow Operations		✓						✓	✓		
104120	Point-in-Space Metering		✓					✓				
104122	Integrated Arrival and Departure Airspace Management						✓					
104123	Time-Based Metering Using RNAV and RNP Route Assignments	✓	✓									
104126	Trajectory-Based Management – Gate-to-Gate						✓					
104128	Time-Based Metering in the Terminal Environment		✓						✓	✓		
104206	Full Surface Traffic Management with Conformance Monitoring						✓					
104208	Enhanced Departure Flow Operations		✓									
104211	Surface Traffic Management		✓							✓		

OI Number	OI Title	Separation Management (1A05)	Traffic Flow Management (1A06)	On-Demand NAS (A107)	NAS Infrastructure (1A08)	Unmanned Aircraft Systems (1A10)	Enterprise Concept Development, Human Factors, & Demonstrations (1A11)	Collaborative Air Traffic Management Technologies (2A14)	Time-Based Flow Management (2A15)	Terminal Flight Data Manager (2B16)	Performance-Based Navigation & Metroplex (2B19)	System Safety Management (3A09)
105207	Full Collaborative Decision Making		✓	✓			✓	✓				
105208	Traffic Management Initiatives with Flight-Specific Trajectories		✓				✓	✓				
105302	Initial Flight Day Evaluation							✓				
105303	Advanced Flight Day Evaluation		✓					✓				
107120	Resilient PBN Operations	✓									✓	
108206	Flexible Airspace Management			✓								
108209	Increase Capacity and Efficiency Using Area Navigation (RNAV) and Required Navigation Performance (RNP)										✓	
108212	Improved Management of Special Activity Airspace (SAA)		✓	✓	✓			✓				
108214	UAS Airspace Access					✓						
108215	Increase Capacity and Efficiency Using Streamlined PBN						✓				✓	
601103	Safety Information Sharing and Emergent Trend Detection											✓
601104	Automated Safety Information Sharing and Analysis											✓
601202	Integrated Safety Analysis and Modeling											✓
601302	Increase International Cooperation for Aviation Safety											✓

Table 4-1 NextGen Operational Improvements (OIs) by Portfolio & Budget Line Item

4.2 NextGen Operational Improvement Descriptions

A short summary description of each of the OIs in the table in 4.1 is included in this section. Each of the portfolios contributes unique elements to the research, development, and implementation activities required to deliver the operational change. Each OI has a unique six-digit identifier that is included as a reference.

Provide Full Flight Plan Constraint Evaluation with Feedback, OI: 101102

Timely and accurate national airspace system (NAS) information enables users to plan and fly routings that meet their objectives. Constraint information that impacts the proposed route of flight is incorporated into automation and is available to users. Examples of constraint information include special use airspace status, SIGMETs, infrastructure outages, and significant congestion event. A user can update their preferences throughout the flight in response to changing conditions.

Provide Interactive Flight Planning from Anywhere, OI: 101103

Flight planning activities are accomplished from the flight deck as readily as at any other location. Airborne and ground automation provide the capability to exchange flight planning information and negotiate flight trajectory agreement amendments in near real-time.

Flight Management with Trajectory, OI: 101202

Develops and maintains all information about a flight and makes that information available to all decision support tools to improve strategic flight planning and tactical flight management. Flight planning data elements will be updated to incorporate unique flight characteristics for UAS. As reroutes are selected, user preferences assessed, and approved, the trajectory flight data will continue to be updated and made available to subscribers so that both tactical and strategic plans can be developed with the most up to date 4D trajectory of the flight.

UAS Flight Information, OI: 101203

UAS operators provide their intended flight information in the form of a notification or authorization request, depending on their intended flight path. The FAA uses this information to generate advisories regarding where UAS are operating for use by ATC when warranted. The UAS flight information service provides a means to conduct safety oversight such as conduct conformance monitoring that UAS are operating with the constructs of the certificate and investigations into incidents with UAS.

Relative Spacing Using Interval Management, OI: 102118

Improved inter-aircraft spacing precision is achieved using new aircraft capabilities, which should increase efficiency and throughput in capacity-constrained airspace without negatively impacting controller workload and task complexity. This will improve overall traffic flow and help avoid some costly, low-altitude maneuvering. This will be used in locations that do not have or are not currently conducting time based flow management.

Automation Support for Separation Management, OI: 102137

Air Navigation Service Provider (ANSP) automation provides the controller with tools to manage aircraft separation in a mixed navigation and wake performance environment. Advances in Performance Based Navigation and additional wake separation categories leads to the use of more sophisticated separation rules between aircraft and the need for advisory support to the controller.

Enhanced Non-Federal Advisory and Sequencing Services for Class D Airport Operations, OI: 102138

Improved surveillance, communications, and decision support capabilities used by personnel located in a remote ground level facility may provide a more cost effective solution for providing advisory and sequencing services in class D airspace. This will enable faster confirmation that the runway is clear thereby enabling more consistent airport services and additional operations, especially during Instrument Meteorological Conditions (IMC) and enable these services to be provided for more airports across the NAS.

Improved Parallel Runway Operations, OI: 102141

This improvement will explore concepts to recover lost capacity through reduced separation standards and increased application of advanced dependent and independent procedures.

Wake Turbulence Mitigation for Arrivals: CSPRs, OI: 102144

This improvement will implement additional controller tools and procedures that increase arrival throughput for dependent parallel approach courses to closely spaced parallel runways (CSPR).

Single Runway Arrival Wake Mitigation, OI: 102145

Single Runway Arrival Wake Mitigation will provide increased arrival capacity to single runways by reducing longitudinal wake separation standards during radar operations under certain crosswind conditions. Weather sensors and wind prediction systems will be used to forecast persistent crosswind conditions and air traffic automation systems will be used to indicate to controllers when they can safely reduce wake separation standards, increasing arrival capacity.

Flexible Routing, OI: 102146

Increased system precision and enhanced automation supports the efficient use of flight levels so that aircraft can more closely fly routes that maximize the airlines' goals of fuel efficiency, aircraft operations, and schedule. Aircraft provide state and intent data that will lead to fewer predicted problems resulting in fewer diversions from the preferred routing.

Single Runway Departure Wake Mitigation, OI: 102151

Single Runway Departure Wake Mitigation will provide increased departure capacity from single runways by reducing longitudinal wake separation standards under certain crosswind conditions. Airport weather sensors and wind predictions systems will be used to forecast persistent crosswind conditions and monitor crosswind conditions. Air traffic automation systems will be used to indicate to controllers when they can safely reduce wake separation standards, increasing departure capacity.

Dynamic, Pair-wise Wake Turbulence Separation, OI: 102152

Wake turbulence separation procedures and applications supporting en route and terminal operations are integrated into air traffic automation to provide dynamic, pairwise, lateral, longitudinal, and vertical wake separation requirements for trajectory management based on aircraft and weather conditions, in real time.

Wake Re-Categorization, OI: 102154

The current set of pairwise wake separation requirements have been updated and expanded based on analysis of wake generation, wake decay and encounter effects for the current fleet of aircraft. These new separation standards are programmed into the automation systems to allow the controllers to use more accurate aircraft separation standards to increase both flight efficiency and runway capacity utilization.

Improved Parallel Runway Operations with Airborne Applications, OI: 102157

Improved flight deck capabilities allow for increased arrival capacity for parallel runway operations in IMC. Reduced separation for dependent approaches of closely spaced parallel runways will be enhanced using aircraft avionics that assist pilots in maintaining the required interval from other aircraft. Ground automation identifies opportunities to the controller who can provide a clearance to the flight crew for specific lateral and longitudinal separation distance from other aircraft.

Automated Support for Initial Trajectory Negotiation, OI: 102158

En Route sector capacity and throughput are increased through the ability to send route changes and instructions to the cockpit over data communications. Trajectory management is enhanced by automated assistance to negotiate pilot trajectory change requests with properly equipped aircraft operators.

CSPR Paired Departure Wake Mitigation, OI: 102159

Changes in procedures, standards, and the implementation of new technology will safely reduce the impact of wake separation standards on airport operations. Changes to wake separation minima implemented at airports with CSPR complexes will increase throughput during departure operations during periods with favorable winds.

Advanced Automation Support for Separation Management, OI: 102160

ANSP automation provides the controller with tools to manage aircraft separation with more advanced wake separation standards and performance based navigation capabilities. Controllers will use ANSP automation enhancements to obtain additional situational awareness to decrease the cognitive workload and increase the operational benefit afforded by more closely spaced routes.

Initial Integration of Weather Information into NAS Automation and Decision Making, OI: 103119

Advances in weather information content and dissemination provide users and/or their decision support tools with the ability to identify specific weather impacts on operations (e.g., trajectory management and impacts on specific airframes, arrival/departure planning) to ensure continued safe and efficient flight.

Full Integration of Weather Information into NAS Automation and Decision Making, OI: 103123

Weather information will be translated into constraint information to be fully integrated into decision-support technologies. Advanced impact assessment tools improve ANSP and flight operator tactical and strategic planning by providing consolidated weather processing of observational and forecast capabilities to produce consistent weather information for improved ATM decision-making for meeting capacity, efficiency, and safety objectives.

Aircraft Collision Avoidance for New Aircraft Types, OI: 103210

New technologies will benefit aircraft-based Collision Avoidance (CA) avionics as they are extended to accommodate Unmanned Aircraft Systems. The CA technologies will process non-cooperative surveillance targets in order to sense/detect and avoid other aircraft. In addition, the logic will also account for the variety of aircraft sizes and dynamic capabilities of the aircraft.

On-Demand NAS Information, OI: 103305

NAS and aeronautical information will be available to users on demand. This information is consistent across applications and locations that are available to authorized subscribers and equipped aircraft. Proprietary and security-sensitive information is not shared with unauthorized agencies or individuals.

Tailored Delivery of On-Demand NAS Information, OI: 103306

The delivery of selected NAS and aeronautical information data elements will be available to users and tailored based on the information that pertains to their flight trajectory. An integrated set of weather information will be available to users on demand and tailored based on their flight trajectory. This information is consistent across applications and locations that are available to authorized subscribers and equipped aircraft.

Optimized Oceanic Trajectories via Interactive Planning, OI: 104102

Interactive planning between the oceanic airspace user and FAA automation both before and after departure enhances the ability of the flight to fly closer to the user's preferred 4D trajectory. Users can receive feedback on their intended Oceanic trajectory and adjust plans if desired. Given the long duration of oceanic flights, there are often changes to wind and weather conditions while the flight progresses which change the flight's progress along the route. The exchange of the route information from the aircraft provides the FAA with more up to date location information. Automation improvements allow the user to more easily request trajectory changes that better fit the new conditions.

Current Tactical Management of Flow in En Route for Arrivals and Departures, OI: 104115

Automation will assist with minimizing the capacity and efficiency impacts of special activity airspace closures using integrated tools based on mature Aeronautical Information Exchange models.

Improved Management of Arrival/Surface/Departure Flow Operations, OI: 104117

This improvement integrates advanced arrival/departure flow management with advanced surface operation techniques to improve overall airport capacity and efficiency.

Point-in-Space Metering, OI: 104120

The ANSP uses scheduling tools and trajectory-based operations to assure smooth flow of traffic and increase the efficient use of airspace. Point-in-space metering can be associated with a departure fix, arrival fix, or any other point-in-space, such as airspace boundaries or other flow converging points. Decision support tools will allow traffic managers to develop scheduled arrival times for constrained resources and allow controllers to manage aircraft trajectories to meet the scheduled meter times.

Integrated Arrival and Departure Airspace Management, OI: 104122

New airspace design takes advantage of expanded use of terminal procedures and separation standards. This is particularly applicable in major metropolitan areas supporting multiple high-volume airports. This increases aircraft flow and introduces additional routes and flexibility to reduce delays.

Time-Based Metering Using RNAV and RNP Route Assignments, OI: 104123

RNAV, RNP and time-based metering provide efficient use of runways and airspace in high-density airport environments. RNAV and RNP provide users with more efficient and consistent arrival and departure routings and fuel-efficient operations. Metering automation will be augmented to provide additional options to manage the flow of aircraft to meter fixes, thus permitting more efficient use of runways and airspace. Decision support tool functions will be implemented in traffic management tools and procedures to assist air traffic management in selecting the routes configurations that optimize airspace in the Metroplex environment.

Trajectory-Based Management – Gate-to-Gate, OI: 104126

All aircraft operating in high-density airspace are managed by Four Dimensional Trajectories (4DT) to dramatically reduce the uncertainty of an aircraft's future flight path. Integration of these improved time estimates into separation assurance and traffic management tools results in more efficient tactical adjustment of individual aircraft trajectories and increased capacity and throughput. Trajectory exchange through data communications will significantly contribute to this improvement.

Time-Based Metering in the Terminal Environment, OI: 104128

This improvement extends current metering capabilities into the terminal environment and furthers the pursuit of end-to-end metering and trajectory-based operations. It also supports capabilities designed to expand the use of terminal separation standards in transition airspace, and solidifies the foundation for future advanced airborne-based applications that will depend upon ground-based automation to maintain the complete sequence of aircraft into and out of high-density terminal locations.

Full Surface Traffic Management with Conformance Monitoring, OI: 104206

Efficiency and safety of surface traffic management is increased using improved automation support for taxi route planning, data link of taxi instructions, and automated conformance monitoring of the aircraft to the approved taxi clearance.

Enhanced Departure Flow Operations, OI: 104208

Efficient departure operations are achieved through the improved ability to quickly revise departure clearances in the event that changing weather, winds or system constraints requires amendments to the pre-departure clearance. Traffic managers create route amendments and send the updated flight data to air traffic controllers for delivery to affected flights. Revised departure clearances are issued electronically to equipped aircraft.

Surface Traffic Management, OI: 104211

Departures are sequenced and staged to maintain throughput. Automation generates predicted airport and runway schedules for arrivals and departures providing better demand/capacity balancing. ANSP uses automation to integrate surface movement operations with departure sequencing to ensure departing aircraft meet departure schedule times while optimizing the physical queue in the movement area. The use of virtual departure queues into the movement area will save fuel and reduce emissions.

Full Collaborative Decision Making, OI: 105207

Timely, effective, and informed decision-making based on shared situational awareness is achieved through advanced communication and information sharing systems. Stakeholder decisions are supported through access to an information exchange environment and a transformed collaborative decision making process that allows wide access to information by all parties, whether airborne or on the ground, while recognizing privacy and security constraints.

Traffic Management Initiatives with Flight-Specific Trajectories, OI: 105208

This capability will increase the agility of the NAS in adjusting and responding to dynamically changing conditions such as severe weather, congestion and system outages through the automated identification, generation and dissemination of route changes.

Initial Flight Day Evaluation, OI: 105302

Users provide updated departure prediction information that is used by ANSP traffic management decision-support tools to improve system constraint predictions and assessments of proposed mitigation strategies. Improved predictions of departure times will enable air traffic management to more closely balance demand to available capacity thereby minimizing traffic management delays.

Advanced Flight Day Evaluation, OI: 105303

Continuous flight day evaluation is improved through advanced predictions of airport capacity, improved integration of ANSP automation systems, and improved algorithms to estimate demand and capacity imbalances. ANSP and users use real-time constraint information and integrated Traffic Management Initiative (TMI) mitigation strategies to increase operational predictability and throughput.

Resilient PBN Operations, OI: 107120

The ability to conduct Performance Based Navigation (PBN) operations in the event of Global Navigation Satellite Service (GNSS) outages will be assured through the use of multiple mitigation strategies. These strategies will enable aircraft to continue to navigate using PBN en route and at our most economically important locations. The ability to assure that PBN operations will continue during GNSS outages or interference events will result in a more resilient NAS.

Flexible Airspace Management, OI: 108206

ANSP automation supports reallocation of trajectory information, surveillance, communications, and display information to different positions or different facilities. The ANSP moves controller capacity to meet demand. Automation enhancements enable increased flexibility to change sector boundaries and airspace volume definitions in accordance with pre-defined configurations.

Increase Capacity and Efficiency Using Area Navigation (RNAV) and Required Navigation Performance (RNP), OI: 108209

This improvement will allow use of RNAV and RNP to enable more efficient aircraft trajectories. Combined with airspace changes, RNAV and RNP increase airspace efficiency and capacity. Further efficiencies will be gained through the development and implementation of advanced criteria. RNAV and RNP will permit the flexibility of point-to-point operations and allow for the development of routes, procedures, and approaches.

Improved Management of Special Activity Airspace (SAA), OI: 108212

Special Activity Airspace availability is optimized and managed in real-time, based on actual flight profiles and real-time operational use parameters. Assignments, schedules, coordination, and changes to all types of SAAs are made readily available for operators and ANSPs using automation systems and are used to assess airspace status and route availability.

UAS Airspace Access, OI: 108214

UAS access to designated airspace volumes is determined based on airspace classes and the performance level of the UAS. Airspace management provides the availability status for airspace volumes as needed to prevent UAS from flying in the vicinity of manned aircraft or to segregate airspace for first responders.

Increase Capacity and Efficiency Using Streamlined PBN Services, OI: 108215

Leveraging lessons learned from community outreach, airspace efficiencies will be gained through the development and implementation of additional and advanced PBN services that provide more efficient aircraft trajectories and increase airspace capacity. PBN procedures will also be redesigned to streamline services in order to enable more optimal descents with time-based terminal sequencing and spacing tools.

Safety Information Sharing and Emergent Trend Detection, OI: 601103

Information analysis and sharing directly supports safety promotion and safety assurance initiatives. It supports analytical efforts such as the comparison of baseline information and trends. It also indirectly supports safety risk management through issue identification, information, and tools for analysis of hazards.

Automated Safety Information Sharing and Analysis, OI: 601104

Aviation operational safety will be enhanced and risk reduced by automating risk identification and notification processes. Improvements in the analytical techniques and tools used to extract information from additional data sources will continuously improve the understanding of the data and its implications for safety.

Integrated Safety Analysis and Modeling, OI: 601202

This OI mitigates safety risk associated with the design, evolution, and implementation of NextGen by providing enhanced integrated safety methods. It will provide advanced capabilities for integrated, predictive safety baseline risk assessment; advanced capabilities for integrated risk analysis; improved validation and verification processes supporting certification; simulation protocols that provide enhanced evaluation frameworks for safe operational procedures; and enhanced training requirements analysis for safe system operation.

Increase International Cooperation for Aviation Safety, OI: 601302

This OI promotes worldwide aviation safety enhancements for the traveling public through international participation in the development and implementation of safer practices and systems. It also contributes to the continued viability of the U.S. Aviation industry by supporting the required harmonization of international standards for an interoperable Safety Management System (SMS).

4.3 NextGen Portfolio Descriptions and their supporting Capital Programs

The portfolios define the research, engineering and acquisition activities needed to achieve additional functionality in base and new systems along with any complementary development of standards, guidance, and procedures that may be required. Each of the portfolio descriptions in this section are followed by a list of the capital programs that support the portfolio. For the full program descriptions see CIP Appendix B. The OIs linked to each portfolio and the corresponding OI descriptions were discussed previously in sections 4.1 and 4.2.

For information on the implementation portfolios; Collaborative Air Traffic Management Technologies (CATMT), Time-Based Flow Management (TBFM), and Terminal Flight Data Manager (TFDM), please refer to the Enterprise Architecture Infrastructure Automation Roadmaps in Section 5.1. For CATMT and TBFM, see section 5.1.1 Air Traffic Management and Air Traffic Control. For TFDM, see section 5.1.2 Air Traffic Support and Oceanic Air Traffic Control.

For more information on [NextGen accomplishments](http://www.faa.gov/nextgen/snapshots/), please visit the following site: <http://www.faa.gov/nextgen/snapshots/>.

4.3.1 Separation Management Portfolio

This portfolio provides controllers and pilots with the necessary tools and procedures to perform separation management in all airspace and airports within the NAS. The aircraft separation assurance service is the cornerstone of ATC operations and the investments tied to this portfolio provide the tools, procedures, standards, and guidance to better manage aircraft in a mixed environment with varying navigation equipment and wake performance capabilities.

Capital investments that support Separation Management are listed below.

BLI #	CIP Title	CIP #
1A05	Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management	G01S.02-01
1A05	Modern Procedures	G01A.01-01
1A05	Wake Turbulence Re-Categorization	G06M.02-02
1A05	Separation Automation System Engineering	G01A.01-06
1A05	Closely Spaced Parallel Runway Operations	G06N.01-02
1A05	Concept Development for Integrated NAS Design & Procedures Planning	G05A.02-04
1A05	NextGen Oceanic Capabilities	G01A.01-07

Table 4-2 Separation Management Programs

4.3.2 Traffic Flow Management (TFM) Portfolio

This portfolio will improve overall access, efficiency, and flexibility of the NAS by making the best use of available airspace and airport capacity through improved planning and coordination. Advanced traffic management automation tools will be used to improve flight and flow decision making to optimize airspace and airport capacity. These tools will also assist with improved collaborative decision making with the user community to best meet their business objectives. The capabilities in the portfolio address the exchange of information between controllers, pilots, and air traffic managers throughout all phases of flight and the development of automation capabilities that increase airspace and airport access and optimize available capacity by improving the flow of flights through integrated planning of departure, en route, arrival, and airport surface operations.

Capital investments that support Traffic Flow Management Portfolio are listed below.

BLI #	CIP Title	CIP #
1A06	Surface Tactical Flow	G02A.01-01
1A06	Time Based Flow Management (TBFM) Work Package 4	G02A.01-08
1A06	Strategic Flow Management Application	G05A.01-01
1A06	Strategic Flow Management Engineering Enhancement (SFMEE)	G05A.01-02
1A06	Advanced Methods	G05A.02-02

Table 4-3 Traffic Flow Management Programs

4.3.3 On-Demand NAS Portfolio

On-Demand NAS Information will provide flight planners, air traffic controllers and traffic managers, and flight crews with consistent and complete information related to changes in various areas of the NAS, such as temporary flight restrictions, temporary availability of special activity airspace (this includes military, Temporary Flight Restrictions, other), equipment outages, and runway closures. This portfolio ensures that NAS and other aeronautical information is consistently provided across all NAS applications and locations using common net enabled access to aeronautical and flight information utilizing global standards – Aeronautical Information Exchange Model (AIXM) and Flight Information Exchange Model (FIXM).

Capital investments that support On-Demand NAS are listed below.

BLI #	CIP Title	CIP #
1A07	Flight Object	G05A.02-03
1A07	Common Status & Structure Data	G05A.02-01
1A07	Flight Object Exchange Services (FOXS)	G05A.02-08
1A07	Dynamic Airspace	G05A.04-01
1A07	Flight Deck Collaborative Decision Making	G05A.02-11

Table 4-4 On-Demand NAS Programs

4.3.4 NAS Infrastructure Portfolio

The NAS Infrastructure Portfolio includes capabilities that address aviation weather issues, which supports the need to improve air traffic management (ATM) decision making during adverse weather conditions. These capabilities will improve the use of weather forecast information in the NAS and evolve the existing aviation weather infrastructure, i.e., dissemination, processor, and sensor systems, to standardize weather information and interfaces, and reduce operational costs. This work also includes new air traffic control management procedures, separation standards and flexible airspace categories to increase throughput.

Capital investments that support NAS Infrastructure are listed below.

BLI #	CIP Title	CIP #
1A08	Weather Observation Improvements	G04W.02-01
1A08	Weather Forecast Improvements – Work Package 1	G04W.03-01
1A08	NextGen Navigation Engineering	G06N.01-03
1A08	New ATM Requirements	G01M.02-02
1A08	Information Management	G05M.03-01

Table 4-5 NAS Infrastructure Programs

4.3.5 NextGen Support Portfolio at WJHTC

This portfolio will continue to explore new technologies at the NextGen laboratories and support operational assessment for system performance. The capital investment that supports the NextGen Support Portfolio at WJHTC is listed below.

BLI #	CIP Title	CIP #
1A09	NextGen Laboratories	G03M.02-01

Table 4-6 NextGen Support Portfolio Program

4.3.6 Unmanned Aircraft Systems (UAS)

NextGen Unmanned Aircraft Systems is essential for ensuring safe integration of UAS into the NAS. These investments play a critical role in providing NAS access to UAS operations without

impacting manned aircraft operations and creating disruptions or delays. They will ensure that UAS operations in the NAS will be more efficient and as safe, or safer, than they are today.

Capital investments that support Unmanned Aircraft Systems are listed below.

BLI #	CIP Title	CIP #
1A10	Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development	G01A.05-02
1A10	Unmanned Aircraft Systems (UAS) Flight Information Management	G01A.05-01

Table 4-7 Unmanned Aircraft Systems (UAS) Programs

4.3.7 Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio

This portfolio will conduct the research needed to determine the viability and benefits of future NAS concepts. It conducts enterprise level activities, including development of concepts across the NAS, human factors analysis of the NextGen operational environment, and demonstrations of proposed NextGen system improvements to ensure operational feasibility and viability with the NAS. Concepts will be researched and assessed to identify research issues, evaluate benefits, reduce risk, and develop preliminary operational requirements and procedures to enhance safety, increase operational efficiency, increase airspace capacity, and expand current capabilities throughout the NAS.

Capital investments that support Enterprise, Concept Development, Human Factors, & Demonstrations Program are listed below.

BLI #	CIP Title	CIP #
1A11	Enterprise Concept Development	G05A.02-10
1A11	Enterprise Human Factor Development	G01M.02-05
1A11	Stakeholder Demonstrations	G08M.01-04

Table 4-8 Enterprise, Concept Development, Human Factors, & Demonstrations Programs

4.3.8 Performance-Based Navigation & Metroplex Portfolio

PBN uses RNAV and Required Navigation Performance (RNP) to improve access and flexibility in the NAS with the goal of providing the most efficient aircraft routes from departure runway to arrival runway with greater precision and accuracy. Progressive stages of PBN capabilities include the safe implementation of more closely spaced flight paths for departure, arrival, and approach and improves the operational efficiency for airports located in Metroplexes.

Capital investments that support Performance Based Navigation & Metroplex are listed below.

BLI #	CIP Title	CIP #
2B19	NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP)	G05N.01-01
2B19	NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN) Strategy	G01N.01-02

Table 4-9 Performance Based Navigation & Metroplex Programs

4.3.9 System Safety Management Portfolio

System Safety Management is developing data acquisition, storage, analysis, and modeling capabilities to meet the safety analysis needs of NextGen designers, implementers, and safety professionals. These resources will be used to ensure that new capabilities either improve or maintain current safety levels while improving capacity and efficiency in the NAS.

Capital investments that support System Safety Management are listed below.

BLI #	CIP Title	CIP #
3A09	Aviation Safety Information Analysis and Sharing (ASIAS)	G07A.02-01
3A09	Systems Safety Management Transformation (SSMT)	G07M.02-01

Table 4-10 System Safety Management Programs

4.3.10 Cross Agency NextGen Management

Delivering NextGen is a high priority for the Administration, the Department of Transportation, and the FAA. Its complexity and interdependencies make it the most challenging FAA undertaking to date requiring evaluation of internal processes and internal structures to meet the demands of modernizing the NAS. The NextGen Interagency Planning Office integrates NextGen multi-agency research and development requirements and facilitates the transfer of research between its partner agencies.

The capital investment that supports Cross Agency NextGen Management is listed below.

BLI #	CIP Title	CIP #
4A10	Cross Agency NextGen Management	G08M.04-01

Table 4-11 Cross Agency NextGen Management

5 Enterprise Architecture Infrastructure Roadmaps

The detailed infrastructure roadmaps in the following subsections are an integral part of the NAS Enterprise Architecture and show the existing systems in the NAS and the planned capital programs for both legacy and NextGen systems. The roadmaps extend beyond the 5-year CIP horizon and show extended timelines with planned or proposed NAS modernization envisioned for the future. Upgrading the sophisticated systems used for air traffic control requires significant engineering development efforts and long range planning to ensure the continued safety and efficiency of the NAS.

The roadmaps present an executive level view of the programs and systems that make up the NAS and do not include every aspect of the detailed planning behind them. The timelines are included to show the length of time that existing systems or their replacements will remain in service. This highlights the future plan for these legacy systems that may impact the planning, management, and budgeting of interdependent CIP programs developing new or improved capabilities for their replacement.

Many improvements shown in the roadmaps require aviation users to add equipment to their aircraft and adopt new procedures which can alert users to potential changes that may affect their equipment and crew training. The roadmaps included in this plan were current as of January 2017. The roadmaps are updated annually to reflect the results of studies, demonstration projects, and economic analyses related to the programs but are generally stable from year-to-year. To view the most recent version of the [Enterprise Architecture Infrastructure Roadmaps](http://faa.gov/nextgen/delivering/nasea) see: <http://faa.gov/nextgen/delivering/nasea> .

The infrastructure roadmaps in this section organize the architecture by functional area. The systems shown in light blue on the left side of the diagrams are currently in service. Funding to maintain and operate the in-service systems is provided by the Operations appropriation. Capital investments to upgrade or replace these systems are shown by the program boxes within the roadmap timeline and are funded by the Facilities and Equipment appropriation. The length of each box on the roadmaps reflects the fiscal years that a program has, or is expected to receive funding; legacy programs are shown as gray bars and NextGen are orange. A dotted box means that a program is planned but funding has not yet been identified.

Below each roadmap, a brief description is provided for each of the systems shown along the left side of the roadmaps. For each related CIP program requesting funds between FY 2018-2022, a brief summary is provided in this section that includes the purpose of the program, the associated BLI number, CIP title, and CIP number. Full descriptions of the capital programs are provided in Appendix B. The BLI may be used to associate a CIP program shown on the FAA Enterprise Architecture Roadmaps with the funding identified in Section 8, Estimated Funding by BLI. Note that BLIs may include funds that support multiple CIP programs.

Figure 5-1 shows and defines the symbols used in the infrastructure roadmaps. The solid red lines indicate the time that systems, or their replacements will remain in operation. The dashed lines indicate that a system is scheduled to be replaced or taken out of service. The end date of operation is indicated with an X. The boxes with names identify programs, functions or systems,

which are either described in the text below each roadmap or are defined in the Acronyms and Abbreviations section of this document.

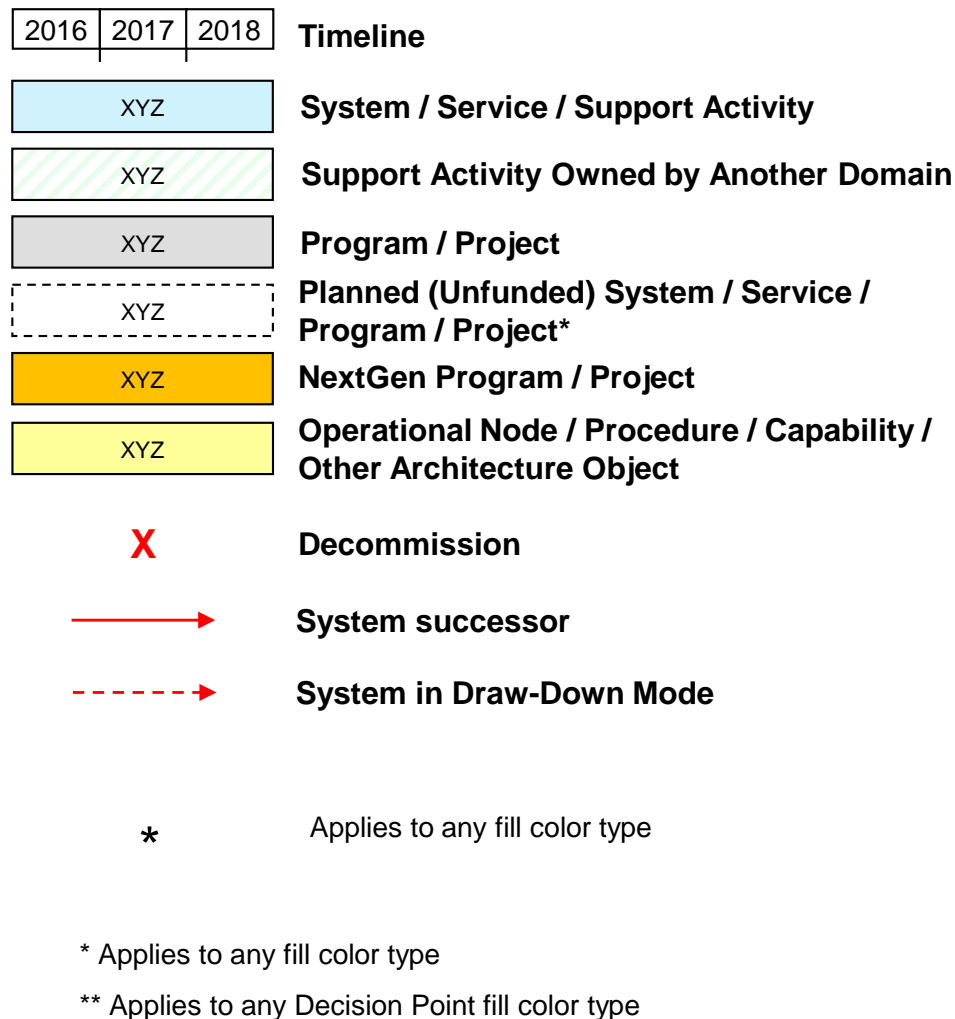


Figure 5-1 Infrastructure Roadmap Legend

5.1 Automation Roadmaps

Automation is a core element of the air traffic control system. Controllers require a real-time display of aircraft location as well as information about the speed, altitude, and direction for approximately 60,000 flights that they track and keep safely separated each day. Automation provides controllers with continuously updated displays of aircraft position and whether the aircraft is level, climbing, or descending. Existing or upgraded automation systems will also host software enhancements developed by NextGen programs to support Operational Improvements (OIs).

The Traffic Flow Management System (TFMS) supports the FAA's Traffic Management personnel in providing efficiency-critical NAS services. The system compares the projected

traffic with the capacity of destination airports to determine if steps need to be taken to manage the flow and prevent delays. Throughout each day, Traffic Managers use the TFMS to maintain near real-time situational awareness and predict areas which may experience congestion due to capacity reductions or an unusual increase in demand. The 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 (80 sites), and flight operators. TFMS remote sites are also located at other FAA and Government offices (39).

Automation implementation, including the plans to sustain, upgrade, replace or decommission current systems from 2016 through 2030 are shown in the following NAS EA roadmaps:

1. Roadmap 1 (figure 5-2) - Air Traffic Management and Air Traffic Control
2. Roadmap 2 (figure 5-3) - Air Traffic Support and Oceanic Air Traffic Control
3. Roadmap 3 (figure 5-4) - Flight Services and Aeronautical / Information Support

5.1.1 Air Traffic Management and Air Traffic Control

Automation Roadmap (1 of 3)

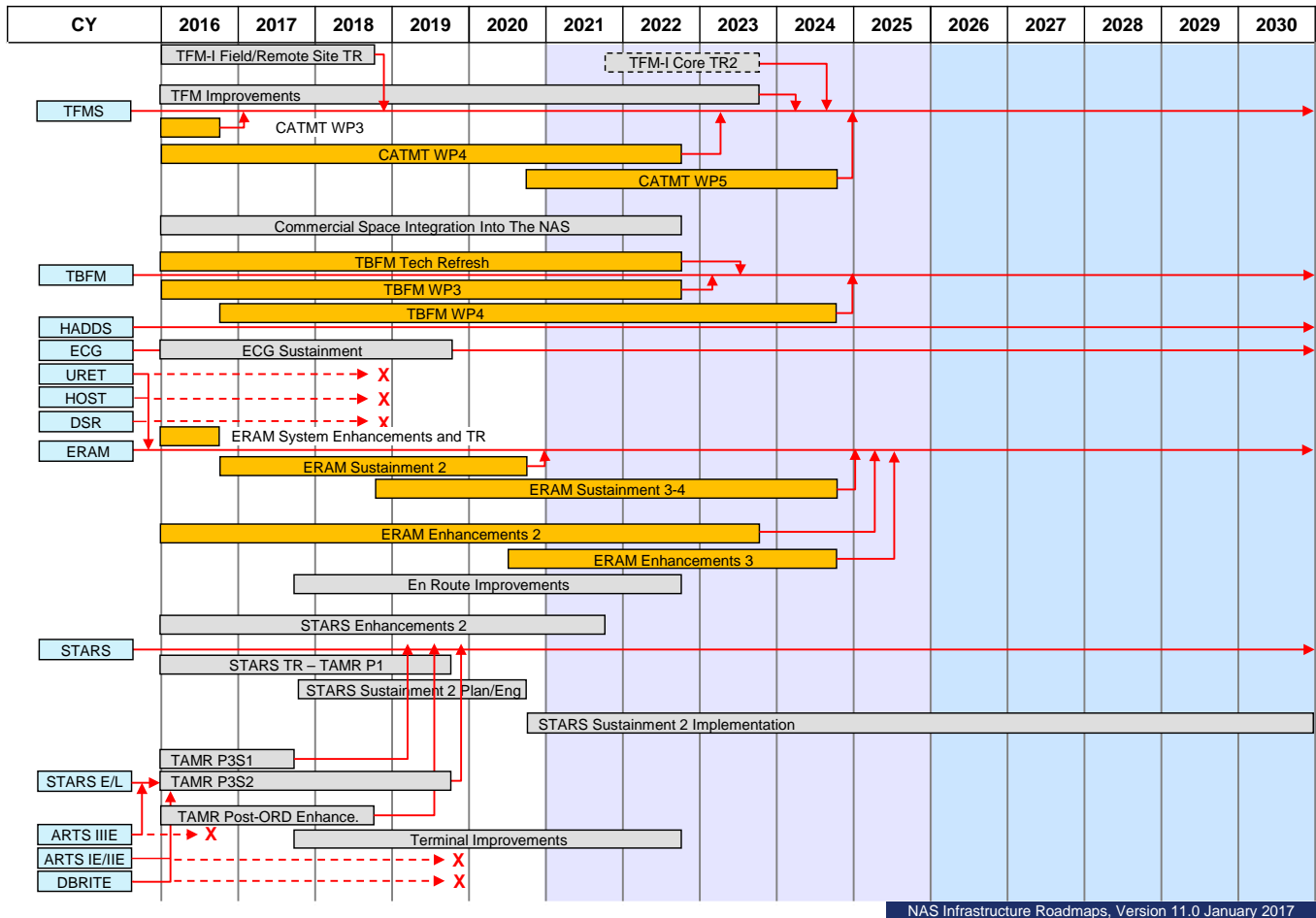


Figure 5-2 Air Traffic Management and Air Traffic Control Roadmap

TFMS, shown at the top left of figure 5-2, is described above in section 5.1 Automation Roadmaps.

The FAA will continue to implement the TFM Infrastructure Field/Remote Site Technology Refresh program to replace TFMS equipment at field sites. The TFM Improvements program will upgrade decision support tools to help traffic managers implement more efficient Traffic Management Initiatives (TMI). The program will conduct operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of TFM services. See BLI 2A05 for more information about the TFM Infrastructure – Field/Remote Site Technology Refresh, A05.01-13, and TFM Infrastructure – TFM Improvements, A05.01-14, programs.

The future program, TFM Infrastructure (TFM-I) Core Technology Refresh 2, now called TFMS Modernization Part 2, will modernize remaining TFMS legacy software applications and will increase integration and interoperability by establishing a robust, commercially-available and standards-compliant system. It will also provide a replace-in-kind technology refresh of the hardware providing the central data processing capability for the TFMS. See BLI 2A05 for more information about the TFMS Modernization Part 2, A05.01-15, program.

Collaborative Air Traffic Management Technologies (CATMT) Work Packages (WP) are capability enhancements to the TFMS and expand collaboration to individual pilots and improve information exchange between the FAA and airline dispatch offices. Collaboration improves the efficiency of operations by helping operators determine the most efficient way to allocate NAS capacity. See BLI 2A14 for more information about the CATMT – Work Package 4, G05A.05-03, and CATMT – Work Package 5, G05A.05-04, programs. *(The NextGen Operational Improvements that these NextGen programs support can be found in Section 4.1.)*

The Commercial Space Integration into the NAS program will introduce processes and procedures that will allow the FAA to reduce the amount of airspace required to be closed in advance of a mission, effectively respond to off-nominal scenarios in a timelier manner during a mission, and quickly release airspace back to the system as the mission progresses. The program will develop a Space Data Integrator capability to automate the FAA’s current manual process and provide data integration capability to process real-time vehicle and aircraft hazard area data and provide the information to the TFMS and affected facilities. The program is working toward a FID. See BLI 2A22 for more information about the Commercial Space Integration Into The NAS, M55.01-01, program.

The Space Integration Enhancements 1 program supports the integration of commercial space into the NAS by focusing on Space Data Integrator improvements as well as the integration of an improved Aircraft Hazard (AHA) generator capability. The improved AHA generator “Hazard Risk Assessment and Management (HRAM)” will be capable of calculating refined AHAs in seconds, rather than minutes. The program is working toward a FID. See BLI 2A22X for more information about the Space Integration Enhancements 1, G01M.03-01, program.

The Time Based Flow Management (TBFM) system uses time-based metering to better utilize NAS capacity by improving traffic flow management of aircraft approaching and departing congested airspace and airports. Aircraft using this technique can arrive properly sequenced and spaced to maximize capacity at the nation’s busiest airports. TBFM has been deployed and is operational at 20 Air Route Traffic Control Centers and adapted for most major airports served by these centers.

TBFM Technology Refresh program will replace the existing hardware that was deployed in 2012 and 2013 with new hardware in the FY 2021-2022 time frame to support TBFM WP4. The program is working toward a FID. See BLI 2A15 for more information about the TBFM Technology Refresh, G02A.01-07, program.

TBFM Work Package 3 will implement additional NextGen concepts, such as optimized descent during time-based metering; Terminal Sequencing and Spacing to provide efficient sequencing

and runway assignment and also includes expansion of the Integrated Departure /Arrival Capability to additional locations. See BLI 2A15 for more information about the TBFM Work Package 3, G02A.01-06, program. *(The NextGen Operational Improvements that this NextGen program supports can be found in Section 4.1.)*

TBFM Work Package 4 will build upon existing core TBFM capabilities to increase benefits from time-based metering and enable the expansion of PBN operations across the NAS. Time-based metering through TBFM has provided an average 3-5% increase in throughput at the airports where it is installed. See BLI 1A06 for more information about the TBFM Work Package 4, G02A.01-08, program. *(The NextGen Operational Improvements that this NextGen program supports can be found in Section 4.1.)*

The Host ATM Data Distribution System (HADDs) supplies data to the TFMS discussed above and will remain in operation through the timeframe of the current roadmap (2016-2030).

The En Route Communications Gateway (ECG) system is a computer system that formats and conveys critical air traffic data to the En Route Automation Modernization (ERAM) and the Enhanced Backup Surveillance System at the Air Route Traffic Control Centers. The ECG Sustainment program plans, procures, and deploys ECG hardware or software components to maintain a high level of system availability. See BLI 2A02 for more information about the ECG – Sustainment, A01.12-02, program.

The ERAM program incorporated three of the en route system component pieces: User request Evaluation Tool (URET); Host Computer; and Display System Replacement (DSR). DSRs are the ATC displays at the en route centers. URET is a conflict-detection tool that automatically detects and advises air traffic controllers of potential conflicts between aircraft or between aircraft and special activity airspace. ERAM became fully operational in 2015 and supports the agency's transition to NextGen. The ERAM system replaced the Host Computer, processes flight and surveillance data, and generates display data for en route air traffic controllers.

The ERAM Sustainment 2 and 3 programs will sustain the ability for en route controllers to collectively track up to 1,900 aircraft at a time by updating a subset of ERAM equipment that is in critical need of replacement at the 20 ARTCC. The ERAM Sustainment 3 program is working toward FID. See BLI 2A01 for more information about the ERAM Sustainment 2, G01A.01-10, and ERAM Sustainment 3, G01A.01-11, programs.

The ERAM Enhancements 2 and 3 programs will improve the efficiency and effectiveness of en route sector operations by enabling the implementation of NextGen capabilities to support increased efficiency and capacity benefits. ERAM Enhancements 2 program provides software enhancements for the en route sector controller team. These include enhancements to improve conflict probe processing, support for Unmanned Aircraft Systems (UAS), and other improvements. The ERAM Enhancements 3 program provides separation management automation enhancements to assist en route controllers in managing safe aircraft separation in a mixed environment of varying navigation equipment and wake performance capabilities. It will improve trajectory modeling, enhance conflict probe processing and detection, and optimize use of aircraft PBN data. The ERAM Enhancements 3 program is working toward FID. See BLI

2A01 for more information about the ERAM Enhancements 2, G01A.01-08, and ERAM Enhancements 3, G01A.01-12, programs.

The En Route Improvements program will 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. It will conduct operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of en route domain services. See BLI 2A21 for more information about the En Route Improvements, A01.16-01, program.

The last five systems in figure 5-2 provide ATC automation for terminal airspace. They include the Standard Terminal Automation Replacement System (STARS); The STARS Enhanced Local Integrated Tower Equipment / Local Integrated Tower Equipment (STARS E/L); The Automated Radar Terminal System model III E (ARTS III E); ARTS 1E/III E; and Digital Bright Radar Indicator Tower Equipment (DBRITE). STARS and ARTS systems allow TRACON controllers to track aircraft as they transition from en route control to terminal airspace, normally within 60 miles of the destination airport. DBRITE is a tower display that allows tower cab controllers to determine the location of approaching traffic before it becomes visible to them.

STARS – Technology Refresh (TAMR Phase 1) program is the technology refresh of STARS automated radar processing and display systems at 48 Terminal Radar Approach Control (TRACON) facilities and their associated Air Traffic Control Towers (ATCTs). The TAMR Phase 1 program will provide hardware updates including new high-resolution Liquid Crystal Display color displays, processors, storage devices, and enhanced memory; and a software update to support NextGen initiatives, and to maintain, correct, or improve system performance, efficiency, safety, and security vulnerabilities. See BLI 2B02 for more information about the STARS – Technology Refresh (TAMR Phase 1), A04.01-01, program.

The STARS Sustainment 2 Planning and Engineering will enable the FAA to design and replace key elements of STARS that have reached their end-of-life (EOL) and are no longer compatible with current commercial offerings. STARS Sustainment 2 Implementation program will engineer and deploy additional key elements of STARS that reach EOL and are no longer compatible with current commercial offerings in the FY 2021 time frame. These programs are working towards a FID. See BLI 2B02 for more information about the STARS – Sustainment 2 Planning/Engineering, A04.01-03, and STARS – Sustainment 2 Implementation, A04.01-05, programs.

The Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2 will replace 91 Automated Radar Terminal System (ARTS) IIE systems at TRACONs and their associated 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 STARS Remote Towers 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. See BLI 2B03 for more information about the TAMR – Phase 3, Segment 2, A04.07-02, program.

The Terminal Automation Modernization – Replacement (TAMR) – Post Operational Readiness Demonstration (ORD) Enhancements program considered requests for operational needs and capabilities that existed in ARTS at the time of transition to STARS at Phase 1 and Phase 3 sites. As requests were identified, validated, prioritized, and approved for implementation, the TAMR Program Office used existing, mature processes for the engineering, design, development, testing, integration and delivery of hardware and software additions to these sites.

The Terminal Improvements program will support operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of terminal services. The scope of these NAS improvements is limited to operational changes that don't require significant capital investments, a formal investment decision, or involve significant systems complexity, interdependencies, or NAS operational changes. See BLI 2B04 for more information about the Terminal Improvements, A.04.09-02, program.

The STARS Enhancements 2 program is the next useful segment for the STARS platform and will consolidate terminal automation onto a single platform. As envisioned by NextGen, it will implement the capabilities necessary to enable trajectory-based operations in the terminal environment and identify and address outstanding operational needs. The program is working towards a FID. See BLI 2B04 for more information about the STARS – Enhancements 2, A04.08-01, program.

5.1.2 Air Traffic Support and Oceanic Air Traffic Control

Automation Roadmap (2 of 3)

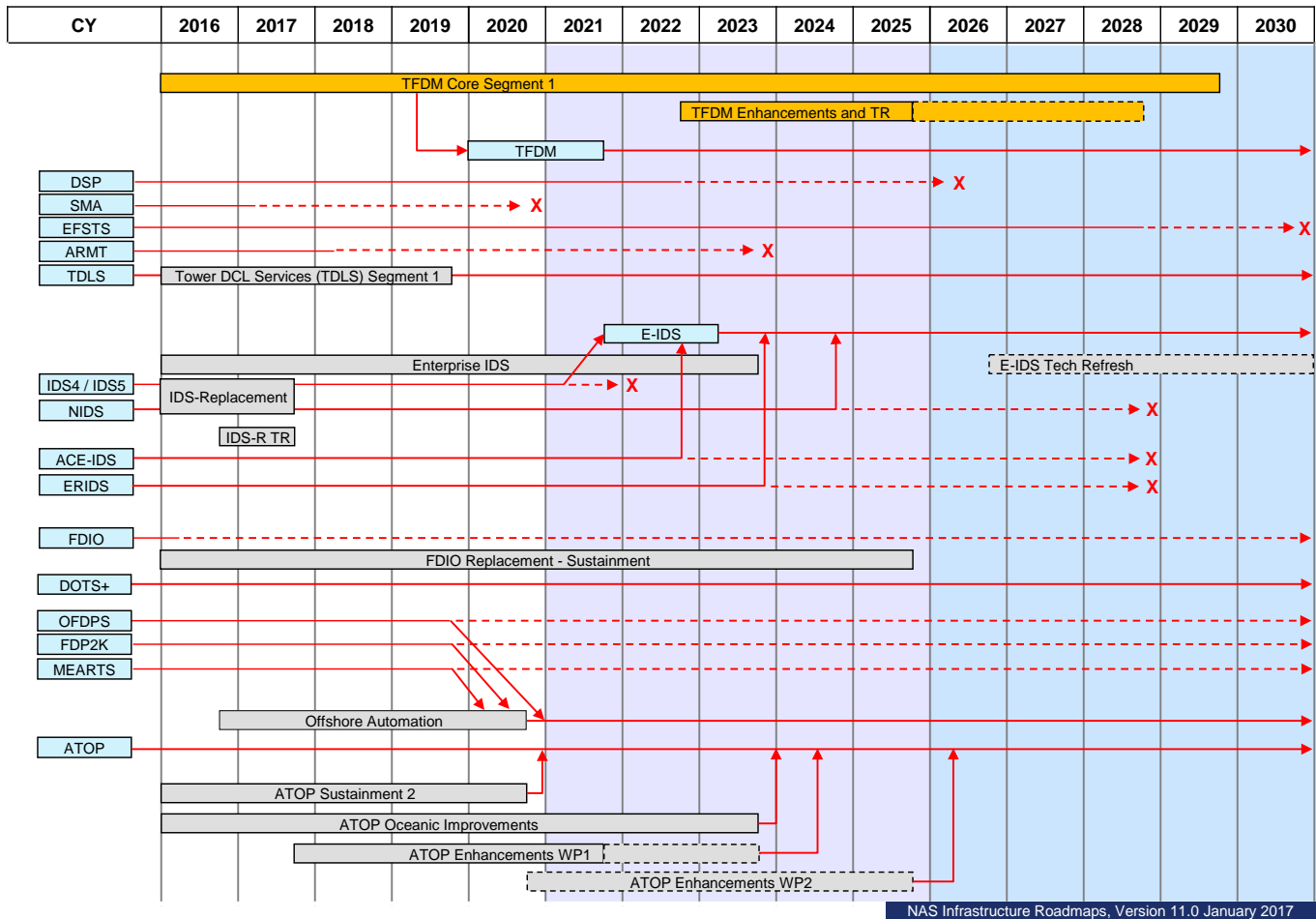


Figure 5-3 Air Traffic Support and Oceanic Air Traffic Control Roadmap

The first program at the top of figure 5-3, the Air Traffic Support and Oceanic Air Traffic Control Roadmap, is Terminal Flight Data Manager (TFDM) – Core, Segment 1. TFDM will provide tower air traffic controllers and FAA traffic managers with NextGen decision support capabilities that integrate flight, surveillance, and traffic management information to improve air traffic control coordination and decision making. The use of Electronic Flight Data and Strips (EFD/EFS) will allow tower controllers to maintain an integrated view of the air traffic environment, improving their situational awareness of airport operations. TFDM decision support capabilities will promote safe and efficient airport operations in managing airport surface traffic sequencing and scheduling. The implementation plan is based on a two software build approach and deployment of TFDM from FY 2020 to FY2028. See BLI 2B16 for more information about the TFDM – Core, Segment 1, G06A.03-01, program. (*The NextGen Operational Improvements that this NextGen program supports can be found in Section 4.1.*)

The first system on the top left of figure 5-3 is the Departure Spacing Program (DSP) used by tower controllers to optimize taxi and takeoff clearances in order to efficiently use available

runway and airspace capacity. The Surface Movement Advisor (SMA) provides the status of aircraft moving from the gates to the runways and improves taxiing efficiency. The Electronic Flight Strip Transfer System (EFSTS) is a system to transfer flight information to towers and TRACONS electronically rather than by paper. The Airport Resource Management Tool (ARMT) provides an assessment of available airport capacity.

The Tower Data Link Services (TDLS) provides data link of the as-filed flight plan (called Pre-Departure Clearance (PDC)) through Airline operators to pilots preparing to depart an airport. See Communications Roadmap 5, section 5.2, for a description of the Data Communications Segment 1 Phase 1 program.

The Enterprise Information Display System (E-IDS) program will manage the upgrade or replacement of systems included in the IDS replacement program. These systems provide controllers, front line managers, traffic managers, and maintenance personnel with the full range of information including aeronautical, weather, and administrative information affecting all phases of flight to assist in efficiently managing airspace. The program is working towards a FID. See BLI 2B13 for more information about the E-IDS, A03.05-03, program.

The Integrated Display Systems model 4 (IDS-4), IDS model 5 (IDS-5), and NAS IDS (NIDS) provide rapid retrieval and display of a wide range of weather, operational support, and administrative information for air traffic controllers and other users in the terminal environment. The Integrated Display Systems (IDS) Replacement program is replacing the IDS-4 with a state-of-the-art system comprised mainly of Commercial-Off-The-Shelf (COTS) components; the last will be in 2017.

The Automated Surface Observing System (ASOS) Controller Equipment-Information Display System (ACE-IDS) displays weather information collected by ASOS to tower controllers. These services will begin a transition to E-IDS starting in FY 2022.

The En Route Information Display System (ERIDS) is an information display system that provides access to aeronautical data including weather, airspace charts, ATC procedures, Notices to Airmen (NOTAM), and pilot reports (PIREPS). The ERIDS will begin a transition to E-IDS starting in FY 2023.

The Flight Data Input/Output (FDIO) system interfaces to several En Route automation systems and provides standardized flight plan data, weather information, safety related data, and Wake Re-categorization to Air Traffic Controllers located at approximately 690 remote sites.

The FDIO – Sustainment program replaces end-of-life/obsolete FDIO equipment with fully compatible Commercial Off-The-Shelf (COTS) and modified COTS equipment. To maintain system availability, the program replaces individual components as they reach the end of their service life based upon a 5 year replacement cycle. See BLI 2B04 for more information about the FDIO – Sustainment, A01.11-01, program.

The Dynamic Ocean Tracking System plus (DOTS+) system uses weather information to determine the most fuel-efficient routes based on wind velocity and direction. It will continue in

operation through the timeframe of the roadmap. The three oceanic automation systems, Offshore Flight Data Processing System (OFDPS), Flight Data Processing 2000 (FDP2K), and the Microprocessor En route Automated Radar Tracking System (Micro-EARTS), process flight data regarding the position of aircraft on oceanic and offshore flights to aid controllers in separating flights in FAA controlled airspace.

The Offshore Automation program will perform service analysis and concept requirements definition for four sites in the NAS that have unique automation platforms not found at CONUS or Oceanic sites. These include the Anchorage Air Route Traffic Control Center, the Honolulu Control Facility, the Guam Combined Control Facility (CCF), and the San Juan CCF. All four have the same Radar Data Processor and Microprocessor En Route Automated Radar Tracking System; the Flight Data Processor varies by facility. Replacing these with existing NAS systems will improve interoperability and reduce costs by standardizing training, maintenance, and development efforts across the platforms. The program is working towards a FID. See BLI 2A19 for more information about the Offshore Automation, A38.01-01, program.

The Advanced Technologies and Oceanic Procedures (ATOP) program updated procedures and modernized the oceanic automation systems located at the Oakland, New York, and Anchorage ARTCCs. ATOP fully integrates flight and radar data processing, detects conflicts between aircraft, provides data link and surveillance capabilities, and automates previously manual processes for oceanic air traffic control.

The ATOP – Sustainment 2 program will replace the hardware and operating system, and integrate the new technology with the baseline ATOP applications. The ATOP program reduces maintenance and logistics costs and supports incorporation of software changes and new capabilities to support future NextGen, Surveillance and Broadcast Services, and other NAS improvements. A FID was achieved in February 2016. See BLI 2A09 for more information about the ATOP – Sustainment 2, A10.03-01.

The ATOP – Oceanic Improvements program will support operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of oceanic domain services. This includes improving the flexibility, reliability, and efficiency of oceanic air traffic control by providing enhancements to more frequently accommodate user preferred flight trajectories and altitude changes increasing the likelihood of on-time arrivals. See BLI 2A09 for more information about the ATOP – Oceanic Improvements, A10.03-03.

The ATOP – Enhancements (Work Package 1) program is addressing the operational shortfalls of the current oceanic system as the FAA moves forward with NextGen and other NAS upgrades. The program is working towards a FID. See BLI 2A09 for more information about the ATOP Enhancements (Work Package 1), A10.03-02, programs.

A future program, ATOP Enhancements (Work Package 2), will continue to address operational shortfall of the oceanic systems beyond FY 2021.

5.1.3 Flight Services and Aeronautical / Information Support

Automation Roadmap (3 of 3)

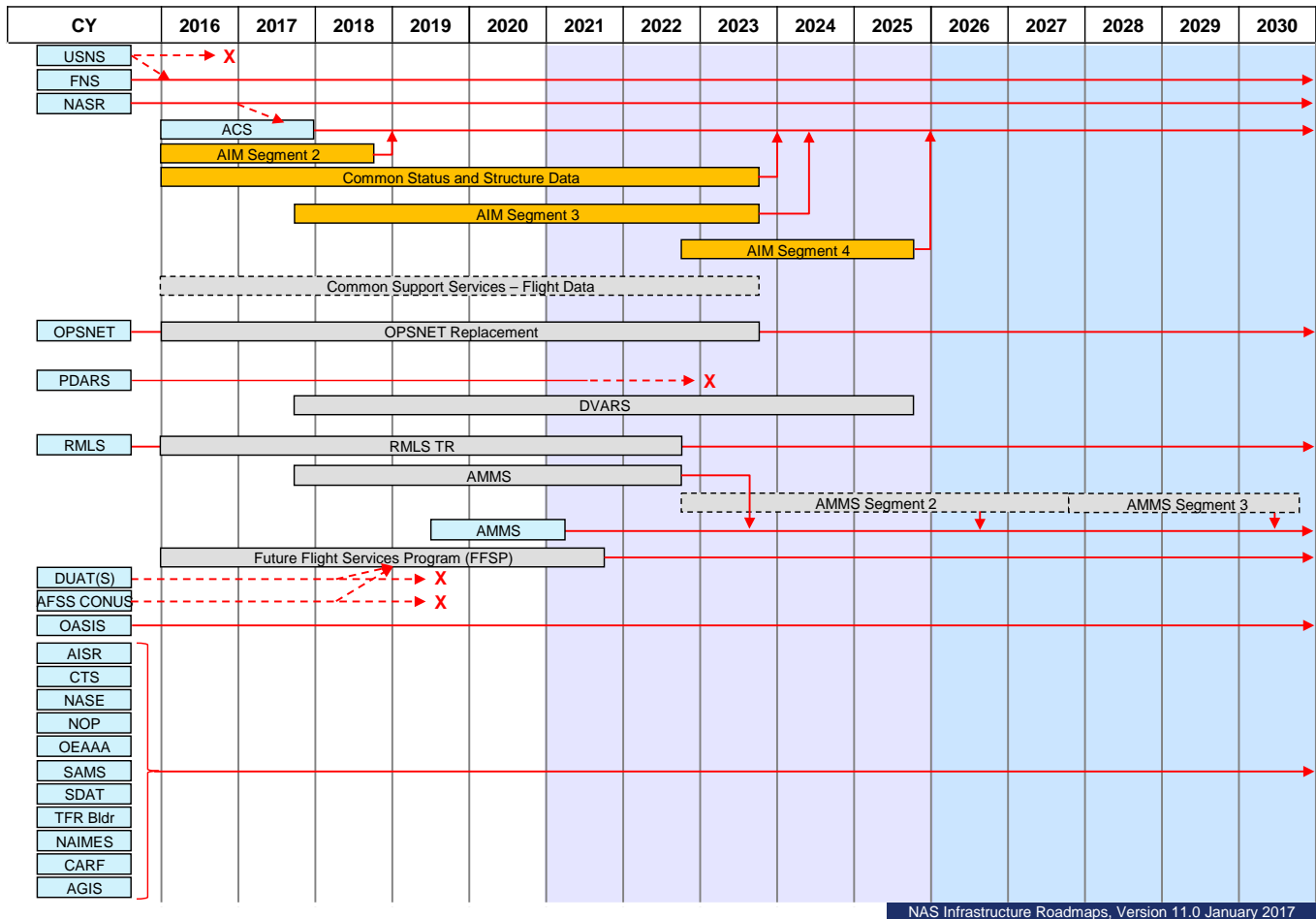


Figure 5-4 Flight Services and Aeronautical / Information Support Roadmap

At the top left of figure 5-4 is the United States NOTAM (Notice to Airmen) System (USNS) which is an automated system used to process, store, and distribute NOTAM information.

The Federal NOTAM System (FNS) will remain in operation throughout the roadmap timeframe. It is a centralized system that collects and distributes NOTAMs to alert pilots to outages of any Navaids, closed runways, or other factors that may affect their flight.

The National Airspace System Resources (NASR) contains information pertaining to Instrument Approach Procedures, Departure Procedures, Standard Terminal Arrival Routes, and Military Training Routes.

Aeronautical Common Services (ACS) publishes information about airports, navigational aids and other aeronautical data.

The Common Status & 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. To support NextGen capabilities, this program enables the FAA to improve situational awareness through better access to aeronautical information and a common language. See BLI 1A07 for more information about the CSSD program, G05A.02-01, program.

The Aeronautical Information Management (AIM) Modernization Segment 2 program will provide aviation users with digital aeronautical information that conforms to international standards and supports NextGen objectives. This program builds on pre-implementation efforts performed in the NextGen Common Status and Structure Data program, G05A.02-01, to baseline and implement suitably mature AIM technologies and tools for Aeronautical Information exchange. See BLI 4A09 for more information about the AIM Modernization Segment 2, G05A.02-05, program.

The Aeronautical Information Management (AIM) Modernization Segment 3 program will modernize and expand on the ACS enterprise service and initial Special Activity Airspace (SAA) and Geographic Information Service (GIS) capabilities developed by AIM Modernization Segment 2. Segment 3 will add performance capability, increase integration with NAS automation, and integrate static aeronautical information with operational data feeds providing updates on the activation status of SAA and active runway/airport configuration data from the authoritative source. The CSSD program is working towards a FID for AIM Segment 3. See BLI 4A09 for more information about the AIM Modernization Segment 3, G05A.02-06, program. Future modernization under AIM Modernization Segment 4 is currently planned to begin in FY 2023.

The Common Support Services – Flight Data (CSS-FD) program will provide single operator interface to NAS for flight planning and filing and improve the exchange of early intent, i.e., pre-departure data, NAS constraint checking, and flight plan submission. This will allow the airspace users to more effectively plan flight operations. This work is being funded under the Flight Object program G05A.02-03.

The Operations Network (OPSNET) is the official FAA system for collecting and reporting flight operations count and delay metrics. The OPSNET system measures the number of delays attributable by cause and includes weather, air traffic volume, equipment status, and runway conditions. The OPSNET Replacement program will expand the collection and recording of delay causes to improve reporting and provide a system that limits manual data entry and automates compilation of operational data received from FAA automation systems. The program is working towards a FID. See BLI 1A01 for more information about the OPSNET Replacement, A37.01-01, program.

The Performance Data Analysis and Reporting System (PDARS) is a fully integrated performance measurement tool designed to help the FAA improve the NAS by tracking the daily operations of the ATC system and its environmental impact.

The Data, Visualization, Analysis and Reporting System (DVARs) program will eventually replace PDARS and 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. The program is working toward a Final Investment Decision (FID). See BLI 2E11 for more information about the DVARs, M08.28-05, program.

The Remote Maintenance Logging System (RMLS) allows systems maintenance staff to monitor equipment performance electronically from a central location and is used for generating, quantifying, analyzing, measuring, and reporting maintenance information. RMLS improves the effectiveness of Tech Ops maintenance processes and practices and oversees the entire event management life cycle, from generation of the initial event through assignment, updates, and event closure. The RMLS Technology Refresh program will extend the service life of RMLS hardware and software located at the National Operations Control Center (NOCC), Atlantic Operations Control Center (AOCC), Mid-States Operations Control Center (MOCC), Pacific Operations Control Center (POCC), Southern California TRACON (SCT), the William J. Hughes Technical Center (WJHTC), ARTCCs, and the Combined Control Facility (CCF) in Hawaii. See BLI 2B14 for more information about the RMLS – Technology Refresh, M07.04-02, program.

The Automated Maintenance Management System (AMMS) will allow for the interfacing of maintenance systems through a Service-Oriented Architecture (SOA) environment utilizing System Wide Information Management (SWIM) to create an enterprise infrastructure for sharing data between dispersed maintenance systems. The ability to efficiently manage the maintenance of FAA's equipment and systems is critical to the operation of the NAS. AMMS will develop common enterprise data services for maintenance data; implement data standards for the exchange of data between services, systems, and equipment; and deliver advanced automated maintenance tools to improve data integrity and increased situational awareness to support predictive rather than periodic maintenance. The program is working towards a FID. See BLI 2B14 for more information about the AMMS, M07.05-01, program.

The Automated Flight Service Station Continental United States (AFSS CONUS), Direct User Access Terminal System (DUATS), and Operational and Supportability Implementation System (OASIS) provide aeronautical and weather data to support flight services. Flight services include flight planning and pilot weather briefings which are primarily used by General Aviation (GA) pilots. Contractor flight service personnel using the AFSS CONUS provide flight services in the lower 48 States, Hawaii and Puerto Rico. The DUATS is a web-based service that allows pilots to access weather and aeronautical data for self-briefings and to file flight plans. The OASIS automation system is used at the Flight Service Stations in Alaska by FAA flight service specialists to provide flight services to GA pilots.

The Future Flight Service Program (FFSP) will subsume AFSS and DUATS scope, seeking to enhance GA and NAS users' safety awareness by providing more accurate and efficient updates to changing weather conditions and allowing pilots to make better decisions on avoiding hazardous weather. FFSP will provide flight services to the GA community within the Continental US, Puerto Rico, and Hawaii. FFSP expands the web portion of flight services and seeks to reduce or eliminate obsolete or redundant services and activities provided by other FAA service organizations. The program is working towards a FID. See BLI 2C02 for more information about the FFSP, A34.01-01, program.

The last 12 systems shown on Figure 5-4 are expected to continue in operation through the current roadmap. A brief description of the service or capability provided by each of these systems for airports, airspace, and navigation facilities is provided below.

Aeronautical Information System Replacement (AISR) distributes information on weather, flight plans, NOTAMS, Pilot Reports, and other NAS status items to FAA facilities, DoD, and pilots.

Coded Time Source (CTS) provides the official source of time that synchronizes the information flows in the air traffic control equipment.

NAS Adaptation Services Environment (NASE) contains detailed information about the airspace, geography, equipment, and procedures required to make each ATC system work properly.

National Offload Program (NOP) allows FAA to download radar information from en route automation systems for analysis and review.

Obstruction Evaluation/Airport Airspace Analysis (OEAAA) contains data about obstructions around airports that present a hazard for aircraft taking off and landing.

Special Airspace Management System (SAMS) informs controllers when airspace ordinarily reserved for military use is available for civilian use.

Sector Design and Analysis Tool (SDAT) is a visualization and analysis tool used to evaluate the impact on controller workload when sector and route changes are being considered during major airspace redesign efforts.

Temporary Flight Restriction Builder (TFR Bldr) is an automated system for establishing temporary flight restrictions that prohibit aircraft from flying over areas where special events such as the Super Bowl are being held.

NAS Aeronautical Information Management Enterprise System (NAIMES) consists of a suite of NAS safety/mission critical systems and services that directly support the collection, validation, management, and dissemination of aeronautical information in the NAS.

Central Altitude Reservation Function (CARF) is a system used by military and civilian pilots to reserve altitudes for their planned flights.

Airport Geographic Information System (AGIS) collects, stores, and disseminates geospatial features and attributes associated with the physical infrastructure of the airport. It is used to develop airport modernization plans and is necessary for maintaining existing and developing new approach and departure procedures.

5.2 Communication Roadmaps

Communication between pilots and controllers is an essential element of air traffic control and is primarily accomplished using voice radios. To ensure controllers can stay in contact with pilots, remotely located radio sites are used to provide continuous coverage. Controllers use electronic links through ground-based telecommunication lines to activate remote site radios that carry voice transmissions between air traffic controls and pilots. If ground links are unavailable, satellite communication links can be used. In the future, data link may be used for most routine communications. Backup systems are also available to ensure uninterrupted communication should a primary system fail.

Communication system implementation is broken down into five different NAS EA roadmaps:

1. Roadmap 1 (figure 5-5) - Telecom and Other Communications
2. Roadmap 2 (figure 5-6) - Voice Switches and Recorders
3. Roadmap 3 (figure 5-7) - Air-to-Ground Voice and Oceanic Communications
4. Roadmap 4 (figure 5-8) - Air-to-Ground Data Communications
5. Roadmap 5 (figure 5-9) - Messaging Infrastructure

5.2.1 Telecom and Other Communications

Communications Roadmap (1 of 5)

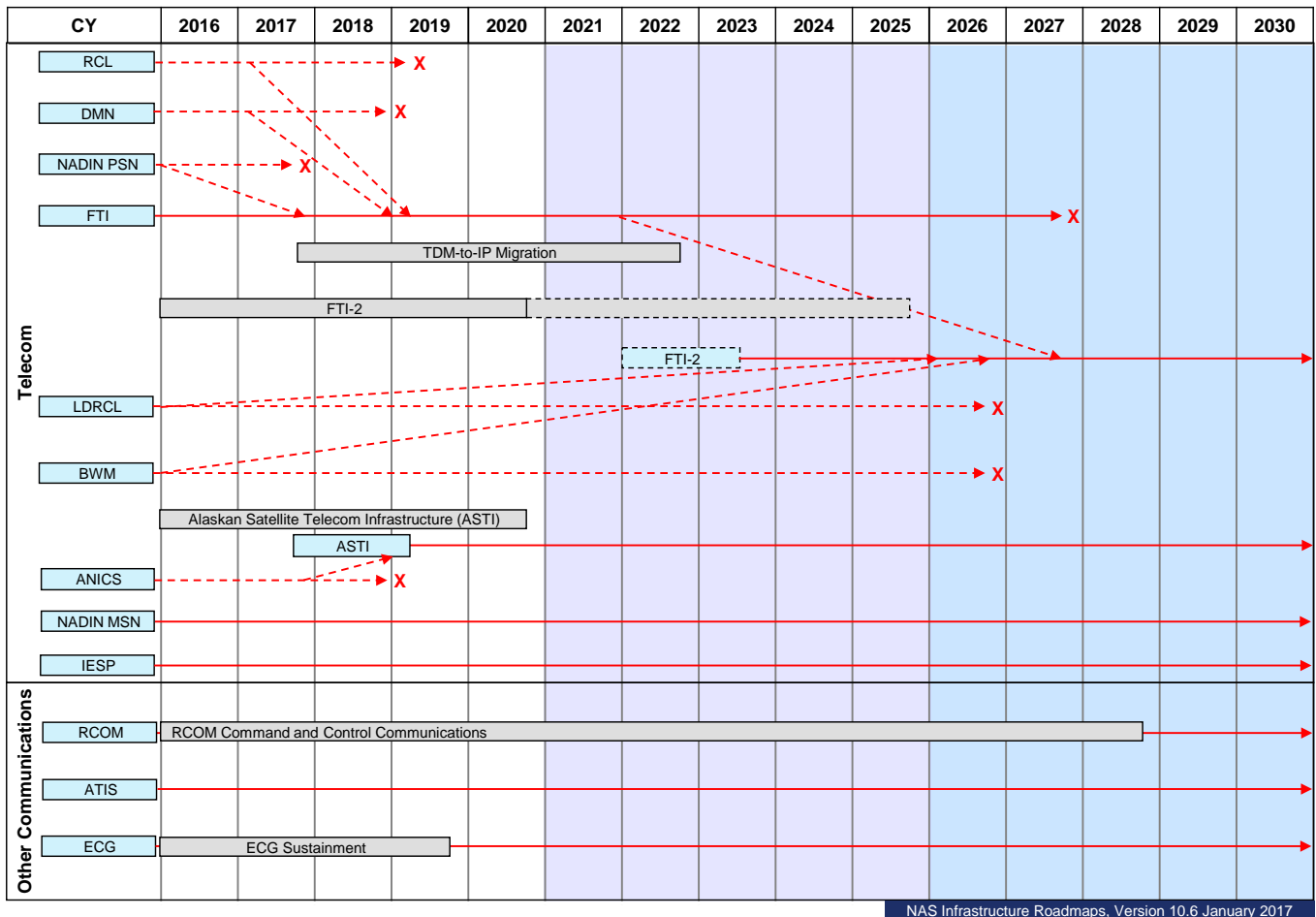


Figure 5-5 Telecom and Other Communications Roadmap

Radio Communications Link (RCL) equipment is an analog microwave system originally, created to transmit radar data from remote radar sites to FAA air traffic control facilities. These systems were linked in a national network to transmit operational and administrative information to and from air traffic control facilities. RCL equipment is now obsolete and its functions are transitioning to the FAA Telecommunications Infrastructure (FTI) contract.

The Data Multiplexing Network (DMN) and the National Airspace Data Interchange Network – Package Switching Network (NADIN PSN), transmit flight plans and other important aeronautical information to air traffic facilities. The functions of DMN and NADIN PSN are also transitioning to the FTI network.

The FTI contract provides telecommunications services that are designed, engineered, and provisioned to meet FAA-specific availability, latency, and security requirements. FTI also provides enterprise messaging services based upon service-oriented architecture technologies

and specialized infrastructure services such as a domain name service, network time protocol service, and security gateway services.

The Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration program oversees the investment portfolio for TDM-to-IP migration and is conducting the systems interface development work in order to modernize NAS systems to be IP-compatible. Major U.S. telecommunications carriers plan to discontinue TDM-based services as early as calendar year 2020. More than 90% of the current FAA services obtained under the FTI contract are TDM-based. See BLI 2E12 for more information about the TDM-to-IP Migration, M56.01-01, program.

FTI-2, the successor program to FTI, will provide all of the capabilities currently available under the existing FTI contract plus the next generation of telecommunications, messaging, and infrastructure services required by FAA programs during the FTI-2 program life cycle. FTI-2 will address the challenges associated with the orderly transition of TDM-based telecommunication services (nearly 90%) to IP. FTI-2 is planned to continue beyond 2030 and is working towards a Final Investment Decision (FID). See BLI 2E10 for more information about the FTI-2, C26.01-02, program.

The Low Density Radio Communication Link (LDRCL) is a legacy analog microwave system providing a similar function as RCL (see above) and is being phased out.

The Bandwidth Manager (BWM) improves efficiency of information flow on the microwave network. It will not be needed when microwave links are no longer used.

The Alaska National Airspace System Interfacility Communications System (ANICS) consists of ground stations that send and receive data from communications satellites to connect the operational facilities in Alaska. Because there are far fewer ground telecommunications connections in Alaska, a satellite system is used to ensure that important air traffic information is reliably transmitted between small and large facilities. ANICS provides 90% of the communications for En Route, Terminal, and Oceanic air traffic control, and Flight Services in Alaska.

The ASTI program will modernize the ANICS to support routine, essential, and critical NAS Systems & Services. The newly approved ASTI Enhancement program will establish yearly software/hardware releases to ensure that components fielded under ASTI remain operational through the system lifecycle. See BLI 2E05 for more information about the ASTI, C17.02-01, and the ASTI Enhancement, C17.02-02, programs.

The NADIN Message Switching Network (MSN) complies with international standards for transmitting flight plans between service providers and remains available for that purpose.

The Integrated Enterprise Service Platform (IESP) is a shared computing infrastructure that provides a common set of server and network hardware for the hosting of multiple NAS services. It leverages virtualization technology to maximize the return on investment for hardware procurements, and provides value added configuration management and high availability

services. IESP uses an enterprise level Simple Network Management Protocol system which is capable of providing monitoring services for external NAS systems.

NAS Recovery Communications (RCOM) program enables the FAA Administrator and senior staff to directly manage the NAS during local, regional, and national emergencies if normal communications with facilities are disrupted. RCOM's Command and Control Communications (C3) system elements provide and enhance communication capabilities through a variety of fixed-position, portable, and transportable emergency communications systems to support crisis management and enable the FAA and other Federal agencies to exchange both classified and unclassified information to protect national security during an emergency. See BLI 3A03 for more information about the RCOM, C18.00-00, program.

The Automated Terminal Information System (ATIS) broadcasts weather and other pertinent information to pilots as they approach an airport. ATIS functions will be maintained during the entire timeframe of the roadmap.

See Automation Roadmap 1 section 5.1.1 and BLI 2A02 for more information about the En Route Communications Gateway (ECG) – Sustainment, A01.12-02, program.

5.2.2 Voice Switches and Recorders

Communications Roadmap (2 of 5)

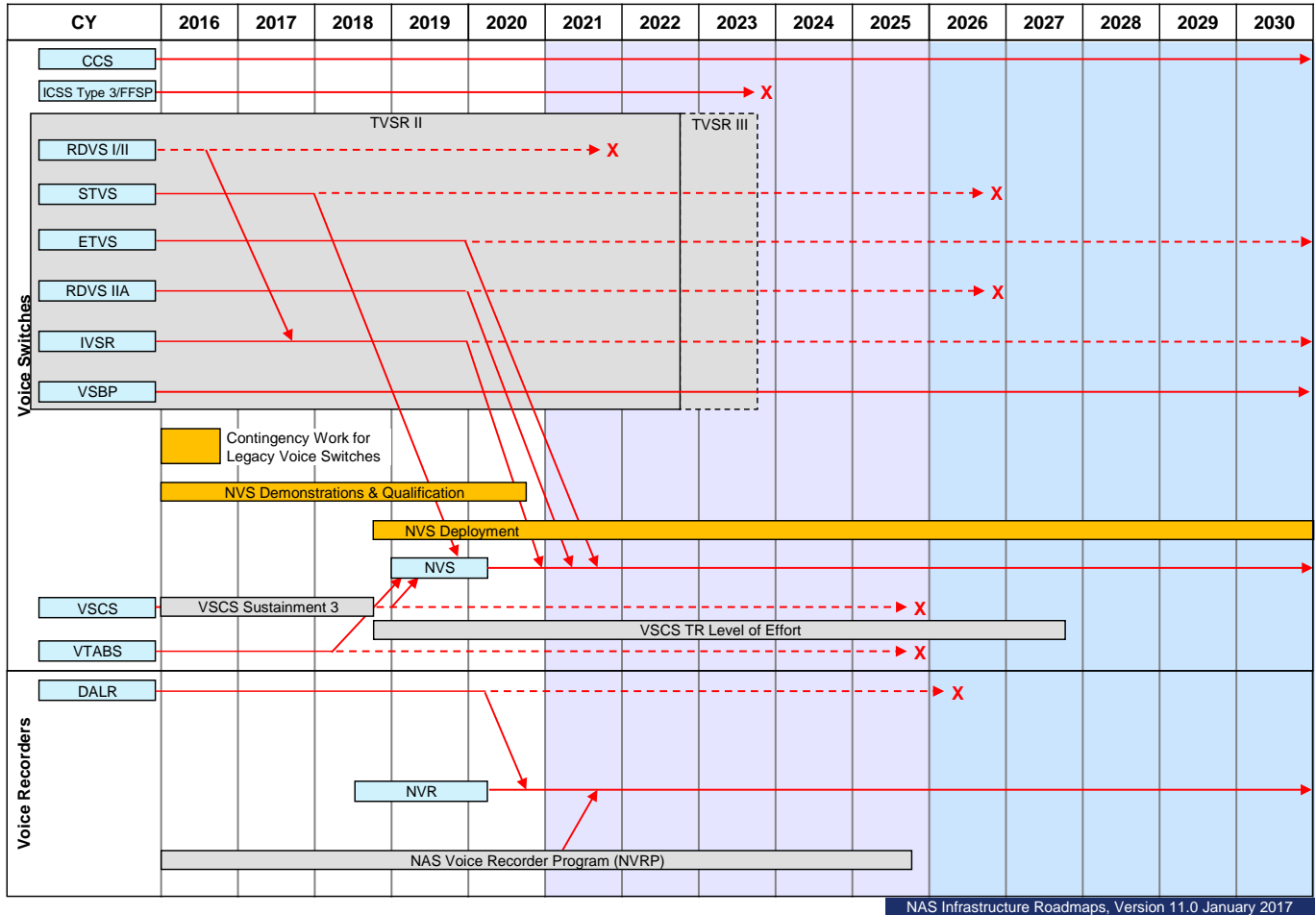


Figure 5-6 Voice Switches and Recorders Roadmap

At the top left of Figure 5-6 is the Conference Control Switch (CCS) which is installed at the FAA's Air Traffic Control System Command Center (ATCSCC) located in Warrenton, Va. The CCS allows the FAA specialists to stay in contact with air traffic control facilities and external users of the NAS. The ATCSCC specialists coordinate with centers, TRACONs, and users to decide how best to implement traffic management initiatives and when to use severe weather avoidance programs.

The Integrated Communication Switching System (ICSS) / Future Flight Services Program (FFSP) are installed at flight service stations. Decisions made for the FFSP will determine the future status of this switch. See also the FFSP description following Automation Roadmap 3 in section 5.1.

The Terminal Voice Switch Replacement (TVSR) II program replaces and sustains aging, obsolete voice switches in ATC Towers and Terminal Radar Approach Controls to ensure controllers have reliable voice communications in the terminal environment. The program

consists of several multiyear equipment contracts for voice switches including Small Tower Voice Switches (STVS), Enhanced Terminal Voice Switches (ETVS), Rapid Deployment Voice Switches (RDVS), Voice Switch By Pass (VSBP) system, and Interim Voice Switch Replacement (IVSR). This program also establishes contract vehicles with the flexibility for FAA to procure voice switch equipment for new or modernized terminal facilities. Terminal voice switching systems direct and control voice communications so that the controller can communicate with another controller position either within or at another air traffic control facility, or with a properly equipped aircraft. The VSBP is a backup voice switch that terminal controllers can use to stay in communication with pilots if there is a failure in the primary voice switch. See BLI 2B07 for more information about the TVSR II, C05.02-00, program.

In FY 2023 a future program, TVSR III, will be established to refurbish and replace terminal voice switches that are not replaced under the NAS Voice System (NVS) program.

The NVS program will replace legacy voice switches at both En Route and Terminal facilities and will be implemented in two segments; Demonstration & Qualification, and Deployment. The NVS – Demonstration & Qualification program received FID for NAS qualification from the Joint Resources Council (JRC) in September 2014. The program will return to the JRC in FY 2019 to request FID approval for deployment of NVS to operational facilities beyond the key sites. See BLI 2B12 for more information about the NVS – Demonstration & Qualification, G03C.01-01, and NVS – Deployment, G03C.01-02, programs.

The Voice Switching and Control System (VSCS) allow en route controllers to communicate with pilots, other controllers, other air traffic facilities, and commercial telephone contacts. VSCS Training and Backup Switches (VTABS) are independent voice communication switches for en route training and serve as hot backup voice communications switches for critical VSCS air-to-ground and ground-to-ground communications. VTABS provides air traffic controllers and pilots with a path for voice communications in the event that VSCS is unavailable. VSCS and VTABS must be available at all ARTCCs until the systems are replaced by the NVS.

VSCS Training and Backup Switch (VTABS) can maintain critical Air-to-Ground (A/G) and ground-to-ground communications if the main communications system becomes inoperable as a result of a power outage, a catastrophic system failure, or during system maintenance or upgrade activities. VTABS also will allow air traffic controllers to train on equipment virtually identical to VSCS.

The VSCS –Technology Refresh – Phase 3 program will replace and upgrade hardware and software components for the voice switching systems in all 21 en route air traffic control centers and at the testing and training systems located at the William J. Hughes Technical Center and the FAA Academy. The VSCS – Technology Refresh – Level of Effort program will maintain ongoing Diminishing Manufacturing Sources and Material Shortages analysis, conduct program management activities, and provide engineering support. Depending on continued engineering analyses, potential technology refresh activities under the Level of Effort program may include VTABS Subsystem refresh, VSCS Control Subsystem refresh and Position Equipment Test Set refresh. VSCS Technology Refresh Level of Effort will be a stand-alone effort starting FY 2019 and will continue to sustain VSCS/VTABS until fully replaced by NVS. See BLI 2A08 for more

information about the VSCS –Technology Refresh – Phase 3, C01.02-04, and VSCS – Technology Refresh – Level of Effort, C01.02-05, programs.

The Digital Audio Legal Recorder (DALR) is the voice recorder that provides a legally accepted recording capability for conversations between air traffic controllers, pilots, and ground-based air traffic facilities in all ATC domains. These recordings are used in the investigation of accidents and incidents and for routine evaluation of ATC operations. The NAS Voice Recorder Program (NVRP) will replace digital voice recorders to comply with new requirements in the Air Traffic Organization (ATO) safety orders. The program is working towards a FID. See BLI 2B17 for more information about the NVRP, C23.02-01, program.

5.2.3 Air-to-Ground Voice and Oceanic Communications

Communications Roadmap (3 of 5)

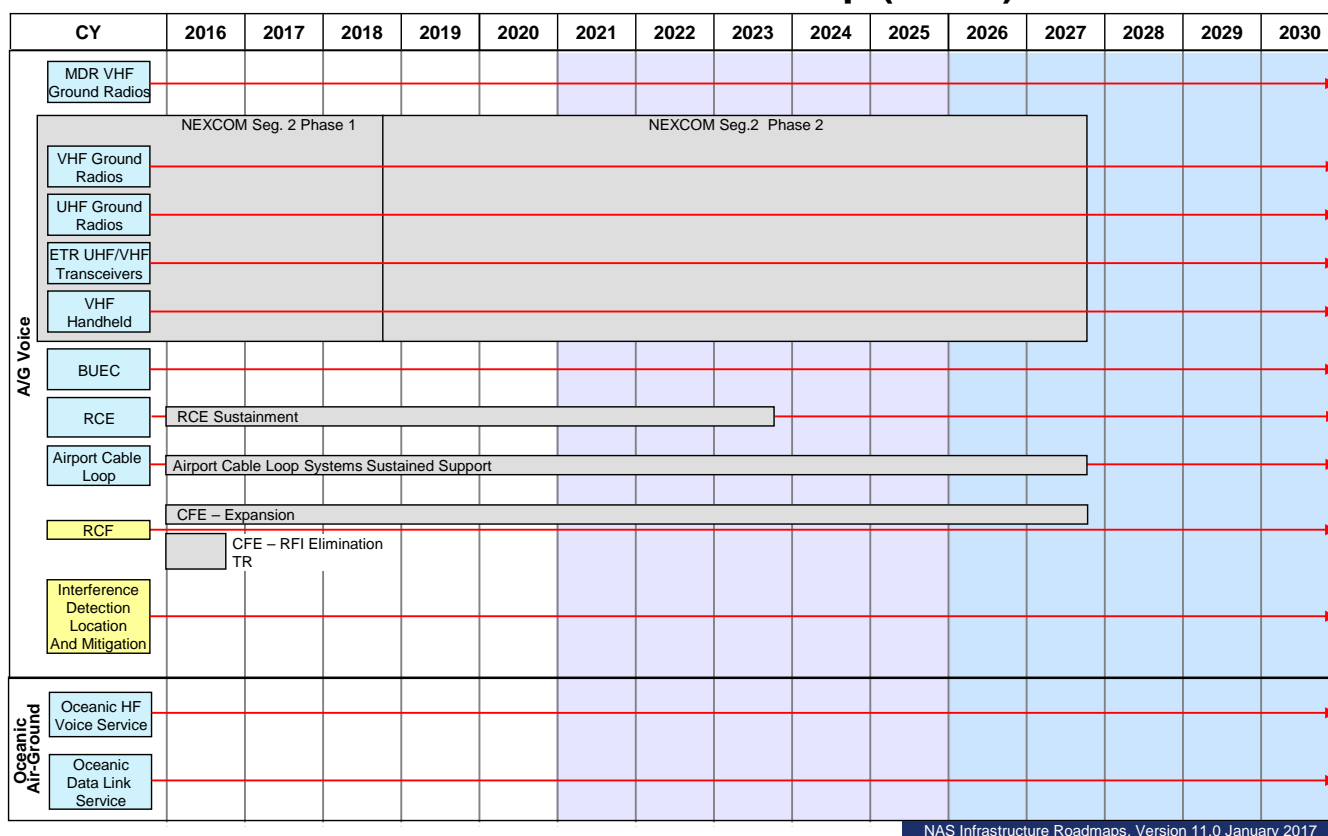


Figure 5-7 Air-to-Ground Voice and Oceanic Communications Roadmap

At the top left of Figure 5-7 is Multimode Digital Radios (MDR) Very High Frequency (VHF) Ground Radios which are used by controllers to communicate with the pilots. MDRs can operate both the existing analog 25 kHz band width voice mode protocol for channel separation, or they can operate in the more efficient 8.33 kHz band width voice mode currently used in Europe. The MDRs support Voice over Internet Protocol (VoIP) and meet the requirements of the NextGen Data Communications and NVS programs.

Very High Frequency (VHF) and Ultra High Frequency (UHF) Ground Radios utilize the 25 kHz band width to allow controllers to communicate with civilian and military aircraft, respectively.

The Emergency Transmitter Replacement (ETR) UHF/VHF Transceivers provide emergency and backup service when primary radios are not working. VHF Handheld Transceivers are used by maintenance technicians so they can communicate with each other and with ATC tower personnel.

The Next Generation VHF and UHF Air/Ground (A/G) Communications (NEXCOM) program replaces the aging and obsolete analog radios with digital radios that allow direct voice communication with pilots. The NEXCOM Segment 1a program completed replacement of all 25,000 en route radios with MDRs in FY 2013, at both primary and back up communications (BUEC) sites.

NEXCOM Segment 2 program will ultimately replace a total of 35,000 primary and back up VHF and UHF radios at terminal and flight service facilities. The Segment 2 program is segmented into two phases; Phase 1 will replace a total of 15,000 radios from FY 2009 through FY 2018; and Phase 2 will replace a total of 20,000 radios from FY 2019 through FY 2026. The Phase 2 program also replaces Emergency Transceivers and is working towards a FID. See BLI 2A10 for more information about the NEXCOM – Segment 2 Phase 1, C21.02-01, and NEXCOM – Segment 2 Phase 2, C21.02-02, programs.

The Backup Emergency Communication (BUEC) is a facility which consists of radios and equipment installed at remote sites that backup the primary radios installed at Remote Communication Air Ground facilities, all of which are used by Air Route Traffic Control Center (ARTCC) controllers to communicate with pilots.

The Radio Control Equipment (RCE) allows voice and data communications between the air traffic controller and pilots using remotely located VHF/UHF radios accessible via the RCE and interconnection telecommunications networks. The RCE – Sustainment 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. See BLI 2A06 for more information about the RCE – Sustainment, C04.01-01, program.

Airport Cable Loop are on-airport copper-based, FAA-owned signal/control cable lines that feed airport surveillance radar, air/ground communications, and landing systems data and information to the tower, and operational and maintenance information to FAA-staffed facilities. The Airport Cable Loop Sustained Support program replaces obsolete underground telecommunications cable infrastructure systems that have deteriorated and are vulnerable to failure which could cause flight delays related to outages. Where cost effective, the program will install a fiber-optic cable in a ring configuration to provide redundancy and communications diversity. See BLI 2E04 for more information about the Airport Cable Loop Sustained Support, F10.00-00, program.

The Communications Facilities Enhancement (CFE) – Expansion program provides new, relocated, or upgraded Remote Communication Facilities (RCF) 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 replaces cables from the equipment to the antennas when necessary to improve radio equipment performance. See BLI 2A06 for more information about the CFE – Expansion program, C06.01-01, program.

The Interference Detection, Location and Mitigation program investigates occurrences of non-FAA transmitters interfering with FAA radios and navigation systems, locates the source, and ensures that they no longer interfere with FAA controlled frequencies. The FAA has specially equipped vehicles that detect and locate the sources of interference.

The Oceanic High Frequency (HF) Voice Service allows controllers and pilots to communicate over oceanic airspace once the aircraft is out of range from ground-based VHF radios.

The Oceanic Satellite Data Link Services is used by equipped aircraft and relies on communications satellites to transfer messages to and from aircraft flying over the oceans. Once aircraft are beyond the range of radar, pilots must report their position using either HF Voice Service or satellite-based Oceanic Data Link Service when they arrive at predetermined waypoints.

5.2.4 Air-to-Ground Data Communications

Communications Roadmap (4 of 5)

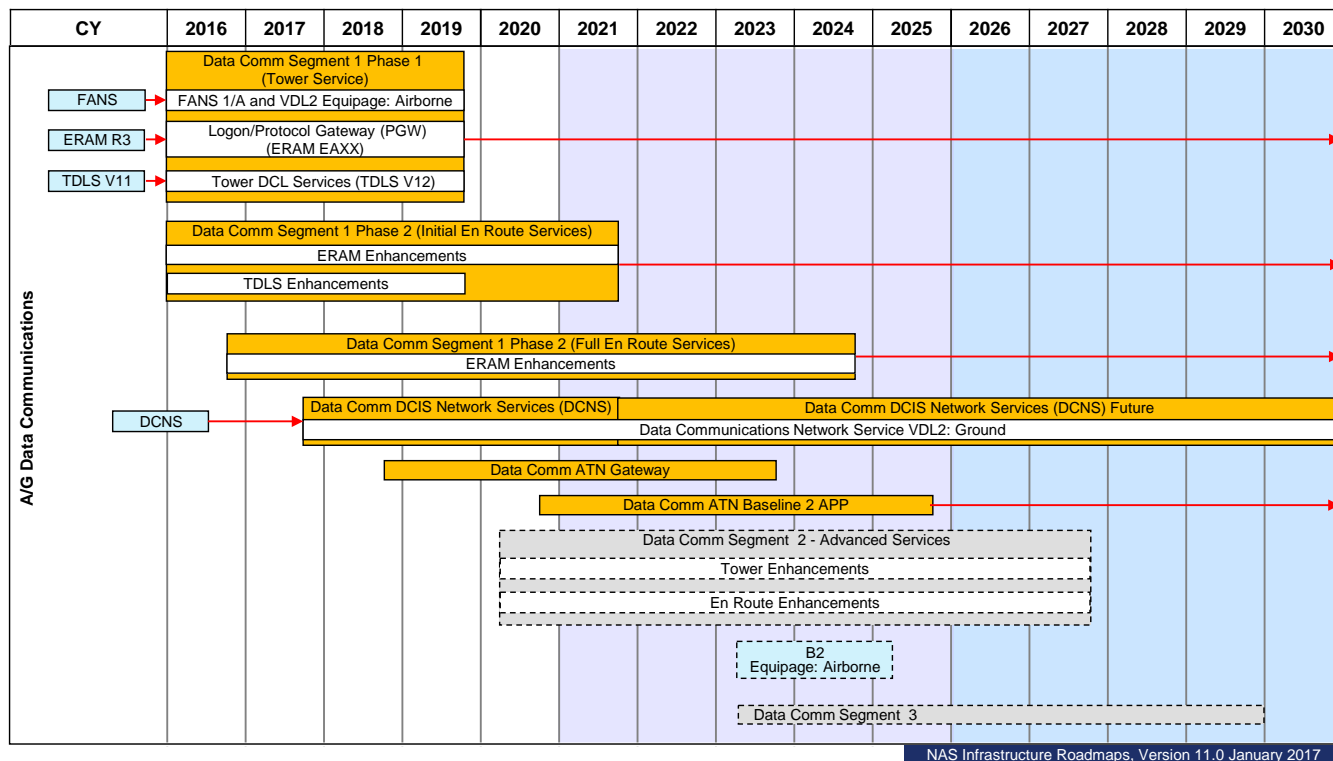


Figure 5-8 Air-to-Ground Data Communications Roadmap

The Future Air Navigation System (FANS) is an avionics system that provides data link communication between the pilot and the Air Traffic Controller using the Aircraft Communications Addressing and Reporting System network.

ERAM R3, the En Route Automation Modernization system became fully operational in 2015 and supports the agency's transition to NextGen.

The Tower Data Link Services (TDLS) provides data link of the as-filed flight plan (called Pre-Departure Clearance (PDC)) through Airline operators to pilots preparing to depart an airport.

The Data Comm program will provide data communications services between pilots and air traffic controllers. Data Comm will provide a link between ground automation and flight deck avionics for ATC clearances, instructions, traffic flow management, flight crew requests and reports. Data Comm is critical to the success of NextGen operational improvements by providing communication infrastructure enhancements. These improvements to the NAS will be delivered by Data Comm in three segments.

Segment 1 will deliver in two phases the initial set of data communications services integrated with automation support tools to provide NAS benefits and lay the foundation for a data-driven NAS. Segment 1 Phase 1 (S1P1) will deploy the Controller-Pilot Data Link Communications (CPDLC) Departure Clearance (DCL) in the Tower domain and the Data Comm Network Services (DCNS) infrastructure to provide the air/ground communications between the controllers and pilots. Segment 1 Phase 2 (S1P2) will deliver CPDLC data communications services to the En Route domain. The Data Comm En Route services will contribute to a reduction in flight delays, more efficient routes for aircraft resulting in increased operational efficiency, enhanced safety all while reducing operational costs for airspace users.

The Data Comm Integrated Services (DCIS) program will continue to provide and expand the VHF Data Link (VDL) Mode 2 air ground network service that provides connectivity between the controllers and the cockpit. The DCNS includes operations and maintenance, monitoring and control, and certification suite activities and supports both surface and en route operations.

See BLI 2A18 for more information about the Data Communications programs that include:

- Data Communications – Segment 1 Phase 1, G01C.01-05
- Data Communications – Segment 1 Phase 2 Initial En Route Services, G01C.01-06
- Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services, G01C.01-07
- Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future, G01C.01-11

In the future, Data Comm Segment 2 and Segment 3 will further build upon CPDLC DCL and En Route services by supporting the delivery of services to enable advanced NextGen operations not possible using voice communications, such as Four Dimensional Trajectory Data Link, Advanced Interval Management, Tailored Arrivals, Digital Taxi, and dynamic Required

Navigation Performance (RNP). Data Comm will also implement an Aeronautical Telecommunications Network (ATN) ground system to support advanced Baseline 2 avionics. ATN is a secure architecture that allows ground/ground, air/ground, and avionic data sub-networks to interoperate by adopting common interface services and protocols. The Baseline 2 set of ATN standards will enable advanced operations and services, and also represents the internationally harmonized standard for data communications avionics.

The addition of advanced NextGen services in Segment 2 will require that Baseline 2 avionics are installed in aircraft. The Baseline 2 applications program will make use of the more capable ATN avionics to support the development of advanced services as mentioned above. The program will provide enhancements to En Route and Terminal ground automation systems software to support message exchange with these advanced avionics.

5.2.5 Messaging Infrastructure

Communications Roadmap (5 of 5)

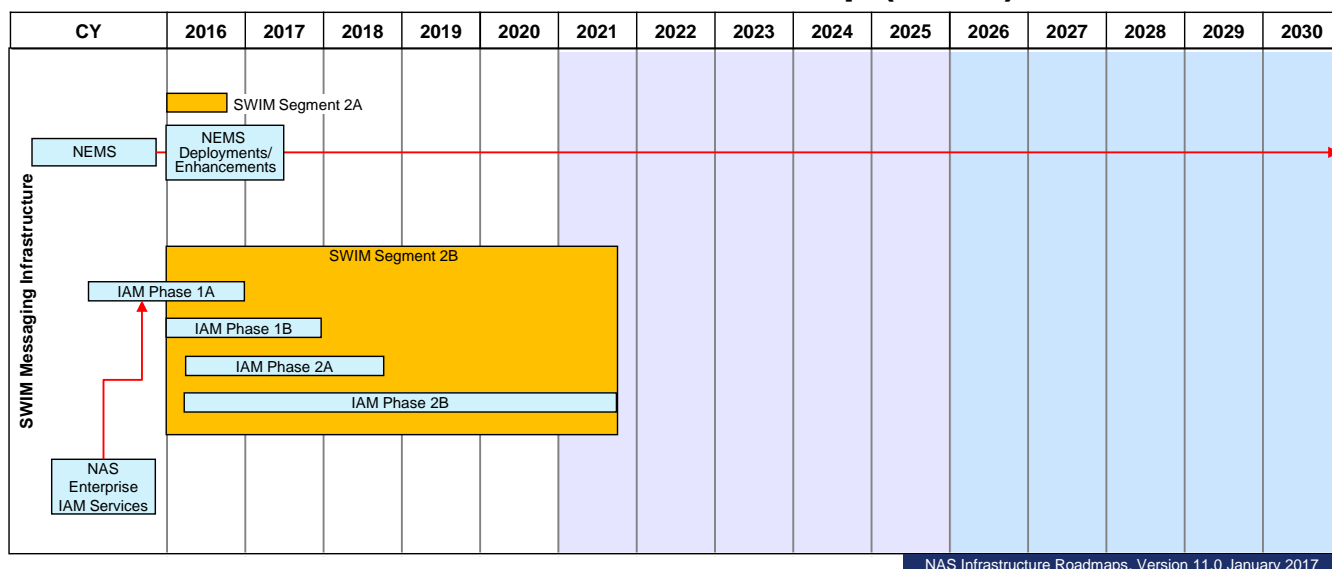


Figure 5-9 Messaging Infrastructure Roadmap

Figure 5-9 shows the System Wide Information Network (SWIM) components.

The NAS Enterprise Messaging Service (NEMS) is a FTI Service, which provides for an Enterprise Service Oriented Architecture (SOA) messaging infrastructure for the NAS. NEMS supports two types of standards-based messaging exchange patterns; Publish/Subscribe, and Request/Response. The Publish/Subscribe model is used when a Service Provider wants to continually publish data to multiple Service Consumers. The Request/Response model is better suited for services with data exchanges on an ad-hoc basis.

NAS Enterprise Identity and Access Management (IAM) Service provides secure digital credentials for NAS messaging and web services. In alignment with the National Strategy for

Trusted Identities in Cyberspace, IAM provides authentication and authorization services that ensure secure information sharing with FAA partners.

SWIM's enterprise infrastructure enables systems to publish information of interest to NAS users; request and receive information from other NAS services; and support NAS security requirements. Segment 2B provides Governance to NAS programs to ensure services are SWIM compliant and meet all FAA SOA standards.

Segment 2B will implement Identity and Access Management Phase 2, Enterprise Service Monitoring Phase 2 and 3, SWIM Terminal Data Distribution System Phase 2, and NAS Common Reference.

A new program SWIM Segment 2C – NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure and 3rd Party Provider Services includes additional infrastructure and capabilities to strengthen the overall NAS information system security posture. Plans for SWIM Segment 2C include technology refresh of existing NAS Enterprise Messaging Service (NEMS) infrastructure such as NEMS nodes, Local Load Balancer, Global Load Balancer, and Solace boxes. The program also plans to complete additional NEMS Infrastructure upgrades at eight sites to expand capacity. Swim 2C will also add 3rd Party Provider Services to support 500+ Tier 2 external NEMS consumers. See BLI 2A11 for more information about the SWIM – Segment 2B, G05C.01-08, and SWIM Segment 2C – NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure and 3rd Party Provider Services, G05C.01-10, programs.

5.3 Surveillance Roadmaps

To provide separation services to aircraft, air traffic controllers must have an accurate display of all aircraft under their control. Surveillance data is provided by the following technologies:

- Primary radar – the radar beam is bounced off the aircraft and reflected back to the radar receiver.
- Secondary radar – a reply is generated by the aircraft transponder and sent back to the radar in response to a secondary radar signal.
- Multilateration – multiple ground sensors receive aircraft electronic signals and triangulate this information to determine aircraft position.
- ADS-B – the aircraft determines its location using a GPS receiver or other navigation equipment and broadcasts that information to an ADS-B ground station. The ground station relays the position information to automation systems which process the data and send it to controller displays. ADS-B Out equipage has been mandated in most controlled airspace by January 1, 2020; where transponders are required today.

En route and terminal facilities normally use Secondary radars (either the Air Traffic Control Beacon Interrogators (ATCBI) or the Mode Select (Mode S)) for traffic separation. Using ATCBI or Mode S enhances the controller's ability to separate traffic because speed and altitude information supplement the position display for each aircraft.

Surveillance systems are shown in three different roadmaps:

1. Roadmap 1 (figure 5-10) - En Route Surveillance
2. Roadmap 2 (figure 5-11) - Terminal Surveillance
3. Roadmap 3 (figure 5-12) - Surface, Approach and Cross Domain Surveillance

5.3.1 En Route Surveillance

Surveillance Roadmap (1 of 3)

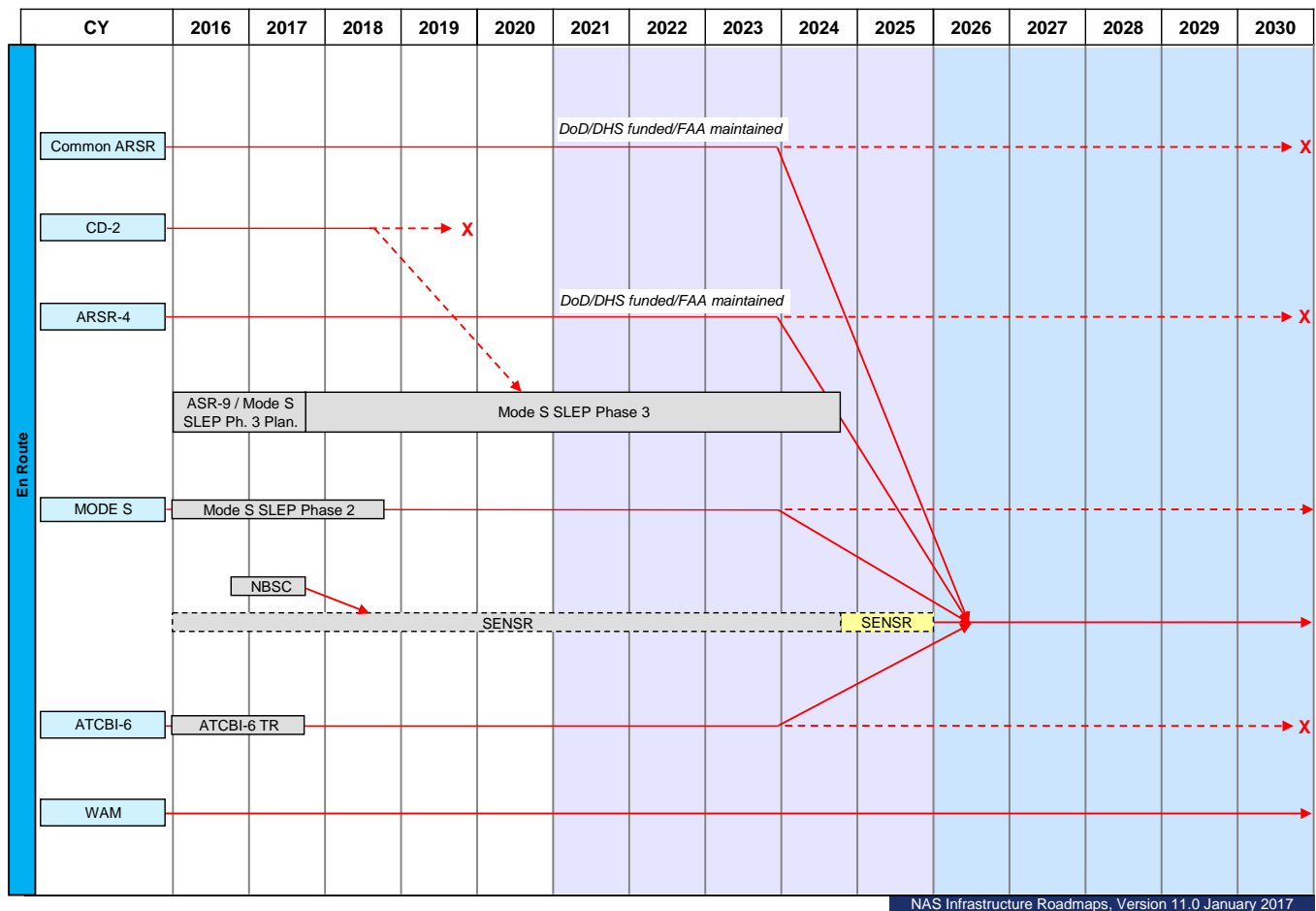


Figure 5-10 En Route Surveillance Roadmap

The Common ARSR (CARSR) and the Air Route Surveillance Radars model-4 (ARSR-4) are long-range primary radars that are used to support defense of the national airspace and provide surveillance data to air traffic control facilities for the continental United States, Guam, and Hawaii. The DoD and Department of Homeland Security will continue to fund system upgrades of the CARSRs and ARSR-4s through the time frame of the roadmap due to national security concerns.

The Common Digitizers (CD-2) that convert analog radar information to a digital format will not be needed after programs to convert radar information to internet protocol are completed.

The Mode Select (Mode S) uses selective beacon detection technology to provide target data and are co-located with Airport Surveillance Radar Model 9 (ASR-9), (ASR-8), or Common Air Route Surveillance Radar (CARSR). The Mode S and co-located primary radars provide beacon reports and correlated radar as digital formatted messages and analog video tailored for automation and display systems at TRACON and ARTCC facilities, the U.S. Department of Defense (DoD), and other users.

The Mode S Service Life Extension Program (SLEP) Phase 2 program will implement modifications to the Mode S system to sustain secondary aircraft surveillance in terminal and en route airspace. The Mode S program is conducting an additional High Gain Open Planner Array Antenna Assessment to determine the requirements for new antenna procurements and/or the number of antennas that can be refurbished to sustain Mode S through 2026. The Mode S SLEP Phase 3 program identified 11 critical Lowest Replaceable Units (LRUs) modifications needed to address obsolescence, end of service life, and diminishing manufacturing sources in order to sustain Mode S operations until 2035. The Phase 3 program is working towards FID. See BLI 2B15 for more information about the Mode S SLEP – Phase 2, S03.01-08, and Mode S SLEP – Phase 3, S03.01-13, programs.

The Next Generation Backup Surveillance Capability (NBSC) will provide a replacement for existing surveillance systems including ATCBI-5, ATCBI-6, Mode-S and ASR-11 Monopulse Secondary Surveillance Radar systems. NBSC will support cooperative target acquisition and maintain continuity of operations if ADS-B outages should occur.

NBSC has been subsumed by a cross-agency program titled Spectrum Efficient National Surveillance Radar (SENSR) that is being initiated to make available the band 1300-1350 MHz for reallocation to shared Federal and non-Federal use through updated radar technology. The SENSR Spectrum Pipeline Plan has been approved and the Government is receiving funds from the Spectrum Relocation Fund to conduct a two-phased feasibility assessment of the proposed spectrum reallocation. The feasibility assessment is expected to be completed by 2021.

- Phase I – Defining: The first phase would occur over approximately two years and will focus on requirements and concept development as well as documenting expected costs and information for all impacted systems.
- Phase II – Refining: The second phase will focus on maturing the selected alternative into a viable and well-planned investment program ready for Solution Implementation.

In the event SENSR program is determined to be infeasible, the FAA must provide a cost-effective replacement for legacy cooperative surveillance service as a backup for ADS-B in en route and select high density terminal environments. In this case the NBSC and Next Generation Surveillance and Weather Radar Capability (NSWRC) investment analysis activities will be reinitiated to address their shortfalls.

The ATCBI-6 provides air traffic controllers with a selective interrogation capability that significantly improves the accuracy of aircraft position and altitude data provided to ATC automation systems. Additionally, the ATCBI-6, in conjunction with a co-located primary Long

Range Radar, provides back-up Combined Control Facility surveillance service to numerous TRACON facilities in the event terminal radar services are lost.

The Colorado Wide Area Multilateration (WAM) system uses electronic transmissions from an aircraft and multilateration technology to detect aircraft position in areas where the radar signal may be unavailable or blocked by mountainous terrain. There are 4 locations in Colorado that are operating the WAM system which is expected to continue in operation beyond 2030.

5.3.2 Terminal Surveillance

Surveillance Roadmap (2 of 3)

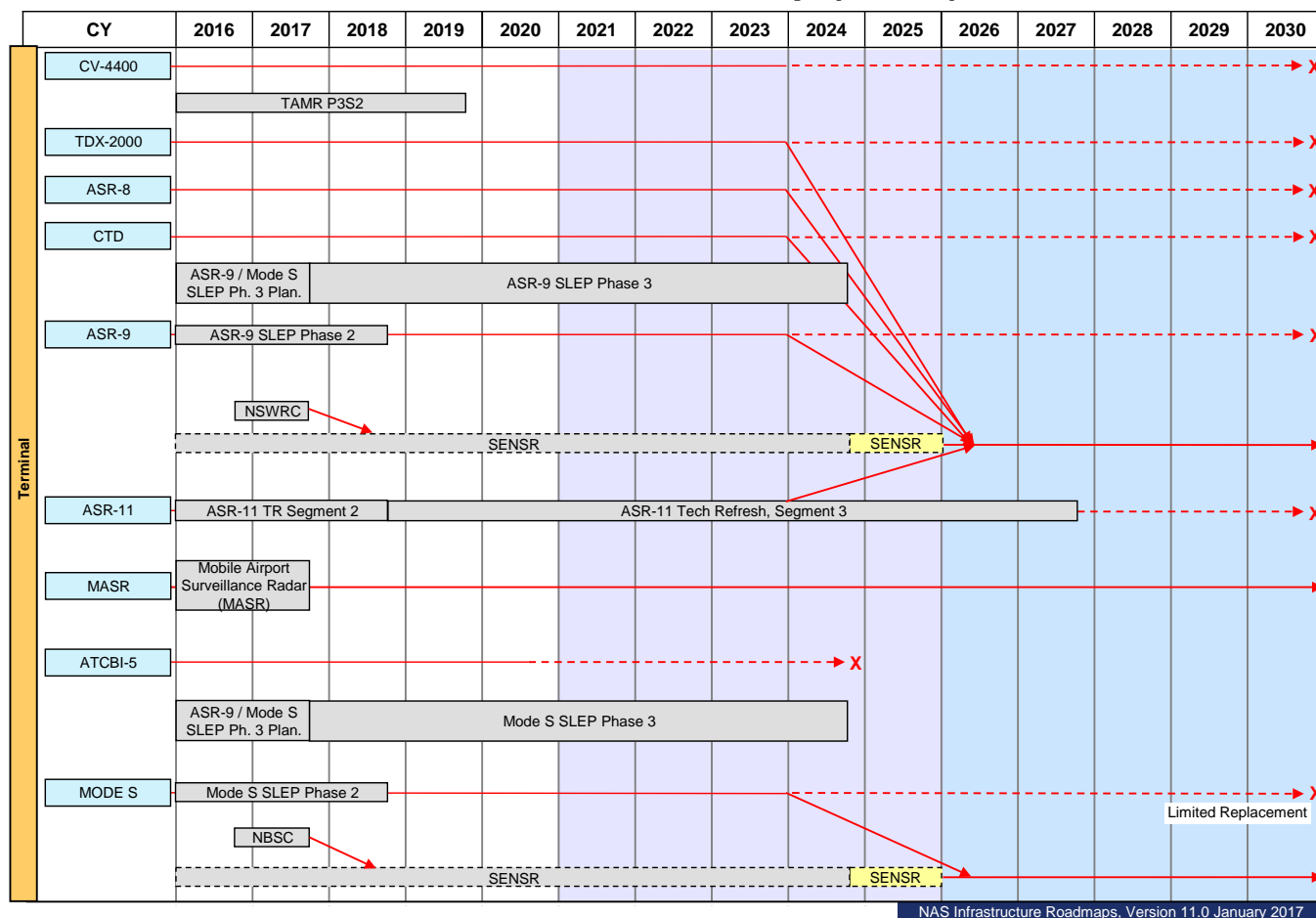


Figure 5-11 Terminal Surveillance Roadmap

The CV-4400 at the top of figure 5-11 is a legacy system that allows use of terminal radar information in en route automation systems, i.e., using terminal radar to fill gaps in en route radar coverage at selected en route centers.

Terminal Automation Modernization Replacement (TAMR) – Phase 3, Segment 2 – See section 5.1.1, Automation Roadmap 1 and BLI 2B03 for more information about the program, A04.07-02, program.

The TDX-2000 is a legacy system that digitizes the output of analog radars, such as an ASR-8, for use by more modern digital automation systems such as STARS.

The ASR-8 is a primary radar system that requires a Common Terminal Digitizer (CTD) be installed to convert analog outputs to digital inputs needed by STARS. As more of the remaining ARTS automation systems are replaced by STARS additional CTDs will be needed.

The ASR-9 is a primary radar that tracks aircraft 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 ASR-9 SLEP Phase 2 program will implement modifications to the ASR-9 system to sustain primary radar in terminal airspace. The program will procure Digital Remote Surveillance Communication Interface Processor Replacement systems, Transmitter Backplanes, and Radar Data Access Point, and replenishment of depot inventory of critical components. The ASR-9 SLEP Phase 3 program replaces or upgrades obsolete ASR-9 hardware and software to ensure the continued operation of the radar system. This is an ongoing program that is accomplished in phases to address obsolescence and supportability issues. The phase 3 program is working towards a FID. See BLI 2B09 for information about the ASR-9 SLEP Phase 2, S03.01-09, and ASR-9 SLEP – Phase 3, S03.01-12, programs.

The Next Generation Surveillance and Weather Radar Capability (NSWRC) program will provide a cost-effective replacement for several models of ASR and the Terminal Doppler Weather Radars (TDWR) for terminal aircraft surveillance and weather detection. The program will address all existing and emerging primary radar and weather requirements. As shown on the roadmap, the alternative to NSWRC for these requirements will be SENSAR if it is formally approved and funded.

For more information see the description for SENSAR under Surveillance Roadmap 1 in section 5.3.1 En Route Surveillance.

The Airport Surveillance Radar Model 11 (ASR-11) is an integrated primary and secondary radar providing six-level weather intensity information to terminal ATC automation systems. The ASR-11 has replaced several of the radars that were not replaced by the ASR-9.

The ASR-11 Technology Refresh Segment 2 program replaces and upgrades obsolete Commercial-Off-The-Shelf (COTS) hardware and software to ensure the continued, reliable, and cost effective operation of the ASR-11 radar system in the NAS. The Segment 2 program will address shortfalls identified in the Shortfall Analysis Report including Site Control Data Interface /Operator Maintenance Terminal obsolescence and Uninterruptible Power Supply capacitor at end of life expectancy. ASR-11 Technology Refresh Segment 3 will address parts obsolescence, operational performance deficiencies, and other areas requiring technology refresh. The segment 3 program is working towards a FID. Future ASR-11 Technology

Refreshes are dependent on decisions for NSWRC and SENSR. See BLI 2B10 for more information about the ASR-11 – Technology Refresh, Segment 2, S03.02-05, and ASR-11 – Technology Refresh, Segment 3, S03.02-07, programs.

The Mobile Airport Surveillance Radar (MASR) is a terminal surveillance radar capability that can be moved from site to site to support radar relocations, temporary planned outages to accommodate installation of upgrades to an existing radar, and emergency operations when existing systems are damaged. MASR capability is planned to continue beyond the time frame of the roadmap.

The ATCBI-5 is a secondary surveillance radar and has been operational for more than 25 years. It provides aircraft identification, altitude, airspeed and direction to terminal ATC systems. It will be phased out by 2024.

See Surveillance Roadmap 1 in section 5.3.1 and BLI 2B15 for information about the Mode S SLEP Phase 2, S03.01-08, and Mode S SLEP Phase 3, S03.01-13, programs.

See Surveillance Roadmap 1 in section 5.3.1 for information about NBSC and SENSR.

5.3.3 Surface, Approach and Cross Domain Surveillance

Surveillance Roadmap (3 of 3)

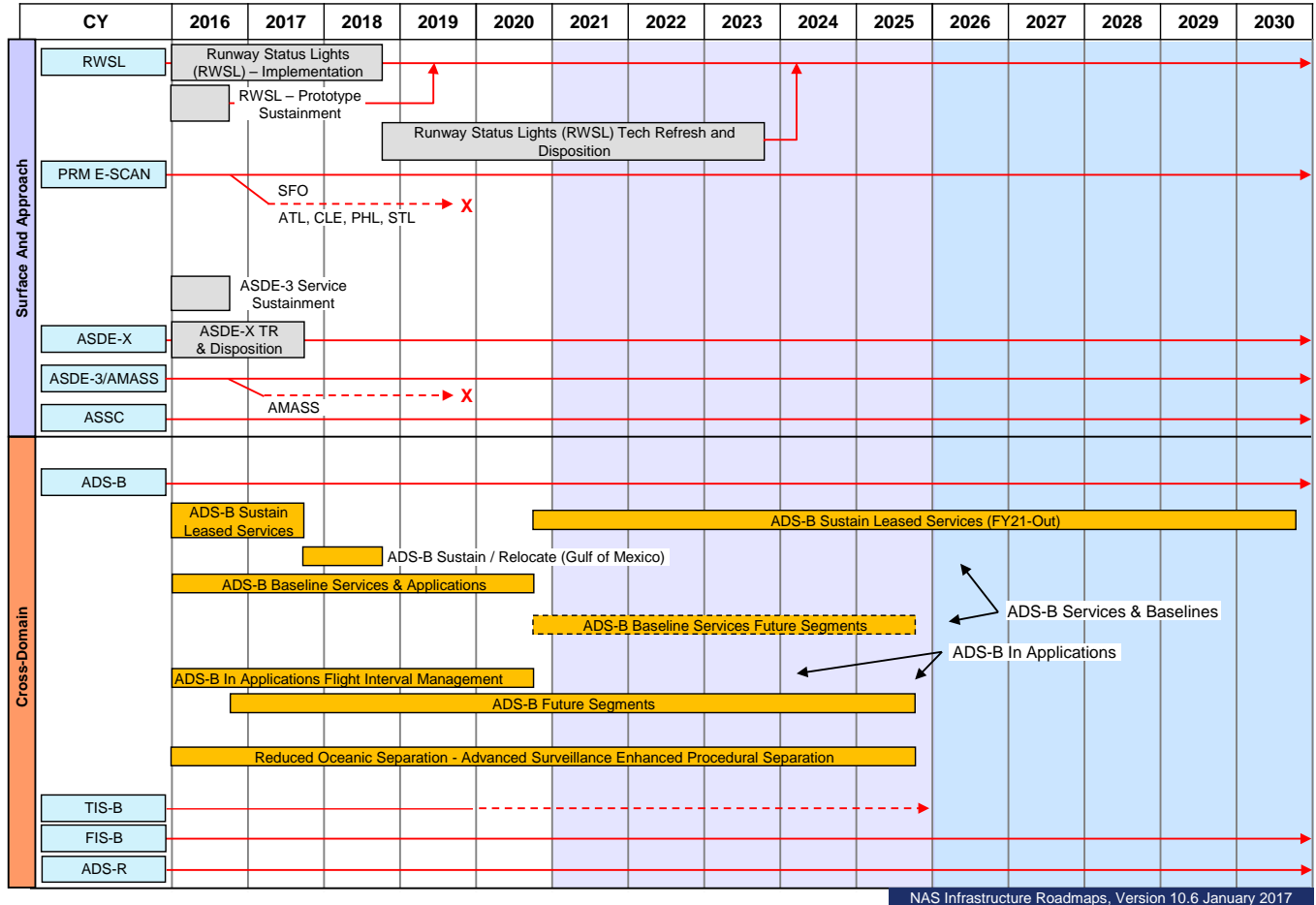


Figure 5-12 Surface, Approach and Cross Domain Surveillance Roadmap

The Runway Status Lights (RWSL) system, see top left of figure 5-12, integrates runway lighting equipment with approach and surface surveillance systems to provide a visual signal to pilots and vehicle operators indicating when it is unsafe to enter/cross or begin takeoff on the runway. The system is fully automated based on inputs from surface and terminal surveillance systems. In August and December 2016, the JRC authorized adding all three prototype systems at Boston, Dallas Fort Worth, and San Diego airports back into the baseline. A total of 19 RWSL systems are planned to be operational by FY 2018. See BLI 2B11 for more information about the RWSL – Implementation – Phase 1, S11.01-02, program.

The RWSL Technology Refresh & Disposition program, now called RWSL Sustainment, will assess the need to replace and upgrade obsolete 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 working towards a FID. See BLI 2B11 for more information about the RWSL – Sustainment, S11.01-04, program.

The electronic scan (E-SCAN) version of Precision Runway Monitor (PRM) is used to monitor the safety of aircraft conducting side-by-side simultaneous approaches to closely spaced parallel runways during Instrument Flight Rules (IFR) conditions. It achieves rapid update by moving the beam electronically rather than relying on turning the antenna. It is a secondary rapid update radar that provides the precision that controllers need to ensure that two aircraft maintain safe clearance between them while approaching closely spaced runways. The FAA Flight Standards organization has determined that required runway separation requirements can be reduced which eliminated the need for PRM at Atlanta (ATL). The PRM at San Francisco (SFO) will be sustained utilizing assets from the ATL PRM which will not be replaced.

Airport Surface Detection Equipment Model-X (ASDE-X) enables air traffic controllers to track surface movement of aircraft and vehicles. ASDE-X Safety Logic enhances the situational awareness for air traffic controllers by using surveillance information from ASDE-X to determine if the current and/or projected positions and movement characteristics of tracked aircraft/vehicles present a potential collision situation. Visual and audible alerts are provided to the air traffic controllers when the safety logic predicts a collision.

The Airport Surface Detection Equipment Model 3 (ASDE-3) is a primary radar system that provides a display of aircraft and ground vehicles in the airport operating areas (runways and taxiways). The Airport Movement Area Safety System (AMASS) is an automation system that utilizes position information from the ASDE-3 system and terminal radars to provide an automatic visual and audio alert to controllers when it detects potential collisions between aircraft or aircraft and vehicles on or near the airport runways.

Implemented within the ADS-B NAS Wide Implementation – Baseline Services & Applications program, the Airport Surface Surveillance Capability (ASSC) is a surface multilateration system that receives inputs from multilateration sensors, ADS-B, and Airport Surveillance Radar/Mode Select (ASR/Mode S) terminal radars. Using fused target data, ASSC enhances situational awareness for tower controllers by providing in near real-time for display, the position of all transponder-equipped aircraft and ADS-B equipped ground vehicles on the airport surface movement area, and aircraft flying within five miles of the airport.

Automatic Dependent Surveillance – Broadcast (ADS-B) is an advanced surveillance technology that provides highly accurate and more comprehensive surveillance information and is an enabling technology for NextGen. Aircraft position is determined using the Global Navigation Satellite Service (GNSS), and/or an internal inertial navigational reference system, or other navigation aids. The aircraft's ADS-B equipment processes this position information, along with other flight parameters to be broadcast on the order of once a second to airborne and ground-based ADS-B receivers. This information is used to display the aircraft's position on en route and terminal automation systems.

ADS-B NAS Wide Implementation – Baseline Services & Applications program ensures continuation of the FAA subscription for ADS-B Baseline Services delivered by the prime

contractor utilizing contractor owned and operated ADS-B infrastructure and service volumes already in place in the NAS. Subscription fees support the operation of the system, necessary upgrades, and eventual modernization. The program also provides Wide-area Multilateration (WAM) surveillance service capability providing aircraft location information to the automation systems. These services allow controllers to provide separation services at airports in Colorado and North Carolina. Eight airports in the NAS will receive Airport Surface Surveillance Capability (ASSC), which is a surface multilateration system that receives inputs from cooperative and non-cooperative sensors. See BLI 2A12 for more information about the ADS-B NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01, program.

The ADS-B Sustain Leased Services (FY21-Out) program will continue to provide leased ADS-B services for FY 2021 and beyond. The program plans to introduce a new scope to Baseline Services & Applications by implementing a surveillance backup strategy, new mitigations for spectrum congestion, and re-competing service contracts. The program is working towards a FID. See BLI 2A12 for more information about the ADS-B – Sustain Leased Services (FY21-out), G02S.03-06, program.

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. In addition to the ADS-B surveillance facilities, voice communications and weather services are maintained to support ATC Instrument Flight Rule requirements. Aircraft utilizing these services include high altitude commercial aircraft transiting the GOM and low-altitude helicopters providing transportation to the multiple energy platforms operating throughout the GOM. The ADS-B Sustain/Relocate (Gulf of Mexico Platform) program will sustain Air Traffic Services by relocating this equipment to other energy platforms when existing platforms shut down operations. See BLI 2A12 for additional information about the ADS-B NAS Wide Implementation – Sustain/Relocate (Gulf of Mexico Platform), G02S.05-01, program.

ADS-B In Applications – Flight Interval Management (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 IM clearance that allows flight crews to manage spacing through speed adjustments generated by onboard IM avionics until reaching a planned termination point. IM operations require new flight-deck functions implemented in Flight Interval Management avionics to provide speed guidance to a flight crew to achieve and maintain a relative spacing interval from another aircraft. See BLI 1A05 for more information about the ADS-B In Application - Flight Interval Management, G01S.02-01, program.

The ADS-B NAS Wide Implementation – Future Segments program will develop Advanced-Interval Management (A-IM) that supports IM arrivals, approach, and cruise operations, and single runway and dependent runway operations. Pre-implementation activities for these future concepts will be conducted under G01S.02-01.

The Reduced Oceanic Separation (ROS) – Advanced Surveillance Enhanced Procedural Separation (ASEPS) program will reexamine current limitations to reducing oceanic separation

standards by evaluating improved surveillance capabilities including Space-Based Automatic Dependent Surveillance – Broadcast (ADS-B) and enhanced Automatic Dependent Surveillance – Contract (ADS-C) with a faster update rate than available today. This investment will increase the precision of information used for aircraft separation resulting in safer and more efficient operations. The program is working towards a FID. See BLI 2A20 for more information about the ROS – ASEPS, G02S.04-01, program.

Traffic Information Services – Broadcast (TIS-B) is a service that provides ADS-B equipped aircraft with surveillance data about both ADS-B and non-ADS-B equipped aircraft, providing a more complete “picture” of nearby air traffic.

Flight Information Services – Broadcast (FIS-B) services provide ground-to-air broadcast of non-air traffic control advisory information which provides users valuable, near real-time information to operate safely and efficiently. FIS-B products include graphical and textual weather reports and forecasts, Special Use Airspace Information, Notices to Airmen, and other aeronautical information.

Automatic Dependent Surveillance – Rebroadcast (ADS-R) translates and uplinks ADS-B messages received from aircraft with data links on different frequencies making it possible for each aircraft and vehicle to receive the information being transmitted by the other.

5.4 Navigation Roadmaps

Navigation aids (Nav aids) can be electronic or visual. En route and terminal electronic aids have traditionally been ground-based radio transmitters that emit signals that allow pilots with aircraft equipped with related avionics to determine the direction and/or distance from the Nav aids. The ground-based system commonly used for en route navigation is the Very High Frequency Omnidirectional Range with Distance Measuring Equipment (VOR with DME). Aircraft equipped with GPS navigation systems are now able to navigate departure to destination routes without the ground-based Nav aids. Visual Nav aids are ground-based lighting systems that show pilots the path they need to follow during approach and landing.

Nav aids also have an important role in guiding pilots to a safe landing in low visibility conditions. They support two types of approaches — precision and non-precision. Instrument Landing Systems (ILS) are used for precision approaches and allow pilots to descend to lower minimum altitudes than are possible with non-precision approaches. Localizer Performance with Vertical Guidance (LPV) is a high precision GPS/WAAS instrument approach procedure with a decision height of 200 feet; similar to the ILS Category I. The minimum altitude, also called the decision height, is the lowest an aircraft can descend before committing to land; the pilot must be able to see the runway at that altitude before descending further. Non-precision approaches use Nav aids (other than ILS) and usually only provide lateral guidance, not vertical guidance.

Navigation aid programs are portrayed in two different roadmaps:

1. Roadmap 1 (figure 5-13) - Precision Approach & Safety and Enhancements
2. Roadmap 2 (figure 5-14) - Infrastructure and En Route/Terminal/Non-Precision Approach

5.4.1 Precision Approach & Safety and Enhancements

Navigation Roadmap (1 of 2)

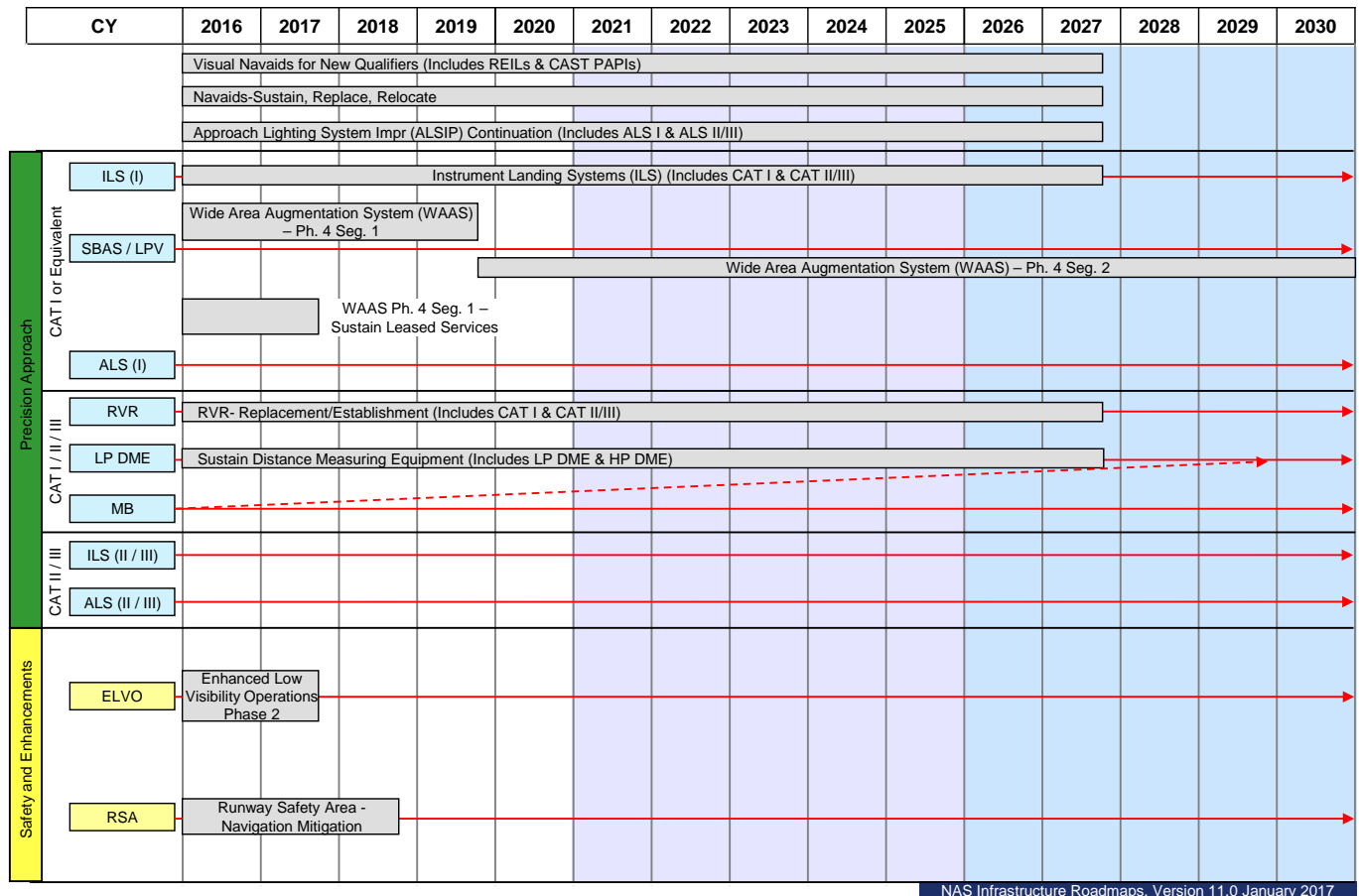


Figure 5-13 Precision Approach & Safety and Enhancements Roadmap

At the top of Figure 5-13 are programs that support the continued operation of existing systems.

See the Navigation Roadmap 2 in section 5.4.2 and BLI 2D07 for more information about Visual Navaids for New Qualifiers, N04.01-00.

Approach Lighting Systems (ALS) (I, II, III) helps the pilot see the end of the runway and transition from instrument to visual flight for landing before reaching runway minimums.

Navaids – Sustain, Replace, Relocate sustains and/or replaces ALS and Instrument Landing Systems (ILS) at sites where there is a high risk for failure of these systems and where failure would increase the visibility required to land. The ALS include Medium Intensity Approach

Lighting System with Runway Alignment Indicator Lights (MALSR) for Category I approaches and High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) for Category II/III approaches. See BLI 2D09 for more information about the NavAids – Sustain, Replace, Relocate, N04.04-00, program.

The Approach Lighting System Improvement Program (ALSIP) Continuation program improves the safety of ALSs built before 1975 to meet current standards by replacing rigid structures, and the entire approach lighting system, with lightweight and low-impact frangible structures that collapse or break apart upon impact if struck during take-off or landing, potentially reducing the severity of an accident. See BLI 2D05 for more information about the ALSIP Continuation, N04.03-00, program.

ILSs provide both vertical and lateral guidance information for the pilot to allow safe landings to touchdown and rollout. These systems allow properly equipped aircraft to land safely with a stabilized approach to a runway which improves both system safety and airport capacity for landing properly equipped aircraft in adverse weather conditions at runways equipped with an ILS. There are three categories of ILS, i.e., Category (CAT) I, CAT II, and CAT III. The lowest altitude at which a pilot is able to decide whether to land or abort, known as the decision height, and how far away the pilot can see the runway, known as runway visual range, defines each category. The ILS program supports the installation of ILSs and/or High Intensity ALSF-2 for the establishment of new Category II/III precision approach procedures. See BLI 2D02 for more information about the ILS, N03.01-00, program.

Satellite Based Augmentation System (SBAS) supports wide-area or regional augmentation through the use of geostationary (GEO) satellites which broadcast the augmentation information. Systems such as the Wide Area Augmentation System (WAAS) meet the international standard developed for SBAS and are commonly composed of multiple ground reference, master, and uplink stations. LPV is a high precision GPS/WAAS instrument approach procedure with a decision height similar to the ILS Cat I. See Navigation Roadmap 2 in section 5.4.2 and BLI 2D03 for more information about the WAAS – Phase IV Segment 1, N12.01-07, and WAAS - Phase IV Segment 2, N12.01-08, programs.

The Runway Visual Range (RVR) provides air traffic controllers with a measurement of the visibility at key points along a runway, touchdown, midpoint, and rollout. RVR data is used to decide whether it is safe to take off or land during limited visibility conditions. RVR – Replacement/Establishment program replaces old RVR equipment with new PC-based RVR equipment which is also safer because the visibility sensors are mounted on frangible structures that break away if accidentally struck by an aircraft during take-off or landing. See BLI 2D04 for more information about RVR – Replacement/Establishment, N08.02-00.

Low Power (LP) Distance Measuring Equipment (DME) is a radio navigation aid used by pilots to determine the aircraft's slant distance from the DME location. A LP DME can be collocated with an ILS where it provides the pilot with an accurate distance to the touchdown area of the runway.

The Sustain DME program is procuring and installing state-of-the-art DME systems to support replacement of DMEs that have exceeded their service life expectancy; to establish new DMEs at qualifying airports; to relocate DME facilities; and establish DMEs in lieu of Instrument Landing System markers. The new DME can respond to more than 250 interrogators from aircraft simultaneously. See BLI 2D06 for more information about the Sustain DME, N09.00-00, program.

MB (Marker Beacon) is a VHF radio beacon, usually in conjunction with an ILS, to give pilots a means to determine position along an established route to a runway.

Enhanced Low Visibility Operations (ELVO) allows pilots to land with more limited visibility conditions than standard procedures. The ELVO Phase III program supports 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. At these airports, ELVO is expected to remain in operation beyond the timeline of the current roadmap. The program is working towards a FID. See BLI 1A08C for more information about the NextGen Navigation Engineering, G06N.01-03, program and the activities supporting ELVO Phase 3.

The FAA's runway safety program improves the overall safety of the runways and Runway Safety Area (RSA). The RSA must be free of all objects that are three inches above the grade and are not frangible. The relocation or removal of existing rigid objects will decrease the potential for damage to aircraft and minimize injuries or fatalities to aircraft passengers and crew members if an aircraft has to use the RSA in an emergency. The program remediates FAA-owned NAVAIDs in RSAs that are not in compliance with the RSA requirements. A new program, Runway Safety Area Navigation Mitigation – Phase 2 will correct FAA-owned facilities and equipment that are not in compliance with RSA Standards and not part of the N17.01-01 CIP effort. This work will include the installation of frangible connections on identified structures to the relocation of facilities within and outside the RSA. See BLI 2D11 for more information about the Runway Safety Area – Navigation Mitigation, N17.01-01, and the Runway Safety Area Navigation Mitigation – Phase 2, N17.01-02, programs.

5.4.2 Infrastructure and En Route/Terminal/Non-Precision Approach

Navigation Roadmap (2 of 2)

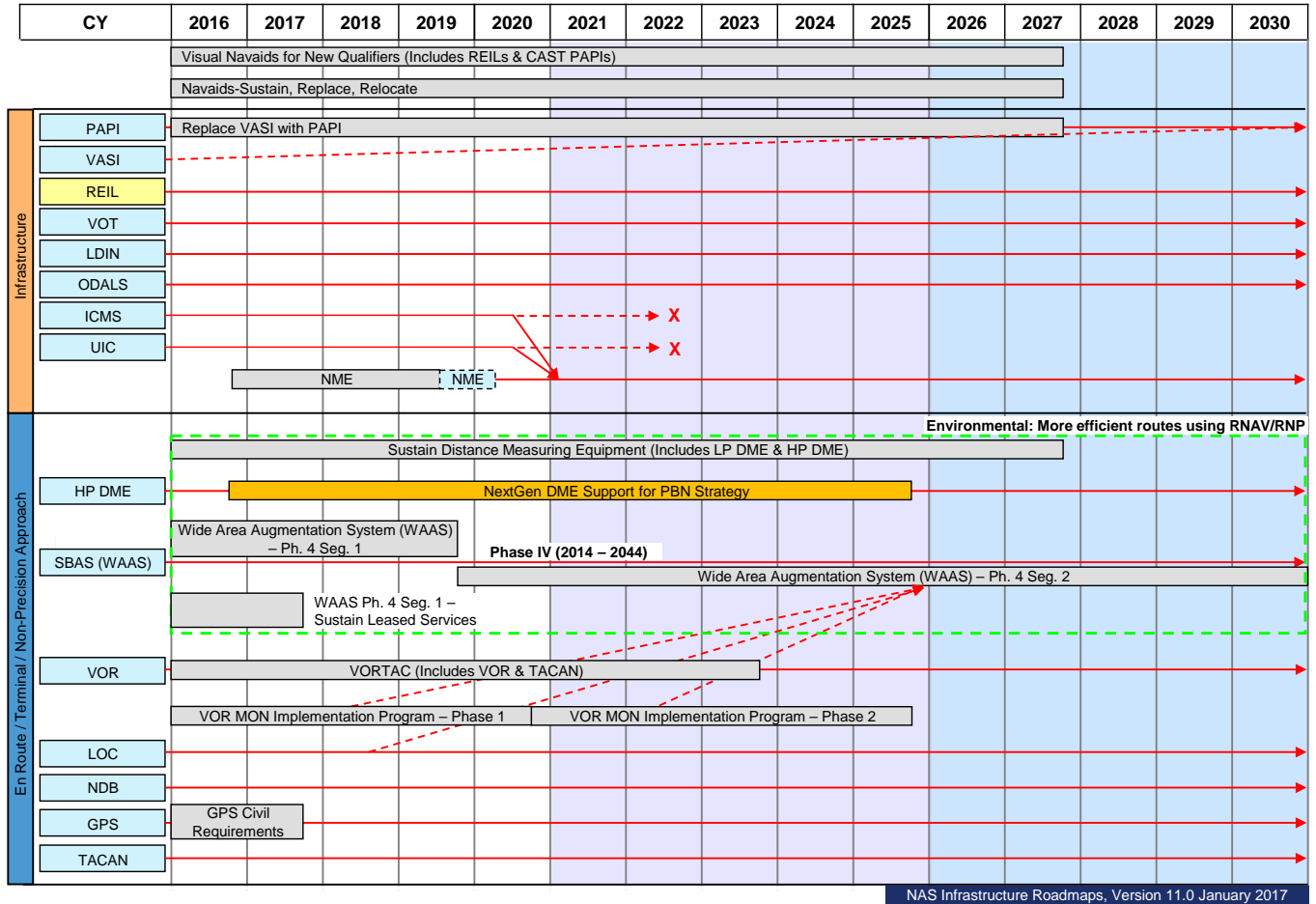


Figure 5-14 Infrastructure and En Route/Terminal/Non-Precision Approach Roadmap

Precision Approach Path Indicators (PAPI) and Visual Approach Slope Indicator (VASI) systems have a set of lights that are arranged so that the pilot sees all red lights when the aircraft is below the glideslope and all white lights when the aircraft is above the glideslope. This visual reference helps the pilot to maintain a stabilized descent and approach-slope clearance over obstructions to the runway.

A Runway End Identification Light (REIL) is a visual aid that provides the pilot with a rapid and positive identification of the approach end of a runway using two simultaneously flashing white lights, one on each side of the runway landing threshold.

The Visual NavAids for New Qualifiers program supports the procurement, installation, and commissioning of PAPI and REIL systems at new qualifying runways. See BLI 2D07 for more information about the Visual NavAids for New Qualifiers, N04.01-00, program.

See Navigation Roadmap 1 in section 5.4.1 and BLI 2D09 for more information about the NavAids – Sustain, Replace, Relocate, N04.04-00, program.

The Replace VASI with PAPI program will continue to replace the VASIs beyond 2030. See BLI 2D10 for more information about the Replace VASI with PAPI, N04.02-00, program.

The VOR Test facility (VOT) is used to check and calibrate VOR receivers in aircraft.

Lead In Light System (LDIN) and Omni-directional Airport Lighting System (ODALS) are installed at the end of runways to help pilots determine the active runway for landing.

The Interlock Control and Monitoring System (ICMS) and Universal Interlock Controller (UIC) allow controllers to rapidly activate and deactivate the navigational aids at an airport.

The NavAids Monitoring Equipment (NME) program will provide efficiencies by combining the control and monitoring functionality currently being provided by legacy systems, i.e. ICMS and UIC, into a single solution with one common software, training and logistics platform. The program is working towards a FID. See BLI 2D12 for more information about the NME, M08.41-02, program.

High Power (HP) DME is a radio navigation aid used by pilots to determine the aircraft's slant distance from the DME location based on its altitude. See the Navigation Roadmap 1 in section 5.4.1 and BLI 2D06 for more information about the Sustain DME, N09.00-00, program.

The NextGen DME program will expand DME coverage in En Route and selected Terminal Airspace to provide a resilient, complimentary navigation service to enable DME/DME Area Navigation (RNAV) aircraft, without Inertial Reference Unit (IRU), to continue Performance Based Navigation (PBN) operations during disruptions of the Global Navigation Satellite System (GNSS). See BLI 2B19 for more information about the NextGen DME Support For Performance Based Navigation (PBN) Strategy, G01N.01-02, program.

The Satellite-Based Augmentation System (SBAS), also called the Wide Area Augmentation System (WAAS), consists of a network of 38 ground reference stations located in North America 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 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. In addition to L1, a new GPS signal, L5 will be added on the next generation of satellites. The Wide Area Augmentation System (WAAS) – Phase IV Segment 1 incorporates WAAS infrastructure upgrades to support the use of the new L5 frequency and to prepare for the full dual frequency user capability planned for implementation in Dual Frequency Operations. WAAS Segment 2 will develop and deploy a WAAS Dual Frequency User Service that will provide correction and integrity data allowing usage of the L5 signal in the NAS. See BLI 2D03 for more information about the WAAS – Phase IV Segment 1, N12.01-07, and WAAS Phase IV Segment 2, N12.01-08, programs.

A Very High Frequency Omni-directional Range (VOR) is a ground-based Navaid that provides the bearing to the VOR and is used by general aviation aircraft for navigation in both en route and terminal airspace. The direct lines between VORs are used to define established air routes. A VOR collocated with a Tactical Air Navigation (TACAN) is called a VORTAC.

The VORTAC program replaces, relocates, or improves VORs associated with Distance Measuring Equipment (DMEs) (VOR/DME) and VORs associated with TACANs. This includes installation of a Doppler VOR electronic and antenna kits to eliminate most signal reflection restrictions caused by obstacles causing electromagnetic interference such as trees, metal buildings, transmission lines, towers, or wind farms. See BLI 2D01 for more information about the VORTAC, N06.00-00, program.

The VOR Minimum Operational Network (MON) Implementation Program will perform the work required to downsize the VOR network to the minimum required for use as a backup navigation system in the event of an unplanned GPS localized outage and allow aircraft not equipped with GPS to navigate and land under Instrument Flight Rules. This program supports the NAS transition from the current VOR airways to PBN consistent with NextGen goals. At the VOR MON Implementation Program Phase 1 FID in September 2015, the program was approved to discontinue approximately 74 VORs by the end of September 2020. The VOR MON Implementation Program Phase 2 is working towards a FID and will address additional sites to achieve the MON. See BLI 2D01 for more information about the VOR – MON Implementation Program – Phase 1, N06.01-01, and VOR – MON Implementation Program Phase – 2, N06.01-02, programs.

The Localizer (LOC) is an ILS component that provides horizontal guidance to a runway end. When used as a stand-alone system without a Glideslope component, the LOC supports non-precision approach operations. SBAS (WAAS) will begin to replace that functionality at airports where only localizers are installed.

A Non-Directional Beacon (NDB) supports navigation by providing the pilot with direction or bearing to the NDB station relative to the aircraft. The FAA will continue operating NDBs in some remote areas where it is not economically justified to install more modern navigational aids.

The DoD operates the GPS. There are typically 24 to 30 active satellites in orbit, and a navigation receiver can determine an aircraft's position by interpreting the data transmitted by the satellites in view of the aircraft's antenna. Two GPS upgrades are expected in future years. The next generation of satellites will have a second frequency (L5) for civilian safety-of-life use. An aircraft receiver that receives both the existing L1 signal and the new L5 signal can internally calculate corrections that enhance the accuracy of the position calculation and eliminate the errors caused by ionospheric distortion. The GPS III family of satellites will be upgraded with an additional civil signal (L1C) and increased transmitting power.

TACAN is the military equivalent of combined VOR and DME systems. VORTAC is a site where a VOR and TACAN are co-located and the VOR uses the TACAN for DME information.

5.5 Weather Roadmaps

Timely and accurate weather observations and forecasts are essential to aviation safety and for making the best use of aviation capacity. Weather information will be even more important when NextGen direct or user chosen trajectory routing becomes routine. Pilots need to know the direction and speed of winds aloft so that they can take advantage of tailwinds and minimize the effect of headwinds. They also need to know if there will be obstructions to visibility that restrict landings at their destination airport, and whether the runway is wet or dry and how that will affect braking action. Traffic flow managers and pilots use weather observations and forecasts to determine when they need to plan alternative routes to avoid severe weather. Pilots must avoid thunderstorms with hail and heavy rain, turbulence, and icing to avoid damage to the aircraft and the potential for injuring passengers. The FAA has a lead role in collecting and distributing aviation weather data – particularly hazardous weather. The FAA distributes hazardous weather information from its own systems and uses both the FAA and National Weather Service (NWS) computer forecast models based on data available from FAA and NWS sensors to develop forecasts for use by air traffic control facilities, pilots, airline operations centers, and other aviation-related facilities.

Weather sensors include weather radars and surface observation systems that measure atmospheric parameters, such as surface temperature, barometric pressure, relative humidity, cloud bases and tops, prevailing wind speed and direction, and occurrences of wind shear and microbursts. These weather sensors provide real-time information to air traffic facilities and to centralized weather-forecasting models.

Weather processing/dissemination/display systems organize and process the sensor's observed data. Data from multiple sensors feed forecast models whose output can be disseminated and integrated in national and local processing and display systems that interpret broad weather trends affecting aviation operations. This information can then be sent to air traffic controllers, traffic flow managers, dispatchers, and pilots.

Weather system implementation is broken down into two different roadmaps:

1. Roadmap 1 (figure 4-15) - Weather Sensors
2. Roadmap 2 (figure 4-16) - Weather Dissemination, Processing, and Display

5.5.1 Weather Sensors

Weather Roadmap (1 of 2)

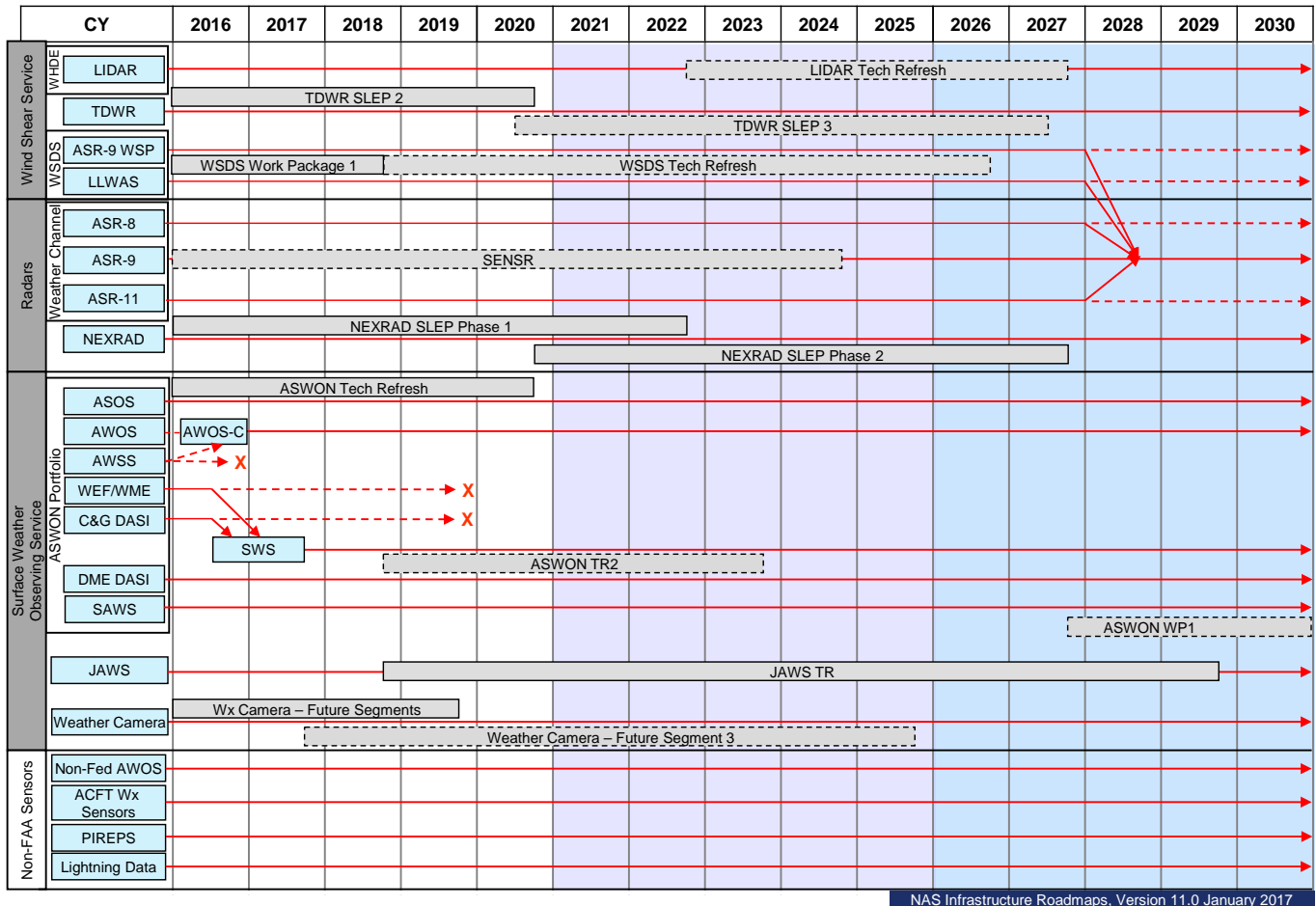


Figure 5-15 Weather Sensors Roadmap

At the top left of Figure 5-15 is the Wind Shear Service portfolio which includes:

- Light Detection and Ranging (LIDAR) system;
- Terminal Doppler Weather Radar (TDWR);
- Airport Surveillance Radar-9 (ASR-9) Wind Shear Processor (WSP); and
- Low Level Wind Shear Alerting System (LLWAS).

The LIDAR system uses lasers to detect dry microbursts and gust fronts in high plains and mountain environment that radar systems may not detect. A future program, LIDAR Technology Refresh, is planned to start in FY 2023.

TDWR, ASR-9 radars, wind sensors and lasers are used to detect wind shear conditions near the runways and approach areas of airports. TDWRs provide vital information and warnings regarding hazardous windshear conditions, precipitation, gust fronts, and microbursts to air traffic controllers managing arriving and departing flights in the terminal area.

TDWR SLEP Phase 2 will replace TDWR components that have deteriorated due to aging, have become obsolete or unsupportable, and were not addressed in Phase 1. See BLI 2B01 for more information about the TDWR – SLEP – Phase 2, W03.03-02, program.

The future program, TDWR – SLEP Phase 3, is planned to start in FY 2021 and will continue to replace TDWR components that have deteriorated due to aging; have become obsolete; or are unsupportable.

Airports with significant wind shear risk that have a lower volume of air traffic are served by the ASR-9 WSP, a lower cost alternative to TDWR. The ASR-9 WSP processes weather from the two dimensional Doppler search radar signals, which are its standard format to detect wind shear which approximates the output of the TDWR.

LLWAS consists of wind sensors located at 6 to 29 points around the runway thresholds to measure surface wind direction and velocity. The LLWAS computer systems compare the wind velocity and direction detected by these sensors at different locations to determine whether wind shear events are occurring at or near the runways. The sensors measure surface winds only and do not detect wind shear above the surface in the approach or departure paths.

Wind Shear Detection Services (WSDS) Work Package 1 is a portfolio program that will address obsolescence and supportability issues of the legacy WSP, LLWAS, and Wind Measuring Equipment (WME) that determines and displays the wind speed and direction on the runways. See BLI 2A13 for more information about the WSDS – Work Package 1, W05.03-01, program.

A future program, WSDS Technology Refresh, will address obsolescence of the WSP and LLWAS. The program will ensure continuation of the existing service levels provided by these legacy systems by upgrading the components necessary to resolve obsolescence and supportability issues.

The next four systems are the ASR-8/9/11 Weather Channel and the Next Generation Weather Radar (NEXRAD) that detect precipitation, wind, and thunderstorms that affect aircraft in flight. NEXRAD is a long range weather radar that detects, analyzes, and transmits weather information for use by the ATC System Command Center, en route, terminal and flight service facilities. This weather information helps determine location, time of arrival, and severity of weather conditions to advise aircraft on recommended routes. See the description for SENSR under Surveillance Roadmap 1 in section 5.3.1 En Route Surveillance.

There are currently 160 Next Generation Weather Radar (NEXRAD) systems that were developed and used under a tri-agency partnership between the Department of Commerce's National Weather Service, Department of Defense, and FAA. The NEXRAD Service Life Extension Program (SLEP) Phase 1 is a refurbishment program to extend the service life of 12 FAA-owned NEXRAD systems until 2030 when a replacement capability is expected to be deployed. The NEXRAD SLEP Phase 2 will identify sustainability issues of the NEXRAD system in 2021 and if needed, will initiate investment analysis activities. See BLI 2A03 for more information about the NEXRAD – SLEP Phase 1, W02.02-02, and NEXRAD SLEP Phase 2, W02.02-03, programs.

The Aviation Surface Weather Observation Network (ASWON) is a portfolio program that consists of the Automated Surface Observing System (ASOS), Automated Weather Observation System (AWOS) and AWOS model C, Stand Alone Weather Sensors (SAWS), Digital Altimeter Setting Indicator (DASI), Wind Equipment F-420 Wind Sensor (WEF), and the AWOS Data Acquisition System (ADAS). All of these systems, except the ADAS, are located at airports and collectively measure and report weather conditions including temperature, barometric pressure, visibility, precipitation type and amount, cloud height and coverage, and wind speed and direction. The data collected is important to pilots and dispatchers as they prepare and file flight plans, and is vital for weather forecasting.

The Wind Equipment F-400 Series (WEF) / Wind Measuring Equipment (WME) determine and display the wind direction and velocity on the runways. These systems feed data directly to air traffic control facilities and support automated broadcast of weather information to pilots and provide regular updates to forecast models.

The ASWON Technology Refresh program will provide compatible technology upgrades and/or replacements to the five legacy ASWON systems (ASOS, AWOS, AWSS, DASI, and WEF) which are experiencing obsolescence, supportability, and maintainability issues. In September 2016, an In-Service Decision for Surface Weather System (SWS) was approved. SWS, within the ASWON program, will replace DASI, WEF, and WME sensors which are experiencing obsolescence, supportability, and maintainability issues. SWS hardware and software designed and developed by the FAA, will replace WME by FY 2018 and WEF/DASI by FY 2019. See BLI 2C01 for more information about the ASWON – Technology Refresh, W01.03-01, program.

A future program, ASWON Technology Refresh-2 (ASWON TR-2), will provide required technology upgrades and/or replacements of the ASWON systems (ASOS, AWOS, SAWS, SWS and DASI) which are experiencing obsolescence, supportability, and maintainability issues. This technology refresh will allow these systems sustain the required level of service to support NAS operations.

The Juneau Airport Weather System (JAWS) measures and transmits wind information to the Juneau Automated Flight Service Station (AFSS), Alaska Airlines, and the NWS for weather forecasting. Other Alaska aviation users access JAWS data via the Internet. 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. The Juneau Airport Wind System (JAWS) – Technology Refresh program will include replacement of computers and controllers, radios, firmware and software, anemometers, and profilers. The program is working towards a FID. See BLI 2A13 for more information about the JAWS – Technology Refresh, W10.01-02, program.

Weather Cameras are installed at airports and strategic en route locations in Alaska to provide pilots, dispatchers, and flight service station specialists with real-time video weather information. These images are designated as an FAA Advisory weather product to be used for enhanced situational awareness and provide pilots, dispatchers, and Flight Service Station Specialists with

up-to-date weather conditions at airports, mountain passes, and strategic locations where weather is known to be a potential hazard.

The Weather Camera Program – Future Segments sustains the operational Weather Cameras installed at airports and strategic en route locations in Alaska. The program ensures that camera network services are available, reliable, responsive, and accessible to pilots and aviation user groups. See BLI 2C04 for more information about the Weather Camera Program – Future Segments, M08.31-02, program.

A future program, Weather Camera Program – Future Segment 3, is seeking to expand camera services to aviators that fly throughout the CONUS and Hawaii by using Third Party Image Hosting. The program will host images from state DOT owned airports and other critical en route locations such as mountain passes and other areas where weather-related accidents and flight interruptions are known to occur.

The non-FAA sensors shown at the bottom of the roadmap are sources of weather information that improve FAA's overall knowledge of weather conditions. Some states and smaller airports operate AWOS for weather observations. Inputs from these systems provide supplemental data to FAA sensors. Aircraft weather sensors can provide humidity, wind speed, and atmospheric pressure readings that are helpful in forecasting weather conditions. Pilot Reports (PIREPS) provide real time reports on the weather along major flight routes. Lightning Data systems provide air traffic facilities important information about the location and intensity of thunderstorms.

5.5.2 Weather Dissemination, Processing, and Display

Weather Roadmap (2 of 2)

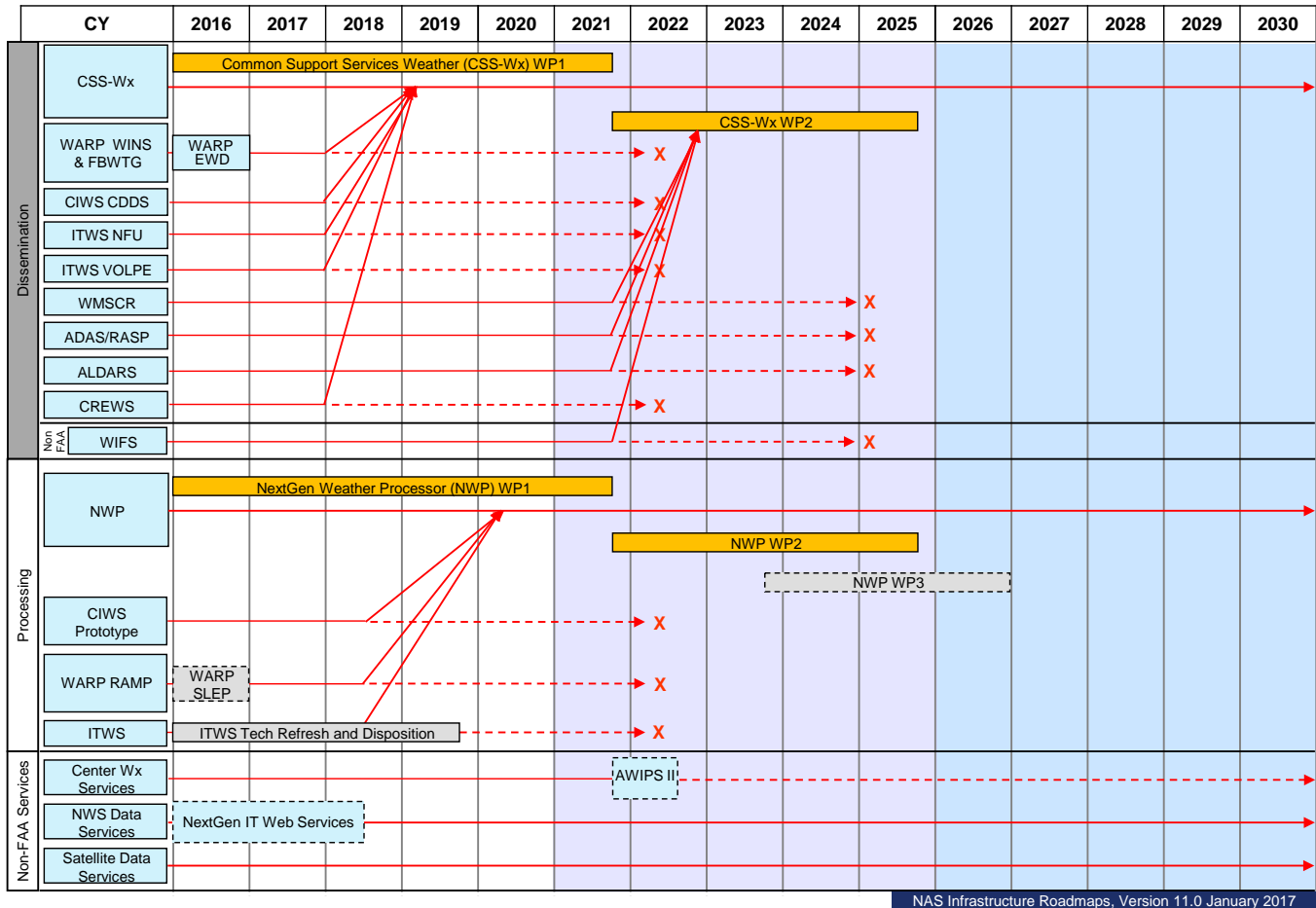


Figure 5-16 Weather Dissemination, Processing, and Display Roadmap

Figure 5-16 shows the Common Support Services – Weather (CSS-Wx) which will be the source for weather information and it will provide access to all users throughout the NAS.

The Weather and Radar Processor (WARP) Weather Information Network Server (WINS) processes and stores data from multiple NEXRAD radars for use by the en route control facilities. The information is used by the Center Weather Service Unit to develop forecasts. WARP also provides NEXRAD precipitation intensity data to controllers' displays.

The WARP FAA Bulk Weather Communications Gateway (FBWTG) provides NWS data to the center weather service units to aid in their forecast of weather conditions in the center's airspace. The roadmap shows that WARP will be upgraded with an Enhanced Weather Information Network Servicer Distribution (WARP EWD) before the WARP functions are incorporated in CSS-Wx.

The Corridor Integrated Weather System (CIWS) gathers weather information along the busiest air traffic corridors to help air traffic specialists select the most efficient routes when they must divert traffic to avoid severe weather conditions. The CIWS Data Distribution System (CDDS) enables the existing CIWS system to distribute data to external NAS users so traffic management participants have the same information for daily route planning.

The Integrated Terminal Weather System (ITWS) National Weather Service Filter Unit (ITWS NFU) will send data collected by FAA to the NWS to use for weather forecasting. The ITWS Volpe will establish an Internet connection to the ITWS weather data for external users. After 2018, ITWS NFU and ITWS Volpe data collection functions will be incorporated into the CSS-Wx.

The FAA-operated Weather Message Switching Center Replacement (WMSCR) is a network with distribution nodes in Salt Lake City and Atlanta that collects and distributes nationwide weather information. The FAA will integrate WMSCR functionality into the CSS-Wx for weather information distribution.

The Automated Weather Observation System (AWOS) Data Acquisition System/Regional ADAS Service Processor (ADAS/RASP) is a communications link that transmits AWOS/ASOS/AWSS data to air traffic facilities. ADAS also correlates cloud-to-ground lightning strike information to AWOS/ASOS/AWSS data to better determine the location of nearby thunderstorm activity.

The Automated Lightning Detection and Reporting System (ALDARS) uses a network of sensors throughout the NAS to triangulate lightning strikes and then send messages to each automated airport station informing it of the proximity of any lightning strikes.

The Center/TRACON automation system (CTAS) Remote Weather System (CREWS) collects data to help en route and terminal facility controllers coordinate the flows of air traffic into busy terminal facilities.

The World Area Forecast System (WAFS) Internet File Service (WIFS) is a commercial service that provides weather information to support global flight operations.

The CSS-Wx Work Package 1 program will deliver improved weather products for input into collaborative decision-making applications using information provided by the NextGen Weather Processor (NWP) (G04W.03-02), the National Oceanic and Atmospheric Administration's (NOAA) NextGen Web Services, and other weather sources available to FAA and NAS users. CSS-Wx Work Package 2 will subsume additional legacy weather systems such as WMSCR, ADAS, ALDARS, and WIFS and provide additional Web services, filtering, and complex queries capabilities. See BLI 2A11 for more information about the System Wide Information Management SWIM – CCS-Wx – Work Package 1, G05C.01-06, and CCS-Wx – Work Package 2, G05C.01-09, programs.

The WARP Radar and Mosaic Processor (RAMP) processes weather data and will remain in service until their functions can be incorporated in the NWP.

ITWS provides air traffic managers with graphic, full-color displays of essential weather information affecting major U.S. airports. ITWS integrates weather data from a number of sources and provides a single, easily used and understood display of supported products.

ITWS – Sustainment & Disposition program is funding a lifetime buy of all necessary and available spare parts of the legacy hardware to attempt to sustain the current system until it is fully replaced by NWP. The program will also fund a contingency effort to mitigate potential accelerated hardware failures. See BLI 2B18 for more information about the ITWS – Sustainment & Disposition, W07.01-02, program.

Next Generation Weather Processor (NWP), Work Package 1 (WP1) will replace and enhance the current processing and display functionality of the ITWS, CIWS, and WARP systems; generate aviation weather products with expanded coverage areas and faster update rates; generate 0-to-8 hour aviation weather products; generate safety critical wind shear alerts and real-time weather radar information; and perform translation of convective weather into weather constraint areas. NWP is planned to be operational at a key site in FY 2020. NWP WP2 will enhance weather algorithms and generate additional advanced products such as new radar mosaic, predictive products, weather avoidance fields, and terminal products. See BLI 2A16 for more information about the NWP, WP1, G04W.03-02 and NWP, WP2, G04W.03-03, programs.

A future program, NWP WP3, will provide additional enhancements for future weather products beyond the scope of those in NWP WP2.

The non-FAA services provide data from the NWS ground and satellite sensors to FAA for use by the NWS meteorologist who interpret and forecast weather at the FAA en route centers. Center Weather, NWS Data and Satellite Data Services comprise a distributed “virtual” database that will receive weather data directly from sensors, NWS, NOAA and other sources, and then, either automatically or by request, send this data to FAA facilities and users so that observations and forecasts can be more widely and consistently distributed via network-enabled communications (NextGen IT Web Services). Decision support tools will use this weather information to assist users in understanding weather constraints and taking actions to reduce risk for aviation operations.

By FY2022, AWIPS II, the Advanced Weather Information Processing System, currently under development by the National Weather Service (NWS) and the National Center for Environmental Prediction is expected to replace current Center Weather Services.

6 Facilities

The FAA maintains and operates thousands of staffed and unstaffed operational facilities that must be maintained and modernized. The largest staffed facilities are the 21 en route centers that house hundreds of employees and the equipment used to control aircraft in the en route environment. Other operational facilities with significant staff include more than 500 towers and 167 TRACON facilities that control arrival and departure traffic to and from airports in the

terminal environment. There are also more than 16,000 unstaffed facilities sheltering communications, navigation, surveillance equipment, and weather sensors. Much of this equipment is located in remote areas housed in buildings that need renovation with many having deteriorating steel towers and foundations. Some newer unstaffed buildings and structures require more frequent renovation because they are located in areas that are subject to harsher environmental conditions such as near the ocean or on a mountaintop. Replacing roofing, electric power generators, heating/cooling, and structural and security components of these facilities is essential to ensure successful operation of the NAS.

The William J. Hughes Technical Center (WJHTC) in Atlantic City, NJ, and the Mike Monroney Aeronautical Center (MMAC) in Oklahoma City, OK, both have many buildings. Each year, these complexes receive funds to upgrade and/or replace infrastructure, and to improve and modernize buildings that support research and development, test and evaluation, operational and second level field support, training, logistics, and management functions. The MMAC operates under a lease from the Oklahoma City Airport Trust. The requested funds are used to pay the cost of the annual lease and to renovate buildings and supporting infrastructure, such as electrical and mechanical equipment. The WJHTC provides the integrated NAS platform used for research, development, test, evaluation, and field support for all NAS and NextGen acquisition programs within the FAA. Annual funding is used to upgrade and reconfigure the laboratories to accommodate acceptance testing for new equipment and to test modifications to existing equipment.

The Terminal Air Traffic Control Facilities – Replace program includes planned funding for the replacement of existing air traffic control towers (ATCT) and TRACON facilities. The projects are funded in five segments and are scheduled based on FAA priorities. A project typically spans a period of 5-10 years from inception to completion depending upon its size and complexity. The budget for each segment of a project includes all of the funds needed to complete the segment but it may take more than one year to finish the work. Funding is allocated to the segments based upon FAA's priorities with consideration given to maintaining the overall 5 year funding estimates for the program.

The Terminal Air Traffic Control Facilities – Modernize program renovates or replaces specific exterior or interior components of existing towers, such as elevators, heating ventilation and cooling equipment, roofs, or other infrastructure that the FAA must upgrade to keep towers functioning.

The FAA upgrades and improves Air Route Traffic Control Center (ARTCC) facilities by replacing heating and cooling systems, upgrading electrical power distribution systems, and providing other facility needs to meet mission requirements.

Capital investments that support facilities are shown below in Table 6-1.

BLI #	CIP Title	CIP #
1A02	William J. Hughes Technical Center Laboratories	F14.00-00
1A03	William J. Hughes Technical Center Laboratory Sustainment	F14.00-00
1A04	William J. Hughes Technical Center Building & Plant Support	F16.00-00
2A04	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements	F06.01-00
2A04	San Juan Facility Remediation	F08.01-01
2B05	Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Replacement	F01.02-00
2B06	Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization	F01.01-00
2B06	Facility Realignment Planning	F02.10-01
2B06	Facility Realignment Implementation	F02.10-02
2A07	Long Range Radar (LRR) Improvements – Infrastructure Upgrades/Sustain	S04.02-03
2B08	Environmental and Occupational Safety and Health (EOSH)	F13.03-00
2C03	Alaska Flight Service Facility Modernization (AFSFM)	F05.04-02
2E01	Fuel Storage Tank Replacement Management	F13.01-00
2E02	Unstaffed Infrastructure Sustainment (UIS)	F12.00-00
2E02	FAA Employee Housing and Life Safety Shelter System Services	F20.01-01
2E06	Decommissioning – Real Property Disposition	F26.01-01
2E07	Power Systems Sustained Support (PS3)	F11.01-01
2E07	Power Systems Sustained Support (PS3) – Future Segments	F11.01-02
2E08	Energy Management and Compliance (EMC)	F13.04-02
2E09	Child Care Centers – Infrastructure Improvements	F22.01-01
3A01	Environmental Cleanup / Hazardous Materials (HAZMAT)	F13.02-00
3A04	Facility Security Risk Management (FSRM) – Two	F24.01-02
3A11	Mobile Asset Management Program	F31.01-01
3A14	Logistics Center Support System (LCSS) – Sustainment	M21.04-02
3B01	Aeronautical Center Infrastructure Modernization	F18.00-00
4A04	Aeronautical Center Lease	F19.00-00

Table 6-1 Facility Programs

7 NAS and Mission Support

The FAA must continually monitor, refresh, and enhance systems technology to ensure the availability, reliability, and accuracy of the equipment and infrastructure that make up the NAS. To meet forecast demand, the NextGen program was established to develop and deliver new aviation services, capabilities, and operational improvements into the NAS by 2025. This ongoing transformation requires systems research and changes to NAS infrastructure, including communication, navigation, and surveillance systems; the development of new procedures; and personnel training to realize the projected benefits from NextGen. To support this transition, the NAS must be fully sustained to ensure the uninterrupted delivery of current services while maintaining the required level of safety expected and relied upon by the aviation community.

Capital investments that support NAS and Mission Support are shown below in Table 7-1.

BLI #	CIP Title	CIP #
1A01	Runway Incursion Reduction Program (RIRP) – ATDP	S09.02-00
1A01	System Capacity, Planning and Improvements – ATDP	M08.28-00
1A01	Operations Concept Validation and Infrastructure Evolution – ATDP	M08.29-00
1A01	Major Airspace Redesign – ATDP	M08.28-04
1A01	Strategy and Evaluation – ATDP	M46.01-01
1A01	Dynamic Capital Planning	M47.01-01
1A01	Operational Analysis and Reporting System (OARS)	M08.32-03
1A01	Operations Network (OPSNET) Replacement – ATDP	A37.01-01
1A01	Enterprise Management, Integration, Planning, & Performance Evaluation for NextGen	M03.04-01
1A01	Operational Modeling Analysis and Data	M52.01-01
1A01	Enterprise Information Management (EIM)	G05M.04-01
2A17	Airborne Collision Avoidance System X (ACAS X) – Segment 1	M54.01-01
2D08	Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 1	A14.02-02
2D08	Instrument Flight Procedures Automation (IFPA) – Sustainment 2	A14.02-03
2E03	Aircraft Related Equipment (ARE) Program	M12.00-00
2E03	NextGen Flight Simulation Testing and Research Technologies (Flight START) – Technology Refresh Program - Additional Projects	M12.01-04
2E03	William J. Hughes Technical Center Laboratories – Flight Program Consolidation – Sustainment	F14.01-01
2E11	Data, Visualization, Analysis and Reporting System (DVARs)	M08.28-05
3A05	Information Systems Security	M31.00-00
3A05	Critical Infrastructure Cybersecurity	M31.05-01
3A10	National Test Equipment Program	M17.01-01
3A13	National Airspace System (NAS) Training - Equipment Modernization – Training Simulators – Tower Simulation System	M20.01-04
3B02	Distance Learning	M10.00-00
4A01	CIP Systems Engineering & Development Support – System Engineering Contract	M03.03-01
4A01	Provide Air Navigation Facilities (ANF)/Air Traffic Control (ATC) Support (Quick Response)	M08.01-00
4A02	Program Support Leases	M08.06-00
4A03	NAS Regional/Center Logistics Support Services	M05.00-00
4A05	NAS Integration Support Contract (NISC)	M22.00-00
4A05	Configuration Management Automation (CMA)	M03.01-02
4A06	Technical Support Services Contract (TSSC)	M02.00-00
4A07	Resource Tracking Program (RTP)	M08.14-00
4A08	CIP Systems Engineering & Technical Assistance – MITRE	M03.02-00

Table 7-1 NAS and Mission Support Programs

8 Estimated Funding by Budget Line Item (BLI)

The following table shows funding by BLI with dollars in millions for the capital programs in the FY 2018 to FY 2022 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 2018 Budget	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.
	Activity 1: Engineering, Development, Test and Evaluation	\$145.6	\$154.8	\$179.4	\$189.9	\$194.4
1A01	Advanced Technology Development and Prototyping (ATDP)	\$26.8	\$34.6	\$38.0	\$37.0	\$37.0
1A02	William J. Hughes Technical Center Laboratory Improvement	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0
1A03	William J. Hughes Technical Center Laboratory Sustainment	\$18.0	\$15.9	\$15.9	\$15.9	\$15.9
1A04	William J. Hughes Technical Center Infrastructure Sustainment	\$10.0	\$10.0	\$10.0	\$10.0	\$10.0
1A05	NextGen – Separation Management Portfolio	\$13.5	\$13.0	\$22.5	\$21.5	\$26.5
1A06	NextGen – Traffic Flow Management Portfolio	\$10.8	\$14.0	\$11.0	\$13.0	\$18.0
1A07	NextGen – On Demand NAS Portfolio	\$12.0	\$16.5	\$25.5	\$31.5	\$26.0
1A08	NextGen – NAS Infrastructure Portfolio	\$17.5	\$13.5	\$17.5	\$20.0	\$20.0
1A09	NextGen – Support Portfolio	\$12.0	\$12.8	\$11.0	\$11.0	\$11.0
1A10	NextGen – Unmanned Aircraft Systems (UAS)	\$15.0	\$14.0	\$17.0	\$20.0	\$20.0
1A11	NextGen – Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio	\$9.0	\$9.5	\$10.0	\$9.0	\$9.0
	Activity 2: Procurement and Modernization of Air Traffic Control Facilities and Equipment	\$1,718.8	\$1,690.7	\$1,669.4	\$1,642.5	\$1,659.9
	A. En Route Programs	\$753.9	\$687.2	\$668.5	\$633.1	\$648.4
2A01	NextGen – En Route Automation Modernization (ERAM) – System Enhancements and Technology Refresh	\$76.7	\$101.7	\$91.6	\$85.5	\$82.7
2A02	En Route Communications Gateway (ECG)	\$2.7	\$1.7	\$2.7	\$2.7	\$0.7
2A03	Next Generation Weather Radar (NEXRAD)	\$5.5	\$5.5	\$4.0	\$6.1	\$5.4
2A04	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements	\$100.4	\$89.4	\$83.0	\$83.0	\$83.0
2A05	Air Traffic Management (ATM) – Traffic Flow Management (TFM)	\$4.9	\$6.2	\$20.0	\$25.2	\$27.9
2A06	Air/Ground Communications Infrastructure	\$9.8	\$8.8	\$8.3	\$8.3	\$8.3
2A07	Air Traffic Control En Route Radar Facilities Improvements	\$5.4	\$6.6	\$6.5	\$6.5	\$6.5
2A08	Voice Switching Control System (VSCS)	\$12.8	\$11.4	\$11.7	\$12.1	\$12.4
2A09	Oceanic Automation System	\$23.1	\$17.5	\$13.6	\$10.0	\$10.0
2A10	Next Generation Very High Frequency Air/Ground Communications System (NEXCOM)	\$53.0	\$50.0	\$60.0	\$64.0	\$65.0
2A11	NextGen – System-Wide Information Management (SWIM)	\$50.1	\$54.9	\$42.6	\$28.5	\$30.8
2A12	NextGen – Automatic Dependent Surveillance – Broadcast (ADS-B) NAS Wide Implementation	\$139.2	\$118.6	\$123.5	\$125.0	\$125.0
2A13	Wind Shear Detection Service (WSDS)	\$1.0	\$1.0	\$1.0	\$1.0	\$0.7
2A14	NextGen – Collaborative Air Traffic Management Technologies Portfolio	\$9.0	\$17.7	\$24.3	\$15.0	\$5.0
2A15	NextGen – Time Based Flow Management (TBFM) Portfolio	\$40.5	\$23.8	\$36.3	\$44.8	\$46.9
2A16	NextGen – Next Generation Weather Processor (NWP)	\$35.5	\$24.3	\$16.0	\$6.2	\$32.4
2A17	Airborne Collision Avoidance System X (ACAS X)	\$7.7	\$9.7	\$6.9	\$5.1	\$0.0

BLI Number	Capital Budget Line Item (BLI) Program	FY 2018 Budget	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.
2A18	NextGen – Data Communication in support of NextGen	\$154.1	\$113.5	\$89.6	\$72.1	\$64.0
2A19	Offshore Automation	\$11.0	\$14.0	\$15.0	\$20.0	\$25.0
2A20	NextGen – Advanced Surveillance Enhanced Procedural Separation (ASEPS)	\$4.4	\$0.0	\$0.0	\$0.0	\$0.0
2A21	En Route Improvements	\$3.0	\$1.0	\$2.0	\$2.0	\$2.0
2A22	Commercial Space Integration	\$4.5	\$10.0	\$10.0	\$10.1	\$14.8
	B. Terminal Programs	\$541.5	\$526.1	\$537.4	\$555.1	\$564.4
2B01	Terminal Doppler Weather Radar (TDWR) – Provide	\$3.8	\$4.5	\$2.2	\$0.0	\$0.0
2B02	Standard Terminal Automation Replacement System (STARS) Sustain	\$86.7	\$66.9	\$40.0	\$62.0	\$50.0
2B03	Terminal Automation Modernization/ Replacement Program (TAMR Phase 3)	\$66.1	\$8.0	\$0.0	\$0.0	\$0.0
2B04	Terminal Automation Program	\$8.5	\$8.5	\$9.0	\$9.0	\$9.0
2B05	Terminal Air Traffic Control Facilities – Replace	\$31.1	\$19.2	\$10.0	\$70.0	\$143.5
2B06	ATCT/Terminal Radar Approach Control (TRACON) Facilities – Improve	\$56.8	\$99.7	\$96.0	\$55.0	\$42.5
2B07	Terminal Voice Switch Replacement (TVSR)	\$6.0	\$6.0	\$6.0	\$5.0	\$5.0
2B08	NAS Facilities OSHA and Environmental Standards Compliance	\$46.7	\$41.9	\$42.0	\$42.0	\$42.0
2B09	Airport Surveillance Radar (ASR-9) Service Life Extension Program (SLEP)	\$11.4	\$18.9	\$14.0	\$25.5	\$9.0
2B10	Terminal Digital Radar (ASR-11) Technology Refresh	\$3.2	\$1.0	\$4.4	\$4.4	\$4.4
2B11	Runway Status Lights (RWSL)	\$2.8	\$2.0	\$3.5	\$3.5	\$5.0
2B12	NextGen – National Airspace System Voice System (NWS)	\$68.8	\$42.8	\$116.6	\$105.5	\$106.6
2B13	Integrated Display System (IDS)	\$5.0	\$18.0	\$24.0	\$34.2	\$45.0
2B14	Remote Monitoring and Logging System (RMLS)	\$7.4	\$18.1	\$16.4	\$15.6	\$16.7
2B15	Mode S Service Life Extension Program (SLEP)	\$20.9	\$15.4	\$21.0	\$19.7	\$8.8
2B16	NextGen – Terminal Flight Data Manager (TFDM)	\$90.4	\$119.0	\$112.8	\$78.7	\$47.9
2B17	NAS Voice Recorder Program (NVRP)	\$5.0	\$14.0	\$14.5	\$17.0	\$21.0
2B18	Integrated Terminal Weather System (ITWS) Sustainment	\$1.0	\$2.1	\$0.0	\$0.0	\$0.0
2B19	NextGen – Performance Based Navigation & Metroplex Portfolio	\$20.0	\$20.0	\$5.0	\$8.0	\$8.0
	C. Flight Service Programs	\$28.0	\$23.9	\$14.8	\$4.7	\$2.8
2C01	Aviation Surface Weather Observation System	\$10.0	\$10.0	\$2.0	\$0.0	\$0.0
2C02	Future Flight Services Program (FFSP)	\$14.0	\$10.1	\$10.1	\$2.0	\$0.0
2C03	Alaska Flight Service Facility Modernization (AFSFM)	\$2.7	\$2.7	\$2.7	\$2.7	\$2.7
2C04	Weather Camera Program	\$1.3	\$1.1	\$0.0	\$0.0	\$0.1
	D. Landing and Navigation Aids Programs	\$152.4	\$157.7	\$160.2	\$173.6	\$181.9
2D01	VHF Omnidirectional Radio Range (VOR) with Distance Measuring Equipment (DME)	\$11.0	\$18.5	\$20.0	\$19.3	\$21.4
2D02	Instrument Landing Systems (ILS)	\$7.0	\$6.0	\$11.0	\$11.0	\$11.0
2D03	Wide Area Augmentation System (WAAS) for GPS	\$102.3	\$96.3	\$93.6	\$99.5	\$98.5

BLI Number	Capital Budget Line Item (BLI) Program	FY 2018 Budget	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.
2D04	Runway Visual Range (RVR)	\$4.0	\$7.0	\$6.0	\$6.0	\$6.0
2D05	Approach Lighting System Improvement Program (ALSIP)	\$3.0	\$5.0	\$5.0	\$5.0	\$5.0
2D06	Distance Measuring Equipment (DME)	\$3.0	\$5.5	\$5.0	\$5.0	\$8.0
2D07	Visual NavAids – Establish/Expand	\$2.0	\$1.0	\$2.0	\$2.0	\$2.0
2D08	Instrument Flight Procedures Automation (IFPA)	\$8.5	\$1.4	\$1.2	\$0.8	\$0.0
2D09	Navigation and Landing Aids – Service Life Extension Program (SLEP)	\$3.0	\$5.0	\$5.0	\$10.0	\$10.0
2D10	VASI Replacement – Replace with Precision Approach Path Indicator	\$5.0	\$7.0	\$10.0	\$15.0	\$20.0
2D11	Runway Safety Areas – Navigation Mitigation	\$1.6	\$2.0	\$1.4	\$0.0	\$0.0
2D12	NAVAIDS Monitoring Equipment	\$2.0	\$3.0	\$0.0	\$0.0	\$0.0
	E. Other ATC Facilities Programs	\$243.0	\$295.8	\$288.6	\$276.0	\$262.4
2E01	Fuel Storage Tank Replacement and Management	\$28.1	\$25.7	\$22.0	\$22.0	\$22.0
2E02	Unstaffed Infrastructure Sustainment	\$35.7	\$50.9	\$49.9	\$46.7	\$46.3
2E03	Aircraft Related Equipment Program	\$12.5	\$16.1	\$16.1	\$16.1	\$12.1
2E04	Airport Cable Loop Systems – Sustained Support	\$8.0	\$10.0	\$10.0	\$10.0	\$10.0
2E05	Alaskan Satellite Telecommunication Infrastructure (ASTI)	\$20.9	\$16.3	\$9.4	\$4.0	\$0.0
2E06	Facilities Decommissioning	\$13.9	\$9.0	\$10.0	\$10.0	\$10.0
2E07	Electrical Power Systems – Sustain/Support	\$110.0	\$147.7	\$140.0	\$133.0	\$135.0
2E08	Energy Management and Compliance (EMC)	\$2.4	\$2.4	\$6.2	\$6.2	\$0.0
2E09	Child Care Center Sustainment	\$1.0	\$1.0	\$1.5	\$1.0	\$0.0
2E10	FAA Telecommunications Infrastructure 2	\$2.0	\$6.7	\$11.5	\$15.0	\$15.0
2E11	Data, Visualization, Analysis and Reporting System (DVARS)	\$5.5	\$4.5	\$4.5	\$4.5	\$4.5
2E12	Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration	\$3.0	\$3.0	\$4.0	\$4.0	\$4.0
2E13X	Independent Operational Assessment	\$0.0	\$2.5	\$3.5	\$3.5	\$3.5
	Activity 3: Non-Air Traffic Control Facilities and Equipment	\$193.0	\$196.1	\$185.2	\$199.6	\$172.5
	A. Support Programs	\$178.0	\$181.1	\$170.2	\$184.6	\$157.5
3A01	Hazardous Materials Management	\$35.3	\$29.8	\$31.0	\$31.0	\$31.0
3A02	Aviation Safety Analysis System (ASAS)	\$12.0	\$16.0	\$19.7	\$20.3	\$20.5
3A03	National Airspace System (NAS) Recovery Communications (RCOM)	\$12.0	\$12.0	\$12.0	\$12.0	\$12.0
3A04	Facility Security Risk Management	\$20.4	\$17.8	\$15.0	\$14.9	\$12.1
3A05	Information Security	\$20.7	\$16.0	\$17.8	\$18.5	\$18.2
3A06	System Approach for Safety Oversight (SASO)	\$25.8	\$25.4	\$23.1	\$23.7	\$25.4
3A07	Aviation Safety Knowledge Management Environment (ASKME)	\$4.0	\$4.0	\$5.0	\$8.4	\$9.8
3A08	Aerospace Medical Equipment Needs (AMEN)	\$7.0	\$19.6	\$12.8	\$18.9	\$5.0
3A09	NextGen – System Safety Management Portfolio	\$16.2	\$14.2	\$17.0	\$17.0	\$17.0

BLI Number	Capital Budget Line Item (BLI) Program	FY 2018 Budget	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.	FY 2022 Est.
3A10	National Test Equipment Program	\$4.0	\$5.0	\$3.0	\$3.0	\$3.0
3A11	Mobile Assets Management Program	\$3.6	\$2.2	\$1.5	\$2.0	\$2.0
3A12	Aerospace Medicine Safety Information System (AMSIS)	\$14.0	\$16.1	\$9.3	\$9.2	\$0.0
3A13	Tower Simulation System (TSS) Technology Refresh	\$3.0	\$3.0	\$3.0	\$0.0	\$0.0
3A14X	Logistics Support System and Facilities (LSSF)	\$0.0	\$0.0	\$0.0	\$5.7	\$1.5
	B. Training, Equipment and Facilities	\$15.0	\$15.0	\$15.0	\$15.0	\$15.0
3B01	Aeronautical Center Infrastructure Modernization	\$14.0	\$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	\$225.0	\$226.2	\$233.6	\$233.1	\$233.5
4A01	System Engineering and Development Support	\$35.7	\$38.0	\$38.0	\$38.0	\$38.0
4A02	Program Support Leases	\$47.0	\$47.0	\$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	\$19.7	\$20.2	\$20.6	\$21.1	\$21.5
4A05	Transition Engineering Support	\$19.9	\$17.0	\$16.0	\$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	\$6.0	\$8.0	\$8.0	\$8.0
4A08	Center for Advanced Aviation System Development (CAASD)	\$57.0	\$60.0	\$60.0	\$60.0	\$60.0
4A09	NextGen – Aeronautical Information Management Program	\$4.7	\$2.0	\$5.0	\$5.0	\$5.0
4A10	NextGen – Cross Agency NextGen Management	\$1.0	\$2.0	\$2.0	\$2.0	\$2.0
	Activity 5: Personnel Compensation, Benefits and Travel	\$483.8	\$498.3	\$498.4	\$500.9	\$505.7
5A01	Personnel and Related Expenses	\$483.8	\$498.3	\$498.4	\$500.9	\$505.7
	Note: BLI numbers with X represent outyear programs not requested in the FY 2018 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	\$2,766.2	\$2,766.0	\$2,766.0	\$2,766.0	\$2,766.0
	Targets	\$2,766.2	\$2,766.0	\$2,766.0	\$2,766.0	\$2,766.0

9 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	\$960.4	
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*	\$736.5	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 baseline schedule 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	
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	NOTE: New Addition. Final Investment Decision (FID) approved by the JRC in Aug-16.
ERAM System Enhancements and Technology Refresh (SETR) ACAT 1	Sep-13	Sep-17	\$152.9				Sep-17	\$140.6	

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	
ERAM Enhancements 2 ACAT 1	Dec-16	Dec-23	\$253.6				Dec-23	\$253.6	NOTE: New Addition. FID approved by the JRC in Dec-16.
Facility Security and Risk Management (FSRM) 2 ACAT 2	Jun-11	Sep-22	\$182.5				Sep-22	\$182.5	
Logistics Center Support System (LCSS) ACAT 2	Apr-10	Apr-14	\$67.4	Apr-14	Apr-16	\$79.4	May-18	\$81.6	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 May-18 (-34.7% variance). The delay is associated with the need to stabilize production and operations.
NAS Voice System (NVS) Demonstration and Qualification Phase ACAT 1	Sep-14	Mar-20	\$294.2				Mar-20	\$294.2	
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	

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 Diego Airports to the baseline. The 3 airports currently have prototype systems and have committed to a work share agreement with the FAA to upgrade to baseline systems. The work share agreement will allow the FAA to complete the work at the 3 airports with no impact to the rebaseline cost.
System Approach for Safety Oversight (SASO) Phase 2B Segment 1A ACAT 3 New Investment	Feb-16	May-23	\$135.7				May-23	\$135.6	NOTE: New Addition. FID approved by the JRC in Feb-16.
System Wide Information Management (SWM) Segment 2A ACAT 2	Jul-12	Dec-17	\$120.2				Dec-17	\$111.5	

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	
System Wide Information Management (SWIM) Segment 2B ACAT 2	Oct-15	Sep-21	\$119.6				Sep-21	\$119.6	
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 and a funding reduction in FY16.
Terminal Automation Modernization and Replacement (TAMR), Phase 1 Technology Refresh ACAT 2	Sep-12	Feb-20	\$531.5				Feb-20	\$531.5	
Terminal Flight Data Manager (TFDM) ACAT 1 New Investment (NI)	Jun-16	Sep-28	\$795.2				Sep-28	\$795.2	NOTE: New Addition. FID approved by the JRC in Jun-16.
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	Rebaseline e-APB Date	Revised Completion Date	Revised Budget \$M	Completion Date	Budget \$M	
Regulation and Certification Infrastructure for System Safety (RCISS) - Segment 2 ACAT 3	Oct-10	Sep-16	\$90.8				May-16	\$90.7	Actual Result vs. Original Baseline: The program finished 4 months early (5.6% favorable variance).
Terminal Automation Modernization and Replacement (TAMR), Phase 3, Segment 1 (P3 S1) ACAT 2	Dec-11	Oct-17	\$438.0	Aug-15	Oct-17	\$528.6	Apr-17	\$528.6	Actual Result vs. Rebaseline: The program declared Operational Readiness Date (ORD) at the last site, New York (N90) on April 7, 2017, completing the baseline 6 months early (7.3% favorable variance) to the original and rebaseline schedule.

10 Conclusion

Each year, the FAA updates and publishes the CIP to provide Congress and the public with the latest information on the plans and objectives for the capital programs over the next five years. The FY 2018-2022 CIP reflects a balanced investment approach to support continued funding for legacy equipment, facilities, systems, and services necessary to sustain current NAS infrastructure continuing modernization to NextGen. The planned funding provides the CIP programs with the appropriate resources to deliver the capabilities to meet both the current and forecast demand for aviation services in the NAS.

The NAS Enterprise Architecture Roadmaps depict the legacy capital systems that support Automation, Communication, Surveillance, Navigation, and Weather. The roadmaps also show the planned CIP programs that will support these functions in the future along with the timeline for their development and future deployment if applicable. A brief description is provided for both the legacy systems and the planned CIP programs.

As the FAA moves forward with the implementation of new applications using proven technologies, such as ADS-B and Data Communications, new capabilities will be deployed for improved surveillance, more efficient flight paths, and the expanded use of automated communications between controllers and pilots to execute routine commands. These technology improvements may also help to support the integration of UAS into the NAS and improve the management of airspace impacted by Commercial Space operations.

The development and implementation of NextGen is well underway and adjustments to the CIP programs will be made as needed to address changes in forecasted demand; challenges with emerging technologies; and the availability of funds to complete NextGen as planned. FAA's capital programs are on track to provide the infrastructure, capabilities, and NAS services required to complete the implementation of NextGen and deliver promised capabilities while maintaining the high level of NAS service and system safety that the aviation community and the public rely on every day.

11 Appendices

The CIP contains two appendices.

Appendix A

- Lists FAA strategic priorities and performance metrics.
- Associates CIP programs with performance metrics.

Appendix B

- Provides CIP program descriptions.
- Shows the selected strategic priority and performance metric for the program.
- Describes the programs contribution to meeting the performance metric.
- Lists performance output goals for FY 2018–2022.
- Shows system implementation schedules for selected programs.

12 Acronyms & Abbreviations (includes appendices)

--Number--	
3T	Time Based Flow Management, Traffic Flow Management System, and Terminal Flight Data Manager
4D	four dimensional
4DT	four-dimensional trajectory
--A--	
AAM	FAA Office of Aerospace Medicine
ACAS X	airborne collision avoidance system X
ACAS Xa	variant of ACAS X for use by commercial aviation (most similar to TCAS II)
ACAS Xo	variant of ACAS X for use with some NextGen operations; e.g. CSPO
ACAS Xp	variant of ACAS X for use by general aviation (GA) and rotorcraft
ACAS Xu	variant of ACAS X for use by UAS operators
ACAT	acquisition category
ACE-IDS	ASOS controller equipment-information display system
ACEPS	ARTCC critical and essential power systems
ACS	aeronautical common services or ASOS controller equipment
ADAS	AWOS (automated weather observing system) data acquisition system
ADS-B	automatic dependent surveillance-broadcast
ADS-C	automatic dependent surveillance-contract
ADSIM+	airfield delay simulation model
ADS-R	automatic dependent surveillance-rebroadcast
AEFS	advanced electronic flight strip system
AES	alternative energy systems
AFIS	automated flight inspection system
AFS	FAA Flight Standards Service
AFSFM	Alaska flight service facility modernization
AFSS	automated flight service station
A/G	air-to-ground
AGIRT	A/G communications integrated requirements team
A-IM	advanced-interval management
AIM	aeronautical information management
AIMM	aeronautical information management modernization
AIMM S4	AIMM segment 4
AIR	FAA Aircraft Certification Service
AISR	aeronautical information system replacement
AIXM	aeronautical information exchange model
ALDARS	automated lightning detection and reporting system
ALS	approach lighting system
ALSF-2	approach lighting system with sequenced flashing light model 2
ALSIP	approach lighting system improvement program
AMASS	airport movement area safety system
AMEN	aerospace medical equipment needs
AMEIN	aerospace medical equipment and infrastructure needs
AMMS	automated maintenance management system
AMS	acquisition management system

AMIS	aerospace medicine safety information system
ANC	air navigation commission
ANF	air navigation facilities
ANICS	Alaskan national airspace system inter-facility communications system
ANSP	air navigation service provider
AOCs	areas of concern or airline operations centers
AOCC	Atlantic operations control center
APB	acquisition program baseline
APT	advanced persistent threat
APTS	automated process tracking system
APWS	aeronautical information services production workflow system
ARAIM	advanced receiver autonomous integrity monitoring
ARB	airmen records building
ARE	aircraft and related equipment
ARMS	airspace resource management system
ARMT	airspace resource management tool
A-RNP	advanced RNP (required navigation performance)
ARS	advanced rotorcraft simulator
ARSR	air route surveillance radar
ARTCC	air route traffic control center
ARTS IE/IIIE/IIIE	automated radar terminal system models IE, IIIE, or IIIE
ASAS	aviation safety analysis system
ASBU	aviation system block upgrades
ASDE-3	airport surface detection equipment model 3 (primary radar)
ASDE-X	airport surface detection equipment model x (safety logic)
ASEPS	advanced surveillance enhanced procedural separation
ASIAS	aviation safety information analysis and sharing
ASKME	aviation safety knowledge management environment
ASOS	automated surface observing system
ASPM	aviation system performance metrics
ASR-8, 9, 11	airport surveillance radar model 8, 9, and 11
ASSC	airport surface surveillance capability
AST	FAA Office of Commercial Space Transportation
ASTI	Alaskan satellite telecommunication infrastructure
ASWON	aviation surface weather observation network
ATC	air traffic control
ATCARS	air traffic control advanced research simulator
ATCBI-5, 6	ATC beacon interrogator model 5, and 6
ATCF/ES	air traffic control facilities / engineering services
ATCS	air traffic control specialist
ATCSCC	air traffic control system command center
ATCT	air traffic control tower
ATD	airspace technology demonstration or anthropometric test device
ATDP	advanced technology development and prototyping
ATFM	applied traffic flow management
ATIS	automated terminal information service
ATM	air traffic management
ATN	aeronautical telecommunication network
ATO	Air Traffic Organization

ATOP	advanced technologies and oceanic procedures
ATSS	airway transportation system specialist
AURS	advanced unmanned aircraft system research simulator
Auto Re-Probe	approval of user requests in oceanic airspace
AVN	Aviation System Standards
AVS	FAA Office of Aviation Safety
AWI	ATM weather integration
AWIPS II	advanced weather interactive processing system (non-FAA service)
AWOS	automated weather observing system
AWSS	automated weather sensor systems
--B--	
BLI	budget line item
BUEC	back up emergency communication
BWM	bandwidth manager
--C--	
CA	collision avoidance
C2	command and control
C3	command and control communications
CAASD	Center for Advanced Aviation System Development
CAMI	Civil Aerospace Medical Institute
CARF	central altitude reservation function
CARTS	common automated radar terminal system
CARSR	common air route surveillance radar
CAS	collision avoidance system or commercially available software
CAST	commercial aviation safety team
CAT (I, II, or III)	category of precision approach capability
CATM	collaborative air traffic management
CATMT	collaborative air traffic management technologies
CCF	combined control facility
CCS	conference control switch
CD-2	common digitizer 2 (converts analog radar data to digital format)
CDDS	corridor integrated weather system data distribution
CDM	collaborative decision making or continuous diagnostics and mitigation
CDR	critical design review
CERAP	combined center/radar approach control
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFE	communications facilities enhancement
CFIT	controlled-flight-into-terrain
CFR	code of federal regulations
CINP	communication, information & network programs
CIP	capital investment plan
CIWS	corridor integrated weather system
CM	configuration management
CMA	configuration management automation
CNS	communications, navigation and surveillance
ConOps	concept of operations
COMSEC	secure communications

CONUS	continental United States
COO	certificate of occupancy
COTS	Commercial-off-the-shelf
CPDLC	controller-pilot data link communications
CPDS	critical power distribution system
CR	comprehensive review
CRD	concept and requirements definition
CRDRD	concept and requirements definition readiness decision
CREWS	CTAS remote weather system
CSPO	closely spaced parallel runway operations
CSPR	closely spaced parallel runways
CSSD	common status and structure data
CSS-FD	common support services – flight data
CSS-Wx	common support services – weather
CST	communication support team
CTAS	center/tracon automation system
CTD	common terminal digitizer
C&V	CONUS ceiling & visibility or corrections & verification
CWP	corporate work plan
--D--	
D&I	design and implementation
DALR	digital audio legal recorder
DASI	digital altimeter setting indicator
Data Comm	data communications
DATCF	deployable air traffic control facility
DB	database
DBRITE	digital bright radar indicator tower equipment
DC BUS	direct current backup system
DCIS	data communications integrated services
DCL	departure clearance
DCP	document change proposal
DCNS	data communications network service (air/ground)
DDC	direct digital controller
DDR	detailed design review
DELPHI	DOT accounting system
DFO	dual frequency operations
DH	decision height
DHS	Department of Homeland Security
DLP	distance learning platform
DME	distance measuring equipment
DME/DME	RNAV using multiple DMEs
DMN	data multiplexing network
DMSMS	diminishing manufacturing sources and material shortages
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DOTS+	dynamic ocean tracking system plus
DRSR	digital remote surveillance communication interface processor replacement

D-Side	radar associate position
DSP	departure spacing program
DSR	display system replacement
DST	decision support tools
DT	development test
DUATS	direct user access terminal system/service
DVOR	Doppler VOR
DVARs	data visualization, analysis and reporting system
--E--	
EA	enterprise architecture
ECG	en route communication gateway
EFD	electronic flight data
EFS	electronic flight strips
EFSTS	electronic flight strip transfer system
EG	engine generator
E-IDS	enterprise information display system
ELD	electrical line distribution
ELITE	enhanced local integrated tower equipment
ELVO	enhanced low visibility operations
EMC	energy management and compliance
EOC	emergency operations center
EOL	end-of-life
EON	emergency operations network
EoR	established-on-RNP
EOS	end-of-service
EOSH	environmental & occupational safety and health
EPA	Environmental Protection Agency
ER	environmental remediation
ERAM	en route automation modernization
ERIDS	en route information display system
ERMS	environmental remote monitoring system
E-Scan	electronic scan version of PRM (precision runway monitor)
ESM	enterprise service monitoring
ETR	emergency transmitter replacement
ETVS	enhanced terminal voice switch
EUIE	early user involvement event
EUROCONTROL	European Organization for the Safety of Air Navigation
--F--	
F-420	wind sensor series 420
FAA	Federal Aviation Administration
FAALC	FAA Logistics Center
FANS	future air navigation system
FAT	factory acceptance testing
FBW	fly by wire
FBWTG	FAA bulk weather communications gateway
FCD	federal continuity directive
FCI	facility condition index

FCT	federal contract tower
FDCS	flight data common service
FDIO	flight data input/output
FDP	flight data processor
FDP2K	flight data processing 2000
F&E	facilities and equipment
FF-ICE	flight and flow integrated collaborative environment
FFRDC	federally funded research and development center
FFSP	future flight service program
FI	flight inspection
FID	final investment decision
FIM	flight interval management
FIS-B	flight information services – broadcast
FIXM	flight information exchange model
FLS	fire life safety
FMC	flight management computer
FMS	flight management system
FNS	federal NOTAM system
FOC	flight operations center or final operational capability
FOXs	flight object exchange service
FSRM	facility security risk management
FSS	flight service station
FST	fuel storage tank
FTB	Florida NextGen test bed
FTE	full time equivalent
FTI	FAA telecommunications infrastructure
FTI-2	successor program to FTI
FY	fiscal year
--G--	
GA	general aviation
GAO	Government Accountability Office
GATTOR	general air traffic and technical operations research
GDP	gross domestic product
GEO	geostationary satellite
GIM-S	ground based interval management-spacing
GIS	geographic information system
GLS	ground based augmentation landing system
GNAS	general national air space system
GNSS	global navigation satellite system or service
GOM	Gulf of Mexico
GPS	global positioning system
GSA	General Services Administration
GTG	graphical turbulence guidance
GUI	graphical user interface
--H--	
HADDS	HOST ATM data distribution system

HAZMAT	hazardous materials
HF	high frequency or human factors
HGOPA	high gain open planar array
HITL	human-in-the-loop
HOST	Host Computer System
HP	high power
HPSB	high performance sustainable building
HRRR	high resolution rapid refresh
HUD	heads up display
HVAC	heating, ventilating and air conditioning
--I--	
IAM	identity and access management
IARD	investment analysis readiness decision
ICAO	International Civil Aviation Organization
ICCT	Interagency Core Cyber Team
ICMS	Interlock control and monitoring system
ICSS	integrated communication switching system
IDAC	integrated departure/arrival capability
IDL	interference detection, location and mitigation
IDP	improved demand predictions
IDRP	integrated departure route planning
IDS	integrated display system
IESP	integrated enterprise service platform
IFP	instrument flight procedures
IFPA	instrument flight procedures automation
IFR	instrument flight rules
IID	initial investment decision
ILS (I, II, or III)	instrument landing system (category I, II, or III)
IM	interval management
IMC	instrument meteorological conditions
INDP	integrated NAS design and procedure planning
IOA	independent operational assessment
IOC	initial operating capability
IP	internet protocol
IPDS	instrument procedure development system
IPS	internet protocol suite
IRU	inertial reference unit
ISAM	integrated safety assessment model
ISD	in-service decision
ISO	International Standards Organization
ISPD	implementation strategy and planning document
ISS	information system security
IT	information technology
ITWS	integrated terminal weather system
IVSR	interim voice switch replacement
--J--	

JAWS	Juneau airport wind system
JRC	joint resources council
--K--	
KVM	kinetic vertical modeling or keyboard video mouse
--L--	
L1 C/A	GPS legacy civil frequency
L5	GPS second civil frequency
L1/L5	GPS dual frequency for WAAS users
LAHSO	land and hold short operations
LAN	local area network
LCSS	logistics center support system
LDIN	lead in light system
LDRCL	low-density radio communication link
LIDAR	light detection and ranging
LITE	local integrated tower equipment
LLWAS	low-level wind shear alert system
LOC	localizer
LP	localizer performance or low power
LPGBS	lightning protection, grounding, bonding, and shielding
LPV	localizer performance with vertical guidance
LRR	long range radar
LRUs	lowest replaceable units
LSS	logistics support services
LSSF	logistics support system and facilities
LVO	low visibility operations
--M--	
MALSR	medium-intensity approach light system with runway alignment indicator lights
MAMP	mobile asset management program
MASA	mobile asset staging area
MASR	mobile airport surveillance radar
MATCT	mobile air traffic control tower
MB	marker beacons
MDR	multimode digital radios
mDAS	miniature data acquisition system
METP	ICAO meteorology panel
mGC	micro gas chromatograph
Micro-EARTS	microprocessor en route automated radar tracking system
MIT/LL	Massachusetts Institute of Technology Lincoln Laboratory
MMAC	Mike Monroney Aeronautical Center
MOCC	mid-states operations control center
Mode S	mode select
MON	minimum operational network
MOPS	minimum operational performance standards
MSN	message switching network

--N--	
NADIN MSN	national airspace data interchange network – message switching network
NADIN PSN	national airspace data interchange network – package switching network
NAFIS	next generation automated flight inspection system
NAIMES	NAS aeronautical information enterprise system
NARP	national aviation research plan
NAS	national airspace system
NASA	National Aeronautics and Space Administration
NASE	NAS adaptation services environment
NAS EA	NAS enterprise architecture
NASR	national airspace system resources
Nav aids	navigation aids
Nav Lean	navigation procedures implementation plan
NBSC	NextGen backup surveillance capability
NCR	NAS common reference
NDB	non-directional beacon
NEB	NextGen executive board
NEMC	network enterprise management center
NEMS	NAS enterprise messaging service
NEWP	Nextgen executive weather panel
NEXCOM	next generation air/ground communications
NEXRAD	next generation weather radar
NextGen	next generation air transportation system
NIDS	NAS information display system
NIEC	NextGen integration and evaluation capability
NISC	NAS integration support contract
NG	new generation RVR
NLN	national logging network
NM	nautical mile (6,076 ft.)
NME	nav aids monitoring equipment
NOAA	National Oceanic and Atmospheric Administration
NOCC	national operations control center
NOP	national offload program
NOTAM	notices to airmen
NPI	NEXRAD product improvement
NPS	NextGen performance snapshots
NRN	national remote maintenance monitoring network
NSG	navigation service group
NSIP	NAS segment implementation plan
NSWRC	next generation surveillance and weather radar capability
NTEP	national test equipment program
NTSB	National Transportation Safety Board
NVR	NAS voice recorder
NVRP	NAS voice recorder program
NVS	national airspace system voice system
NWP	NextGen weather processor
NWS	National Weather Service

--O--	
OA	operational analysis
OARS	operational analysis and reporting system
OAS	oceanic automation system
OASIS	operational and supportability implementation system
OBV	operational benefits validation
ODALS	omni-directional airport lighting system
OEAAA	obstruction evaluation/airport airspace analysis
OFDPS	offshore flight data processing system
OIs	operational improvements
O&M	operations and maintenance
OMB	Office of Management and Budget
OPD	optimized profile descent
OPS	operations
OPSNET	operations network
ORD	operational readiness demonstration
O/S or OS	operating system
OSHA	Occupational Safety and Health Administration
OSI	organization success indicators
OT	operational test or testing
OT&E	operational test and evaluation
--P--	
PA	paired approach
PAF	primary alternate facility
PAPI	precision approach path indicator
PBN	performance-based navigation
PCB	polychlorinated biphenyl
PCS	power conditioning system
PDARS	performance data analysis and reporting system
PDC	pre-departure clearance
PDD	presidential decision directive
PDR	preliminary design review
PIREPS	pilot reports
PLM	programming language for microcomputers
PMO	program management office
POCC	pacific operations control center
PRD	pilot records database
PRISM	procurement information system for management
PRM	precision runway monitor
PRM E-SCAN	precision runway monitor – electronic scan radar
PS3	power systems sustained support
PSN	package switching network
PTM	pairwise trajectory management
--Q--	
Q1, Q2, Q3, Q4	quarter of a fiscal year starting October, January, April, or July; respectively

--R--	
RAMP	radar and mosaic processor
RECAT	wake re-categorization
RCE	radio control equipment
RCF	radio communication facilities
RCISS	regulation and certification infrastructure for system safety
RCL	radio communication link
RCLR	radio communications link repeater
RCLT	radio communications link terminal
RCOM	recovery communications
R&D	research and development
RDVS	rapid deployment voice switch
R,E&D	research, engineering and development
REIL	runway end identifier lights
RepCON	replacement documentation and configuration identification system
RF	radius-to-fix
RI	runway incursion
RIPSA	runway incursion prevention shortfall analysis
RIRP	runway incursion reduction program
RMLS	remote monitoring and logging system
RLMS	replacement lamp monitoring system
RMM	remote maintenance monitoring
RNAV	area navigation
RNP	required navigation performance
ROC	radar operations center
ROM	rough order of magnitude
ROS	reduced oceanic separation
RPM	revenue passenger miles
RSA	runway safety area
R-Side	radar position
RTCA	founded in 1935 as Radio Technical Commission for Aeronautics, Inc.
RTP	resource tracking program
RVR	runway visual range
RWSL	runway status lights
--S--	
S1P1	segment 1, phase 1
S1P2	segment 1, phase 2
S3	segment 3
SA	special authorization or safety assurance
SAA	special activity airspace
SAMS	special use airspace management system
SARP	standards and recommended practices
SAS	safety assurance system
SASS	small airport surveillance sensor
SASO	system approach for safety oversight
SATCOM	satellite communications system
SAWS	standalone weather sensors
SBAS	satellite based augmentation system

SCDI	site control data interface
S-CDM	surface collaborative decision making
SDAT	sector design and analysis tool
SDD	software design document
SDI	space data integrator
SE2025	systems engineering 2025 contract
SENSR	spectrum efficient national surveillance radar
SFMA	strategic flow management application
SFMEE	strategic flow management engineering enhancement
SIGGEN	signal generator
SIGMETS	significant meteorological information
SIPIA	simultaneous independent parallel instrument approach
SIR	screening information request
SLE	second level engineering
SLEP	service life extension program
SMA	surface movement advisor
SME	subject matter expert
SMS	safety management system
SOA	service oriented architecture
SOC	security operations center
SPC	senior policy committee
SPO	safety policy
SPR	safety promotion
SRM	safety risk management
SRMD	safety risk management document
SRS	software requirements specifications
SSA	surface situational awareness
SSCs	system support centers
SSMT	systems safety management transformation
SSS	system segment specification
STARS	standard terminal automation replacement system
STARS E/L (ELITE)	STARS enhanced local integrated tower equipment
STB	systems training building
STBO	surface trajectory-based operations
STDDS	SWIM terminal data distribution system
STEN	satellite telephone emergency network
STEP	sustainment and technology evolution plan
STF	surface tactical flow
STM	surface traffic management
STVS	small tower voice switch
sUAS	small unmanned aircraft system
SWAC	system-wide analysis capability
SWIM	system wide information management
SWS	surface weather system
SWx	space weather
--T--	
TACAN	tactical air navigation antenna
TAGARS	technically advanced general aviation research simulator

TAMR	terminal automation modernization replacement
TBFM	time based flow management
TBO	trajectory based operation
TCAS II	traffic alert and collision avoidance system II
TDLS	tower data link service
TDM	time division multiplex
TDWR	terminal Doppler weather radar
Tech Ops	Technical Operations Services
TF	Track-to-fix
TFDM	terminal flight data manager
TFM	traffic flow management
TFMS	traffic flow management system
TFR Bldr	temporary flight restriction builder
TIS-B	traffic information services-broadcast
TMC	traffic management coordinator
TMI	traffic management initiatives
TMU	traffic management units
TRACON	terminal radar approach control
TRS	traffic flow management infrastructure field/remote site
TSAS	terminal sequencing and spacing
TSO	technical standard order
TSS	tower simulation system
TSSC	technical support services contract
TVSR	terminal voice switch replacement
--U--	
UAS	unmanned aircraft systems
UFPF	unified flight planning and filing service
UHF	ultra high frequency
UIC	universal interlock controller
UIS	unstaffed infrastructure sustainment
UPS	uninterruptible power supply or United Parcel Service
URET	user request evaluation tool
USNS	United States NOTAM (notice to airmen) system
UTM	UAS Traffic Management Data Exchange
UV/VAS	ultraviolet and visible absorption spectroscopy
--V--	
VA	volcanic ash
VASI	visual approach slope indicator
VDL	VHF data link
VHF	very high frequency
VoIP	voice over internet protocol
VOR	very high frequency omni-directional range
VOT	VHF omni-directional range test facility
VORTAC	very high frequency omni-directional range collocated with tactical air navigation
VRTM	verification requirements traceability matrix
VSCS	voice switching and control system

VSBP	voice switch bypass
VTABS	VSCS training and backup switch
--W--	
WAAS	wide-area augmentation system
WAFS	world area forecast system
WAM	Wide-area multilateration
WAP	wireless application protocol
WARP	weather and radar processor
WDS	windshear detection service
WebCM	web configuration management
WEF	wind equipment series F-420
WID	wireless intrusion detection
WIFS	WAFS internet file service (non-FAA service)
WiWaves	wind and wave evacuation & survival
WFI	weather forecast improvements
WJHTC	William J. Hughes Technical Center
WME	wind measuring equipment
WMS	WAAS master station
WMSCR	weather message switching center replacement
WP	work package
WSDD	web service description documents
WSDS	wind shear detection services
WSP	weather systems or windshear processor
WSRF	water survival research facility
W _x	weather
WXXM	weather information exchange model
--X--	
XLS	next type of landing system
XR	Planned input/output interface upgrade for Boeing and Airbus flight simulators
--Y--	
--Z--	

Federal Aviation Administration

National Airspace System

Capital Investment Plan

Appendix A

Fiscal Years 2018 – 2022

APPENDIX A

ALIGNMENT OF PROGRAMS TO STRATEGIC PRIORITIES

The Federal Aviation Administration (FAA) Administrator established a strategic framework to define where the agency will focus its efforts. This framework includes high-level Strategic Priorities and related Performance Metrics that will help achieve the priorities. The Strategic Priorities and Performance Metrics support the Department of Transportation's (DOT) strategic plan. The four Strategic Priorities are:

- Make aviation safer and smarter
- Deliver benefits through technology and infrastructure
- Enhance global leadership
- Empower and innovate with the FAA's people

Performance Metrics are a tool the agency uses to track progress towards accomplishment of the Strategic Priorities. The Capital Investment Plan (CIP) programs have been aligned to the performance metrics. In the CIP Appendix B, a section entitled "Relationship of Program to FAA Performance Metric" gives more specific information about how each program helps meet a Performance Metric.

Many FAA programs will support more than one performance metric; however the program linkages in the CIP (Appendix A and B) are aligned to a single metric to which a program's contribution is most significant. Only CIP programs with currently planned funding in any or all of Fiscal Years (FY) 2018-2022 are included in Appendix A, B, and C.

To provide a complete picture of FAA performance, additional performance metrics are identified and tracked by the FAA to assess progress in meeting internal organizational performance objectives. These additional metrics are identified in the FAA Business Plan and many are included in this Appendix.

Each program, listed under its performance metric, includes the following information: FY 2018 Budget Line Item (BLI); CIP number; and CIP Program Name. BLI numbers with an X (i.e., 1A05X) are used to designate programs that are not funded in the FY 2018 President's Budget, but future funding is planned within the FY 2019-2022 timeframe. These programs are new starts or future extensions of existing programs. Appendix B will report the future year planned activities for these programs based on the planned funding.

For clarification, the following definitions generally describe the terms used in the CIP.

FAA STRATEGIC PRIORITY

The agency will use four strategic priorities as its organizing principle to focus efforts in the coming years.

PERFORMANCE METRIC

A quantifiable target for the desired improvement in performance, which will be accomplished in a specific timeframe. These metrics normally affect FAA customers, such as: "Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over a 9-year period (2010-2018). No more than 6.2 in 2018."

Table of Contents

1. FAA Strategic Priority: Make Aviation Safer and Smarter	1
2. FAA Strategic Priority: Deliver Benefits through Technology and Infrastructure	3
3. FAA Strategic Priority: Enhance Global Leadership.....	9
4. FAA Strategic Priority: Empower and Innovate with the FAA’s People	9

1. FAA STRATEGIC PRIORITY: MAKE AVIATION SAFER AND SMARTER

There is an imperative to be smarter about how we ensure aviation safety because the aviation industry is growing more complex. At the same time, we have more safety data than we have ever had before. This provides us with the opportunity to be more proactive about safety and constantly raise the bar.

- **Performance Metric 1:** Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9-year period (2010-2018). No more than 6.2 in 2018.

FY 2018 BLI	CIP #	CIP Name
1A07B	G05A.02-01	Common Status & Structure Data
2A13	W05.03-01	Wind Shear Detection Services – Work Package 1
2A17	M54.01-01	Airborne Collision Avoidance System X (ACAS X) – Segment 1
2B17	C23.02-01	NAS Voice Recorder Program (NVRP)
2D05	N04.03-00	Approach Lighting System Improvement Program (ALSIP) Continuation
2D07	N04.01-00	Visual NavAids for New Qualifiers
2D11	N17.01-01	Runway Safety Area - Navigation Mitigation
2D11X	N17.01-02	Runway Safety Area - Navigation Mitigation – Phase 2
2E03B	M12.01-04	NextGen Flight Simulation Testing and Research Technologies (Flight START) – Technology Refresh Program – Additional Projects
2E13X	M25.00-00	Independent Operational Assessment (IOA)
3A02	A17.01-03	Regulation and Certification Infrastructure for System Safety (RCISS) – Segment 3
3A06	A25.02-02	System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1a
3A06X	A25.02-03	System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1b
3A07	A26.01-01	Aviation Safety Knowledge Management Environment (ASKME) – Segment 2
3A07X	A26.01-02	Aviation Safety Knowledge Management Environment (ASKME) – Segment 3
3A08A	M53.01-02	Aerospace Medical Equipment Needs (AMEN) – Phase 2
3A08B	M53.01-03	Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Wind & Wave Evacuation Survival Facility (WIWAVES)
3A09A	G07A.02-01	Aviation Safety Information Analysis and Sharing (ASIAS)
3A09B	G07M.02-01	Systems Safety Management Transformation (SSMT)
3A12	A35.01-01	Aerospace Medicine Safety Information System (AMSIS) – Segment 1
4A09	G05A.02-05	Aeronautical Information Management (AIM) Modernization Segment 2
4A09X	G05A.02-06	Aeronautical Information Management (AIM) Modernization Segment 3

- **Performance Metric 2:** Reduce the general aviation fatal accident rate to no more than one (1) fatal accident per 100,000 flight hours by 2018.

FY 2018 BLI	CIP #	CIP Name
2C02	A34.01-01	Future Flight Services Program
2C04	M08.31-02	Weather Camera Program – Future Segments
2D03	N12.01-07	Wide Area Augmentation System (WAAS) – Phase IV Segment 1
2D03X	N12.01-08	Wide Area Augmentation System (WAAS) – Phase IV Segment 2

1. FAA Strategic Priority: Safer and Smarter

- **Performance Metric 3:** No fatalities, serious injuries, or significant property damage to the uninvolved public during licensed or permitted space launch and reentry activities.

FY 2018 BLI	CIP #	CIP Name
2A22	M55.01-01	Commercial Space Integration Into The NAS
2A22X	G01M.03-01	Space Integration Enhancements 1

- **Performance Metric 4:** Reduce Category A & B (most serious) runway incursions to a rate of no more than: 0.375 per million operations.

FY 2018 BLI	CIP #	CIP Name
1A01A	S09.02-00	Runway Incursion Reduction Program (RIRP) – ATDP
2B11	S11.01-02	Runway Status Lights (RWSL) – Implementation – Phase 1
2B11X	S11.01-04	Runway Status Lights (RWSL) – Sustainment

- **Performance Metric 5:** Reduce risks in flight by limiting the rate of the most serious losses of standard separation to 10 or fewer for every thousand (.01) losses of standard separation within the National Airspace System.

FY 2018 BLI	CIP #	CIP Name
1A01G	M08.32-03	Operational Analysis and Reporting System (OARS)
2A20	G02S.04-01	Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Reduced Oceanic Separation (ROS) Advanced Surveillance Enhanced Procedural Separation (ASEPS)

- **Performance Metric 6:** Address 80% of high value risks within 30 days. Continue Cyber Security Steering Committee oversight to assure consistent risk acceptance decisions. Visualize vulnerabilities on all IP based systems.

FY 2018 BLI	CIP #	CIP Name
3A05	M31.00-00	Information Systems Security

- **Performance Metric 7:** Exceed Continuity Communications activation levels, as identified in the Federal Continuity Directive (FCD) Annex H, by 5 percent. (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
3A03	C18.00-00	NAS Recovery Communications (RCOM)

2. FAA STRATEGIC PRIORITY: DELIVER BENEFITS THROUGH TECHNOLOGY AND INFRASTRUCTURE

NextGen gives us the opportunity to redefine the National Airspace System for the future and prove that we can deliver benefits to the users of the system. We also need to safely integrate new types of user technologies into the airspace, as well as rebalance existing services and modernize our infrastructure, which will enable us to reduce our costs and become more efficient in the long run.

- **Performance Metric 1:** Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.

FY 2018 BLI	CIP #	CIP Name
2A01A	G01A.01-10	En Route Automation Modernization (ERAM) Sustainment 2
2A01X	G01A.01-11	En Route Automation Modernization (ERAM) Sustainment 3
2A02	A01.12-02	En Route Communication Gateway (ECG) – Sustainment
2A03	W02.02-02	Next Generation Weather Radar (NEXRAD) – Service Life Extension Program (SLEP) Phase 1
2A03X	W02.02-03	Next Generation Weather Radar (NEXRAD) – Service Life Extension Program (SLEP) Phase 2
2A04A	F06.01-00	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements
2A04B	F08.01-01	San Juan Facility Remediation
2A05X	A05.01-15	Traffic Flow Management System (TFMS) Modernization Part 2
2A06	C04.01-01	Radio Control Equipment (RCE) – Sustainment
2A06	C06.01-00	Communications Facilities Enhancement – Expansion
2A07	S04.02-03	Long Range Radar (LRR) Improvements – Infrastructure Upgrades/Sustain
2A08	C01.02-04	Voice Switching and Control System (VSCS) – Technology Refresh – Phase 3
2A08X	C01.02-05	Voice Switching and Control System (VSCS) – Technology Refresh – Level of Effort
2A09A	A10.03-01	Advanced Technologies and Oceanic Procedures (ATOP) – Sustainment 2
2A10	C21.02-01	Next-Generation VHF and UHF A/G Communication System (NEXCOM) – Segment 2 – Phase 1 of 2
2A10	C21.02-02	Next-Generation VHF and UHF A/G Communication System (NEXCOM) – Segment 2 – Phase 2 of 2
2A12B	G02S.05-01	Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Sustain/Relocate (Gulf of Mexico Platform)
2A13X	W10.01-02	Juneau Airport Wind System (JAWS) – Technology Refresh
2A19	A38.01-01	Offshore Automation
2B01	W03.03-02	Terminal Doppler Weather Radar (TDWR) – Service Life Extension Program (SLEP) – Phase 2
2B02A	A04.01-01	Standard Terminal Automation Replacement System (STARS) – Technology Refresh (TAMR Phase 1)
2B02B	A04.01-03	Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Planning/Engineering
2B02X	A04.01-04	Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Implementation
2B04A	A01.11-01	Flight Data Input/Output (FDIO) – Sustainment
2B05	F01.02-00	Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Replacement

2. FAA Strategic Priority: Benefits Through Technology

FY 2018 BLI	CIP #	CIP Name
2B06A	F01.01-00	Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization
2B07	C05.02-00	Terminal Voice Switch Replacement (TVSR) II
2B09A	S03.01-09	Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP), Phase 2
2B09B	S03.01-12	Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP) – Phase 3
2B10	S03.02-05	Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 2
2B10X	S03.02-07	Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 3
2B14A	M07.04-02	Remote Monitoring and Logging System (RMLS) – Technology Refresh
2B14B	M07.05-01	Automated Maintenance Management System (AMMS)
2B15A	S03.01-08	Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2
2B15B	S03.01-13	Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3
2B18	W07.01-02	Integrated Terminal Weather System (ITWS) – Sustainment & Disposition
2C01	W01.03-01	Aviation Surface Weather Observation Network (ASWON) – Technology Refresh
2C03	F05.04-02	Alaska Flight Service Facility Modernization (AFSFM)
2D01B	N06.00-00	Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC)
2D04	N08.02-00	Runway Visual Range (RVR) Replacement/Establishment
2D09	N04.04-00	NavAids – Sustain, Replace, Relocate
2E01	F13.01-00	Fuel Storage Tank Replacement Management
2E02	F12.00-00	Unstaffed Infrastructure Sustainment (UIS)
2E03A	M12.00-00	Aircraft Related Equipment (ARE) Program
2E04	F10.00-00	Airport Cable Loop Systems Sustained Support
2E05	C17.02-01	Alaskan Satellite Telecommunication Infrastructure (ASTI)
2E05X	C17.02-02	Alaskan Satellite Telecommunication Infrastructure (ASTI) Enhancement
2E07	F11.01-01	Power Systems Sustained Support (PS3)
2E07X	F11.01-02	Power Systems Sustained Support (PS3) – Future Segments
2E12	M56.01-01	Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration
3A04	F24.01-02	Facility Security Risk Management (FSRM) – Two
3A05X	M31.05-01	Critical Infrastructure Cybersecurity
3A10	M17.01-01	National Test Equipment Program
3A11	F31.01-01	Mobile Assets Management Program
3A14X	M21.04-02	Logistics Center Support System (LCSS) – Sustainment
Multiple	M08.49-01	NAS Resiliency Assessment

2. FAA Strategic Priority: Benefits Through Technology

- **Performance Metric 2:** Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.

FY 2018 BLI	CIP #	CIP Name
1A01B	M08.28-00	System Capacity, Planning and Improvements – ATDP
1A01C	M08.29-00	Operations Concept Validation and Infrastructure Evolution – ATDP
1A01D	M08.28-04	Major Airspace Redesign – ATDP
1A01E	M46.01-01	Strategy and Evaluation – ATDP
1A01H	A37.01-01	Operations Network (OPSNET) Replacement – ATDP
1A01I	M03.04-01	Enterprise Management, Integration, Planning, & Performance Evaluation for NextGen
1A01X	M52.01-01	Operational Modeling Analysis and Data
1A01X	G05M.04-01	Enterprise Information Management (EIM)
1A05A	G01S.02-01	Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management
1A05B	G01A.01-01	Modern Procedures
1A05C	G06M.02-02	Wake Turbulence Re-Categorization
1A05D	G01A.01-06	Separation Automation System Engineering
1A05E	G06N.01-02	Closely Spaced Parallel Runway Operations
1A05F	G05A.02-04	Concept Development for Integrated NAS Design & Procedures Planning
1A05X	G01A.01-07	NextGen Oceanic Capabilities
1A06A	G02A.01-01	Surface Tactical Flow
1A06B	G02A.01-08	Time Based Flow Management (TBFM) Work Package 4
1A06C	G05A.01-01	Strategic Flow Management Application
1A06D	G05A.01-02	Strategic Flow Management Engineering Enhancement (SFMEE)
1A06E	G05A.02-02	Advanced Methods
1A07A	G05A.02-03	Flight Object
1A07C	G05A.02-08	Flight Object Exchange Services (FOXs)
1A07D	G05A.04-01	Dynamic Airspace
1A08A	G04W.02-01	Weather Observation Improvements
1A08B	G04W.03-01	Weather Forecast Improvements – Work Package 1
1A08C	G06N.01-03	NextGen Navigation Engineering
1A08D	G01M.02-02	New Air Traffic Management (ATM) Requirements
1A08E	G05M.03-01	Information Management
1A11A	G05A.02-10	Enterprise Concept Development
1A11B	G01M.02-05	Enterprise Human Factor Development
1A11C	G08M.01-04	Stakeholder Demonstrations
2A01B	G01A.01-08	En Route Automation Modernization (ERAM) Enhancements 2
2A01X	G01A.01-12	En Route Automation Modernization (ERAM) Enhancements 3
2A05B	A05.01-14	Traffic Flow Management (TFM) Infrastructure – TFM Improvements
2A11B	G05C.01-06	System Wide Information Management (SWIM) – Common Support Services Weather (CSS-Wx) Work Package 1
2A11X	G05C.01-09	System Wide Information Management (SWIM) – Common Support Services Weather (CSS-Wx) Work Package 2
2A15	G02A.01-06	Time Based Flow Management (TBFM) Work Package 3
2A15X	G02A.01-07	Time Based Flow Management (TBFM) Technology Refresh

2. FAA Strategic Priority: Benefits Through Technology

FY 2018 BLI	CIP #	CIP Name
2A18	G01C.01-05	Data Communications – Segment 1 Phase 1
2A18	G01C.01-06	Data Communications – Segment 1 Phase 2 Initial En Route Services
2A18	G01C.01-07	Data Communications – Segment 1 Phase 1 & 2 Data Comm Integrated Services (DCIS) Network Services
2A18X	G01C.01-11	Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future
2A21	A01.16-01	En Route Improvements
2B03	A04.07-02	Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2
2B04B	A04.08-01	Standard Terminal Automation Replacement System (STARS) Enhancements 2
2B04C	A04.09-02	Terminal Improvements
2B12	G03C.01-01	NAS Voice System (NVS) – Demonstration & Qualification
2B12X	G03C.01-02	NAS Voice System (NVS) – Deployment
2B13	A03.05-03	Enterprise Information Display System (E-IDS)
2B16	G06A.03-01	Terminal Flight Data Manager (TFDM) – Core, Segment 1
2B19B	G01N.01-02	NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN) Strategy
2D02	N03.01-00	Instrument Landing Systems (ILS)
2D06	N09.00-00	Sustain Distance Measuring Equipment (DME)
2D12	M08.41-02	NAVAIDS Monitoring Equipment (NME)
2E11	M08.28-05	Data Visualization and Reporting System (DVARs)

- **Performance Metric 3:** Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.

FY 2018 BLI	CIP #	CIP Name
1A07X	G05A.02-11	Flight Deck Collaborative Decision Making
2A05A	A05.01-13	Traffic Flow Management (TFM) Infrastructure – Field/Remote Site Technology Refresh
2A09B	A10.03-03	Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Improvements
2A12A	G02S.03-01	Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume)
2A12X	G02S.03-06	Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services (FY21-Out)
2A14	G05A.05-03	Collaborative Air Traffic Management Technologies (CATMT) – Work Package 4
2A14X	G05A.05-04	Collaborative Air Traffic Management Technologies (CATMT) – Work Package 5
2A16	G04W.03-02	NextGen Weather Processor (NWP), Work Package 1
2A16X	G04W.03-02	NextGen Weather Processor (NWP), Work Package 1
2D10	N04.02-00	Replace Visual Approach Slope Indicator (VASI) with Precision Approach Path Indicator (PAPI)
4A08	M03.02-00	CIP Systems Engineering & Technical Assistance – MITRE

2. FAA Strategic Priority: Benefits Through Technology

- **Performance Metric 4:** Reduce the U.S. population exposed to significant aircraft noise around airports to less than 315,000 persons by calendar year 2016.

FY 2018 BLI	CIP #	CIP Name

- **Performance Metric 5:** Limit the impact of aircraft CO2 emissions on the global climate by achieving carbon neutral growth by 2020 compared to 2005, and net reductions of the climate impact from all aviation emissions over the longer term (by 2050). (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
2A09C	A10.03-02	Advanced Technologies and Oceanic Procedures (ATOP) – ATOP Enhancements (Work Package 1)

- **Performance Metric 6:** Optimize airspace and Performance Based Navigation (PBN) procedures to improve efficiency an average of 10 percent across core airports by 2018. (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
2B19A	G05N.01-01	NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP)
2D01A	N06.01-01	Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program – Phase 1
2D01X	N06.01-02	Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program – Phase 2

- **Performance Metric 7:** Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.

FY 2018 BLI	CIP #	CIP Name
1A02 / 1A03	F14.00-00	William J. Hughes Technical Center Laboratories & William J. Hughes Technical Center Laboratory Sustainment
1A04	F16.00-00	William J. Hughes Technical Center Building and Plan Support
1A09	G03M.02-01	NextGen Laboratories
2A11A	G05C.01-08	System Wide Information Management (SWIM) – Segment 2B
2A11X	G05C.01-10	System Wide Information Management (SWIM) Segment 2C – NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure and 3rd Party Provider Services
2B06B	F02.10-02	Facility Realignment Implementation
2B06X	F02.10-01	Facility Realignment Planning
2B06X	M08.48-01	Strategic Initiatives Analysis and Validation
2D08	A14.02-02	Instrument Flight Procedures Automation (IFPA) –Technology Refresh, Segment 1
2D08	A14.02-03	Instrument Flight Procedures Automation (IFPA) – Sustainment 2
2E02X	F20.01-01	FAA Employee Housing and Life Safety Shelter System Services
2E03C	F14.01-01	William J. Hughes Technical Center Laboratories – Flight Program Consolidation – Sustainment
2E06	F26.01-01	Decommissioning – Real Property Disposition
2E08	F13.04-02	Energy Management and Compliance (EMC)
2E10	C26.01-02	FAA Telecommunications Infrastructure – 2
3A01	F13.02-00	Environmental Cleanup / Hazardous Materials (HAZMAT)

2. FAA Strategic Priority: Benefits Through Technology

FY 2018 BLI	CIP #	CIP Name
3A13	M20.01-04	National Airspace System (NAS) Training - Equipment Modernization – Training Simulators – Tower Simulation System
3B01	F18.00-00	Aeronautical Center Infrastructure Modernization
3B02	M10.00-00	Distance Learning
4A01A	M03.03-01	CIP Systems Engineering & Development Support – System Engineering Contract
4A01B	M08.01-00	Provide Air Navigation Facilities (ANF)/Air Traffic Control (ATC) Support (Quick Response)
4A02	M08.06-00	Program Support Leases
4A04	F19.00-00	Aeronautical Center Lease
4A05A	M22.00-00	NAS Integration Support Contract (NISC)
4A05B	M03.01-02	Configuration Management Automation (CMA)
4A06	M02.00-00	Technical Support Services Contract (TSSC)
4A10	G08M.04-01	Cross Agency NextGen Management

- **Performance Metric 8:** 90% of major baselined acquisition programs must be maintained within 10% of their current acquisition cost, schedule and technical performance baseline as of the end of fiscal year 2017. (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
1A01F	M47.01-01	Dynamic Capital Planning
4A07	M08.14-00	Resource Tracking Program (RTP)

- **Performance Metric 9:** Safely and efficiently integrate new types of operations, such as commercial space and unmanned aircraft, into the NAS and enable the benefits these operations will provide. (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
1A10A	G01A.01-09	Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development
1A10B	G01A.05-01	Unmanned Aircraft Systems (UAS) Flight Information Management

3. FAA STRATEGIC PRIORITY: ENHANCE GLOBAL LEADERSHIP

Aviation is a global industry. We have to continue our heritage as world leaders in aviation and set the safety standard for others to measure against. We need to be at the table to shape international standards to improve aviation safety and efficiency around the world.

4. FAA STRATEGIC PRIORITY: EMPOWER AND INNOVATE WITH THE FAA’S PEOPLE

The FAA’s employees are the ultimate driver behind our success, and we need to have the best and the brightest talent with the appropriate leadership and technical skills to transform the FAA and the aviation system.

- **Performance Metric 1:** The FAA is rated in the top 25 percent of places to work in the federal government by employees. (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
2B08	F13.03-00	Environmental and Occupational Safety and Health (EOSH)
2E09	F22.01-01	Child Care Centers – Infrastructure Improvements

- **Performance Metric 2:** Achieve a 90% success rate in the areas of financial management and human resources management: Receive annual Unqualified Audits with no material weaknesses. Maintain the competitive status of all FAA employees within the federal personnel system. Improve the “effective leadership” index score on the OPM Employee Viewpoint Survey by 8 percent. Improve the “talent management” index score on the OPM Employee Viewpoint Survey by 8 percent. (FAA Business Planning Metric)

FY 2018 BLI	CIP #	CIP Name
4A03	M05.00-00	NAS Regional/Center Logistics Support Services

Federal Aviation Administration

National Airspace System

Capital Investment Plan

Appendix B

Fiscal Years 2018 – 2022

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APPENDIX B

DETAILED PROGRAM PLAN DATA

Appendix B provides detailed information about planned capital investments in the 5 year window of the plan. Each year, these details are updated to reflect any program changes.

ACTIVITIES AND BUDGET LINES

The structure of Appendix B follows the structure presented in the FY 2018 President's Budget Request. Budget Activities group together budget line items (BLI) with similar objectives. There are 5 budget activities in the FAA Facilities & Equipment (F&E) account for capital spending including engineering development, air traffic investments, other FAA investments, support contracts, personnel costs, and other services. Activity 5, personnel costs, is not discussed. The BLI shown within each budget activity provide a detailed description for each program. In some BLIs, related programs are shown and described together within a single write-up. This occurs when individual programs have the same overall objective (e.g. data communications) but each addresses a different aspect of the solution. Note that programs with planned funding beginning after FY 2018, while not included in the President's Budget, are included in the CIP and are designated with an "X" in the BLI number or before the CIP title.

PROGRAM DESCRIPTION

The program scope and purpose is provided in this section. Some programs may have distinctly different activities included within the overall program write-up. In this case, each program activity will be separately described and have its own Performance Output Goals.

ALIGNMENT OF PROGRAM TO FAA STRATEGIC PRIORITY AND PERFORMANCE METRIC

Each program in the CIP is aligned with a single Strategic Priority and Performance Metric. The Strategic Priorities are part of the framework for strategic planning and the metrics are based on the approved Agency Organization Success Indicators (OSI). The FAA specific metrics in the DOT strategic plan are included in the OSI metrics. To align all programs to an appropriate metric, some business planning metrics have also been included. Some programs, as a bi-product, may contribute to other metrics, but to maintain focus on the single performance metric these secondary contributions are not described.

RELATIONSHIP TO PERFORMANCE METRIC

This section describes how the new system, service or capability provided by this program contributes to the selected Performance Metric. If available, quantifiable information has been provided. This section may also highlight how NAS safety or operations will change as a result of the new system, service or capability.

PERFORMANCE OUTPUT GOALS

Output goals are the specific accomplishments, deliverables or work products that will be delivered for each year within the 5 year window of the plan. "None" indicates that no funding is planned for that year. Programs baselined for cost, schedule and performance have specific approved Acquisition Program Baseline (APB) milestones that are tracked for accomplishment and included as output goals. The FAA F&E appropriation can be obligated for up to 2 years after the year appropriated (funds available for 3 years). Program milestones and deliverables shown as output goals beyond the last year of planned funding are marked as "prior year funding".

SYSTEM IMPLEMENTATION SCHEDULE

A schedule is provided for programs deploying systems or upgrades into the NAS. When available, other information will also be provided to indicate how long the system will be in operation or when a system will be decommissioned. The schedule legend is as follows:

Upgrades	
Development	
Implementation	
Operational	
Decommissioning	
Continued	

Table of Contents

ACTIVITY 1: ENGINEERING, DEVELOPMENT, TEST, AND EVALUATION	1
1A01, Advanced Technology Development and Prototyping (ATDP).....	1
A, Runway Incursion Reduction Program (RIRP) – ATDP, S09.02-00	1
B, System Capacity, Planning and Improvements – ATDP, M08.28-00	2
C, Operations Concept Validation and Infrastructure Evolution – ATDP, M08.29-00.....	4
D, Major Airspace Redesign – ATDP, M08.28-04	5
E, Strategy and Evaluation – ATDP, M46.01-01	6
F, Dynamic Capital Planning, M47.01-01	8
G, Operational Analysis and Reporting System (OARS), M08.32-03.....	8
H, Operations Network (OPSNET) Replacement – ATDP, A37.01-01	10
I, Enterprise Management, Integration, Planning, and Performance Evaluation for NextGen, M03.04-01	11
X, Operational Modeling Analysis and Data, M52.01-01.....	12
X, Enterprise Information Management, G05M.04-01	14
1A02/1A03, William J. Hughes Technical Center Laboratory Improvement.....	16
William J. Hughes Technical Center Laboratories, F14.00-00	16
1A04, William J. Hughes Technical Center Infrastructure Sustainment	18
William J. Hughes Technical Center Building & Plant Support, F16.00-00.....	18
1A05, NextGen – Separation Management Portfolio.....	20
A, Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management, G01S.02-01	20
B, Modern Procedures, G01A.01-01	21
C, Wake Turbulence Re-Categorization, G06M.02-02	22
D, Separation Automation System Engineering, G01A.01-06.....	24
E, Closely Spaced Parallel Runway Operations, G06N.01-02.....	27
F, Concept Development for Integrated NAS Design & Procedures Planning, G05A.02-04	29
X, NextGen Oceanic Capabilities, G01A.01-07	31
1A06, NextGen – Traffic Flow Management Portfolio	32
A, Surface Tactical Flow, G02A.01-01	32
B, Time Based Flow Management (TBFM) Work Package 4, G02A.01-08	34
C, Strategic Flow Management Application, G05A.01-01	35
D, Strategic Flow Management Engineering Enhancement (SFMEE), G05A.01-02	38
E, Advanced Methods, G05A.02-02	41
1A07, NextGen – On Demand NAS Portfolio	43
A, Flight Object, G05A.02-03.....	43
B, Common Status & Structure Data, G05A.02-01	45
C, Flight Object Exchange Services (FOXS), G05A.02-08	47
D, Dynamic Airspace, G05A.04-01	49
X, Flight Deck Collaborative Decision Making, G05A.02-11	50
1A08, NextGen – NAS Infrastructure Portfolio.....	51
A, Weather Observation Improvements, G04W.02-01	52
B, Weather Forecast Improvements – Work Package 1, G04W.03-01	53
C, NextGen Navigation Engineering, G06N.01-03.....	56
D, New ATM Requirements, G01M.02-02.....	58
E, Information Management, G05M.03-01	62
1A09, NextGen – Support Portfolio	64
NextGen Laboratories, G03M.02-01.....	64
1A10, NextGen – Unmanned Aircraft Systems (UAS).....	67
A, Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development, G01A.05-02..	67

B, Unmanned Aircraft Systems (UAS) Flight Information Management, G01A.05-01	70
1A11, NextGen – Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio	73
A, Enterprise Concept Development, G05A.02-10	73
B, Enterprise Human Factor Development, G01M.02-05	74
C, Stakeholder Demonstrations, G08M.01-04	76
ACTIVITY 2: AIR TRAFFIC CONTROL FACILITIES AND EQUIPMENT	78
A: En Route Programs	78
2A01, NextGen – En Route Automation Modernization (ERAM) – System Enhancements and Technology Refresh	78
A, En Route Automation Modernization (ERAM) Sustainment 2, G01A.01-10 / X, En Route Automation Modernization (ERAM) Sustainment 3, G01A.01-11	78
B, En Route Automation Modernization (ERAM) Enhancements 2, G01A.01-08	80
X, En Route Automation Modernization (ERAM) Enhancements 3, G01A.01-12	82
2A02, En Route Communications Gateway (ECG)	83
En Route Communications Gateway (ECG) – Sustainment, A01.12-02	83
2A03, Next Generation Weather Radar (NEXRAD)	85
Next Generation Weather Radar (NEXRAD) – Service Life Extension Program (SLEP) Phase 1, W02.02-02 / X, Next Generation Weather Radar (NEXRAD) – Service Life Extension Program (SLEP) Phase 2, W02.02-03	85
2A04, Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements	87
A, Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements, F06.01-00	87
B, San Juan Facility Remediation, F08.01-01	89
2A05, Air Traffic Management (ATM) – Traffic Flow Management (TFM)	90
A, Traffic Flow Management (TFM) Infrastructure – Field/Remote Site Technology Refresh, A05.01-13	91
B, Traffic Flow Management (TFM) Infrastructure – TFM Improvements, A05.01-14	92
X, Traffic Flow Management (TFM) Infrastructure – Traffic Flow Management System (TFMS) Modernization Part 2, A05.01-15	93
2A06, Air/Ground Communications Infrastructure	95
Radio Control Equipment (RCE) – Sustainment, C04.01-01 / Communications Facilities Enhancement – Expansion, C06.01-00	95
2A07, Air Traffic Control En Route Radar Facilities Improvements	97
Long Range Radar (LRR) Improvements – Infrastructure Upgrades/Sustain, S04.02-03	97
2A08, Voice Switching Control System (VSCS)	98
Voice Switching and Control System (VSCS) – Technology Refresh – Phase 3, C01.02-04 / X, Voice Switching and Control System (VSCS) – Technology Refresh – Level of Effort, C01.02-05	98
2A09, Oceanic Automation System (OAS)	100
A, Advanced Technologies and Oceanic Procedures (ATOP) – Sustainment 2, A10.03-01	100
B, Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Improvements, A10.03-03	101
C, Advanced Technologies and Oceanic Procedures (ATOP) – ATOP Enhancements (Work Package 1), A10.03-02	102
2A10, Next Generation Very High Frequency Air/Ground Communications System (NEXCOM)	103
Next-Generation VHF and UHF A/G Communications (NEXCOM) – Segment 2 – Phase 1 of 2, C21.02-01 / Next-Generation VHF and UHF A/G Communications (NEXCOM) – Segment 2 – Phase 2 of 2, C21.02-02	103

2A11, NextGen – System-Wide Information Management (SWIM)	105
A, System Wide Information Management (SWIM) – Segment 2B, G05C.01-08	105
B, System Wide Information Management (SWIM) – Common Support Services-Weather (CSS-Wx) Work Package 1, G05C.01-06 / X, System Wide Information Management (SWIM) – Common Support Services-Weather (CSS-Wx) Work Package 2, G05C.01-09	107
X, System Wide Information Management (SWIM) Segment 2C – NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure and 3rd Party Provider, G05C.01-10	109
2A12, NextGen – Automatic Dependent Surveillance - Broadcast (ADS-B) NAS Wide Implementation	110
A, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01	111
B, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Sustain/Relocate (Gulf of Mexico Platform), G02S.05-01	112
X, Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services (FY21-Out), G02S.03-06	114
2A13, Wind Shear Detection Service (WSDS)	115
Wind Shear Detection Services – Work Package 1, W05.03-01	115
X, Juneau Airport Wind System (JAWS) – Technology Refresh, W10.01-02	115
2A14, NextGen – Collaborative Air Traffic Management Technologies Portfolio	116
Collaborative Air Traffic Management Technologies (CATMT) – Work Package 4, G05A.05-03 / X, Collaborative Air Traffic Management Technologies (CATMT) – Work Package 5, G05A.05-04	116
2A15, NextGen – Time Based Flow Management (TBFM) Portfolio	119
A, Time Based Flow Management (TBFM) Work Package 3, G02A.01-06 / X, Time Based Flow Management (TBFM) Technology Refresh, G02A.01-07	119
X, Time Based Flow Management (TBFM) Work Package 4, G02A.01-08	121
2A16, NextGen – Next Generation Weather Processor (NWP)	123
NextGen Weather Processor (NWP), Work Package 1, G04W.03-02 / X, NextGen Weather Processor (NWP), Work Package 2, G04W.03-03	123
2A17, Airborne Collision Avoidance System X (ACAS X)	125
Airborne Collision Avoidance System X (ACAS X) – Segment 1, M54.01-01	125
2A18, NextGen – Data Communication in support of NextGen	126
Data Communications – Segment 1 Phase 1, G01C.01-05 / Data Communications – Segment 1 Phase 2 Initial En Route Services, G01C.01-06 / Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services, G01C.01-07 / X, Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future, G01C.01-11	126
2A19, Offshore Automation	129
Offshore Automation, A38.01-01	129
2A20, NextGen - Advanced Surveillance Enhanced Procedural Separation (ASEPS)	131
Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Reduced Oceanic Separation Advanced Surveillance Enhanced Procedural Separation (ASEPS), G02S.04-01	131
2A21, En Route Improvements	132
En Route Improvements, A01.16-01	132
2A22, Commercial Space Integration	133
Commercial Space Integration Into The NAS, M55.01-01	133
X, Space Integration Enhancements 1, G01M.03-01	135
B: Terminal Programs	137
2B01, Terminal Doppler Weather Radar (TDWR) – Provide	137
Terminal Doppler Weather Radar (TDWR) – Service Life Extension Program (SLEP) – Phase 2, W03.03-02	137

2B02, Standard Terminal Automation Replacement System (STARS) Sustain	138
A, Standard Terminal Automation Replacement System (STARS) – Technology Refresh (TAMR Phase 1), A04.01-01	138
B, Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Planning/Engineering, A04.01-03 / X, Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Implementation, A04.01-05	140
2B03, Terminal Automation Modernization/ Replacement Program (TAMR Phase 3)	141
Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2, A04.07-02	141
2B04, Terminal Automation Program	143
A, Flight Data Input/Output (FDIO) – Sustainment, A01.11-01	143
B, Standard Terminal Automation Replacement System (STARS) – Enhancements 2, A04.08-01	144
C, Terminal Improvements, A04.09-02	145
2B05, Terminal Air Traffic Control Facilities - Replace	146
Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Replacement, F01.02-00	146
2B06, ATCT/Terminal Radar Approach Control (TRACON) Facilities - Improve	147
A, Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization, F01.01-00	147
B, Facility Realignment Implementation, F02.10-02 / X, Facility Realignment Planning, F02.10-01	148
X, Strategic Initiatives Analysis and Validation, M08.48.01	150
2B07, Terminal Voice Switch Replacement (TVSR)	150
Terminal Voice Switch Replacement (TVSR) II, C05.02-00	150
2B08, NAS Facilities OSHA and Environmental Standards Compliance	152
Environmental and Occupational Safety and Health (EOSH), F13.03-00	152
2B09, Airport Surveillance Radar (ASR-9) Service Life Extension Program (SLEP)	153
A, Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP), Phase 2, S03.01-09	153
B, Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP) – Phase 3, S03.01-12	154
2B10, Terminal Digital Radar (ASR-11) Technology Refresh	155
Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 2, S03.02-05 / X, Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 3, S03.02-07	155
2B11, Runway Status Lights (RWSL)	157
Runway Status Lights (RWSL) – Implementation – Phase 1, S11.01-02 / X, Runway Status Lights (RWSL) – Sustainment, S11.01-04	157
2B12, NextGen – National Airspace System Voice System (NVS)	158
NAS Voice System (NVS) – Demonstration & Qualification, G03C.01-01 / X, NAS Voice System (NVS) – Deployment, G03C.01-02	158
2B13, Integrated Display System (IDS)	160
Enterprise Information Display System (E-IDS), A03.05-03	160
2B14, Remote Monitoring and Logging System (RMLS)	163
A, Remote Monitoring and Logging System (RMLS) – Technology Refresh, M07.04-02	163
B, Automated Maintenance Management System (AMMS), M07.05-01	166
2B15, Mode S Service Life Extension Program (SLEP)	168
A, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2, S03.01-08	168
B, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3, S03.01-13	169
2B16, NextGen – Terminal Flight Data Manager (TFDM)	170
Terminal Flight Data Manager (TFDM) – Core, Segment 1, G06A.03-01	170
2B17, NAS Voice Recorder Program (NVRP)	172

NAS Voice Recorder Program (NVRP), C23.02-01	172
2B18, Integrated Terminal Weather System (ITWS) Sustainment	173
Integrated Terminal Weather System (ITWS) – Sustainment & Disposition, W07.01-02.....	173
2B19, NextGen – Performance Based Navigation & Metroplex Portfolio	174
A, NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required	
Navigation Performance (RNP), G05N.01-01	174
B, NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN)	
Strategy, G01N.01-02	176
C: Flight Service Programs	178
2C01, Aviation Surface Weather Observation System	178
Aviation Surface Weather Observation Network (ASWON) – Technology Refresh,	178
W01.03-01	178
2C02, Future Flight Services Program (FFSP).....	179
Future Flight Services Program, A34.01-01.....	179
2C03, Alaska Flight Service Facility Modernization (AFSFM)	181
Alaska Flight Service Facility Modernization (AFSFM), F05.04-02.....	181
2C04, Weather Camera Program.....	183
Weather Camera Program – Future Segments, M08.31-02.....	183
D: Landing and Navigation Aids Programs	184
2D01, VHF Omnidirectional Radio Range (VOR) with Distance Measuring Equipment (DME)	
.....	184
A, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON)	
Implementation Program – Phase 1, N06.01-01 / X, Very High Frequency Omni-Directional Range (VOR) –	
Minimum Operational Network (MON) Implementation Program – Phase 2, N06.01-02	184
B, Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation	
(VORTAC), N06.00-00	187
2D02, Instrument Landing Systems (ILS).....	188
Instrument Landing Systems (ILS), N03.01-00	188
2D03, Wide Area Augmentation System (WAAS) for GPS.....	189
Wide Area Augmentation System (WAAS) – Phase IV Segment 1, N12.01-07 / X, Wide Area Augmentation	
System (WAAS) – Phase IV Segment 2, N12.01-08	189
2D04, Runway Visual Range (RVR)	194
A, Runway Visual Range (RVR) – Replacement/Establishment, N08.02-00.....	194
2D05, Approach Lighting System Improvement Program (ALSIP).....	195
Approach Lighting System Improvement Program (ALSIP) Continuation, N04.03-00	195
2D06, Distance Measuring Equipment (DME)	196
Sustain Distance Measuring Equipment (DME), N09.00-00	196
2D07, Visual Navaids - Establish/Expand	197
Visual Navaids for New Qualifiers, N04.01-00	197
2D08, Instrument Flight Procedures Automation (IFPA)	199
Instrument Flight Procedures Automation (IFPA) – Sustainment Technology Refresh, Segment 1, A14.02-02	
/ Instrument Flight Procedures Automation (IFPA) – Sustainment 2, A14.02-03	199
2D09, Navigation and Landing Aids – Service Life Extension Program (SLEP)	201
Navaids – Sustain, Replace, Relocate, N04.04-00	201
2D10, VASI Replacement – Replace with Precision Approach Path Indicator	203
Replace Visual Approach Slope Indicator (VASI) with Precision Approach Path Indicator (PAPI), N04.02-00	
.....	203

2D11, Runway Safety Areas – Navigation Mitigation.....	204
Runway Safety Area – Navigation Mitigation, N17.01-01 / Runway Safety Area – Phase 2, N17.01-02.....	204
2D12, NAVAIDS Monitoring Equipment	205
NAVAIDS Monitoring Equipment (NME), M08.41-02.....	205
E: Other ATC Facilities Programs.....	206
2E01, Fuel Storage Tank Replacement and Management.....	206
Fuel Storage Tank Replacement Management, F13.01-00	206
2E02, Unstaffed Infrastructure Sustainment	208
Unstaffed Infrastructure Sustainment (UIS), F12.00-00	208
X, FAA Employee Housing and Life Safety Shelter System Services, F20.01-01	209
2E03, Aircraft Related Equipment Program	210
A, Aircraft Related Equipment (ARE) Program, M12.00-00.....	210
B, NextGen Flight Simulation Testing and Research Technologies (Flight START) – Technology Refresh Program - Additional Projects, M12.01-04	213
X, William J. Hughes Technical Center Laboratories – Flight Program Consolidation – Sustainment, F14.01- 01.....	214
2E04, Airport Cable Loop Systems – Sustained Support.....	216
Airport Cable Loop Systems Sustained Support, F10.00-00.....	216
2E05, Alaskan Satellite Telecommunication Infrastructure (ASTI)	217
Alaskan Satellite Telecommunication Infrastructure (ASTI), C17.02-01 / X, Alaskan Satellite Telecommunication Infrastructure (ASTI) Enhancement, C17.02-02	217
2E06, Facilities Decommissioning	219
Decommissioning – Real Property Disposition, F26.01-01	219
2E07, Electrical Power Systems – Sustain/Support	221
Power Systems Sustained Support (PS3), F11.01-01 / X, Power Systems Sustained Support (P3S) – Future Segments, F11.01-02.....	221
2E08, Energy Management and Compliance (EMC).....	224
Energy Management and Compliance (EMC), F13.04-02	224
2E09, Child Care Center Sustainment.....	226
Child Care Centers – Infrastructure Improvements, F22.01-01	226
2E10, FAA Telecommunications Infrastructure 2	227
FAA Telecommunications Infrastructure – 2, C26.01-02.....	227
2E11, Data, Visualization, Analysis and Reporting System (DVARs)	229
2E12, Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration	230
Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration, M56.01-01	230
2E13X, Independent Operational Assessment	232
X, Independent Operational Assessment (IOA), M25.00-00	232
ACTIVITY 3: NON-AIR TRAFFIC CONTROL FACILITIES AND EQUIPMENT	233
A: Support Programs	233
3A01, Hazardous Materials Management	233
Environmental Cleanup / Hazardous Materials (HAZMAT), F13.02-00.....	233
3A02, Aviation Safety Analysis System (ASAS)	234
Regulation and Certification Infrastructure for System Safety (RCISS) – Segment 3, A17.01-03.....	234
3A03, National Airspace System (NAS) Recovery Communications (RCOM).....	236
NAS Recovery Communications (RCOM), C18.00-00	236
3A04, Facility Security Risk Management	238

Facility Security Risk Management (FSRM) – Two, F24.01-02	238
3A05, Information Security	239
Information Systems Security, M31.00-00	239
3A06, System Approach for Safety Oversight (SASO)	244
System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1a, A25.02-02 / X, System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1b, A25.02-03	244
3A07, Aviation Safety Knowledge Management Environment (ASKME)	247
Aviation Safety Knowledge Management Environment (ASKME) – Segment 2, A26.01-01 / X, Aviation Safety Knowledge Management Environment (ASKME) – Segment 3, A26.01-02	247
3A08, Aerospace Medical Equipment Needs (AMEN)	249
A, Aerospace Medical Equipment Needs (AMEN) – Phase 2, M53.01-02	250
B, Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Wind & Wave Evacuation Survival Facility (WIWAVES), M53.02-01	251
3A09, NextGen – System Safety Management Portfolio	252
A, Aviation Safety Information Analysis and Sharing (ASIAS), G07A.02-01	253
B, Systems Safety Management Transformation (SSMT), G07M.02-01	255
3A10, National Test Equipment Program	256
National Test Equipment Program, M17.01-01	256
3A11, Mobile Assets Management Program	258
Mobile Asset Management Program, F31.01-01	258
3A12, Aerospace Medicine Safety Information System (AMSIS)	259
Aerospace Medicine Safety Information System (AMSIS) – Segment 1, A35.01-01	259
3A13, Tower Simulation System (TSS) Technology Refresh	261
National Airspace System (NAS) Training - Equipment Modernization – Training Simulators – Tower Simulation System, M20.01-04	261
3A14X, Logistics Support System and Facilities (LSSF)	263
X, Logistics Center Support System (LCSS) – Sustainment Technology Refresh, M21.04-02	263
<i>B: Training, Equipment, and Facilities</i>	<i>264</i>
3B01, Aeronautical Center Infrastructure Modernization	264
Aeronautical Center Infrastructure Modernization, F18.00-00	264
3B02, Distance Learning	266
Distance Learning, M10.00-00	266
ACTIVITY 4: FACILITIES AND EQUIPMENT MISSION SUPPORT	268
4A01, System Engineering and Development Support	268
A, CIP Systems Engineering & Development Support – System Engineering Contract, M03.03-01	268
B, Provide Air Navigation Facilities (ANF)/Air Traffic Control (ATC) Support (Quick Response), M08.01- 00	270
4A02, Program Support Leases	271
Program Support Leases, M08.06-00	271
4A03, Logistics and Acquisition Support Services	272
NAS Regional/Center Logistics Support Services, M05.00-00	272
4A04, Mike Monroney Aeronautical Center Leases	273
Aeronautical Center Lease, F19.00-00	273
4A05, Transition Engineering Support	275
A, NAS Integration Support Contract (NISC), M22.00-00	275
B, Configuration Management Automation (CMA), M03.01-02	276

4A06, Technical Support Services Contract (TSSC)	277
Technical Support Services Contract (TSSC), M02.00-00	277
4A07, Resource Tracking Program (RTP)	278
Resource Tracking Program (RTP), M08.14-00	278
4A08, Center for Advanced Aviation System Development (CAASD)	279
CIP Systems Engineering & Technical Assistance – MITRE, M03.02-00	279
4A09, NextGen – Aeronautical Information Management Program	281
Aeronautical Information Management (AIM) Modernization Segment 2, G05A.02-05 / X, Aeronautical Information Management (AIM) Modernization Segment 3, G05A.02-06	281
4A10, NextGen – Cross Agency NextGen Management	283
Cross Agency NextGen Management, G08M.04-01	283

ACTIVITY 1: ENGINEERING, DEVELOPMENT, TEST, AND EVALUATION

1A01, ADVANCED TECHNOLOGY DEVELOPMENT AND PROTOTYPING (ATDP)

FY 2018 Request \$26.8M

- A, Runway Incursion Reduction Program (RIRP) – ATDP, S09.02-00
- B, System Capacity, Planning and Improvements – ATDP, M08.28-00
- C, Operations Concept Validation and Infrastructure Evolution – ATDP, M08.29-00
- D, Major Airspace Redesign – ATDP, M08.28-04
- E, Strategy and Evaluation – ATDP, M46.01-01
- F, Dynamic Capital Planning, M47.01-01
- G, Operational Analysis and Reporting System (OARS), M08.32-03
- H, Operations Network (OPSNET) Replacement – ATDP, A37.01-01
- I, Enterprise Management, Integration, Planning, and Performance Evaluation for NextGen, M03.04-01
- X, Operational Modeling Analysis and Data, M52.01-01
- X, Enterprise Information Management, G05M.04-01

A, Runway Incursion Reduction Program (RIRP) – ATDP, S09.02-00

Program Description

The RIRP will continue research, development, and operational evaluation of technologies to increase runway safety. Consistent with standing National Transportation Safety Board recommendations, research emphasis will remain on technologies that provide pilots with direct safety indications and alerts at large airports; and at small to medium airports for those that can be cost effectively applied. This program will test alternative airport surface detection technologies and the application of these technologies for pilot, controller, and vehicle operator situational awareness tools. Current initiatives include the development and operational testing of the Small Airport Surveillance Sensor (SASS), Runway Safety Assessment studies such as Runway Incursion Prevention Shortfall Analysis (RIPSA) to identify candidate small-to-medium sized airports with historically high rates of runway incursions, where new Runway Incursion (RI) prevention technologies can be prototyped and evaluated, and the removal of the Low Cost Ground Surveillance pilot sites. When appropriate, investment analyses will be performed to support acquisition and implementation of selected solutions.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 4 – Reduce Category A & B (most serious) runway incursions to a rate of no more than: 0.375 per million operations.*

Relationship to Performance Metric

The RIRP is developing and testing technologies that provide direct and preventive alerts to pilots and vehicle operators to reduce both the frequency of, and the risk of runway incursions. Much of the program's research emphasis is based on studies that show that direct pilot and vehicle warning mechanisms are the best defense against the most serious runway conflicts. For example, initial operational evaluations of the Runway Status Lights technology have yielded a reduction in runway incursions of up to 70% at the test runways. Other RIRP technology development initiatives will evaluate other technologies that may further support the performance metric.

Program Plans FY 2018 – Performance Output Goals

- Complete the annual report documenting the results of human-in-the-loop (HITL) testing Human Factors (HF), safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface based RI indications.
- Complete report on results of initial shadow operations testing for the utilization of a SASS system as a sensor to drive the activation of direct to pilot alerting safety logic.
- Complete report documenting RIPS candidate site selection for a system to test the utilization of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.
- Complete report on integration of a system to test the utilization of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.

Program Plans FY 2019 – Performance Output Goals

- Complete the annual report documenting results of HITL testing HF, safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface based RI indications.
- Select site, complete Safety Risk Management Document (SRMD), and initiate operational evaluation of using a SASS system as a sensor to drive the activation of direct to pilot alerting safety logic.
- Complete report on results of initial shadow operations testing for the utilization of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.

Program Plans FY 2020 – Performance Output Goals

- Complete annual report documenting results of HITL testing HF, safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface based RI indications.
- Complete annual report documenting results of using a SASS system as a sensor to drive the activation of direct to pilot alerting safety logic.
- Select site, complete SRMD, and initiate operational evaluation of using an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.

Program Plans FY 2021 – Performance Output Goals

- Complete the annual report documenting results of HITL testing HF, safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface based RI indications.
- Complete annual technical and operational evaluation report documenting results of using a SASS as a sensor to drive the activation of direct to pilot alerting safety logic.
- Initiate technical transfer of SASS technology to Air Traffic Organization (ATO) Program Management Office (PMO).
- Complete annual technical and operational evaluation report documenting results of using an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.

Program Plans FY 2022 – Performance Output Goals

- Complete annual report documenting results of HITL testing HF, safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface based RI indications.
- Complete annual technical and operational evaluation report documenting results of using an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.
- Initiate technical transfer of advanced ground surveillance sensor technology to ATO PMO.

B, System Capacity, Planning and Improvements – ATDP, M08.28-00

Program Description

The System Capacity, Planning, and Improvements program provides data and analyses on the NAS operations to FAA executives and managers to help them identify deficiencies and develop proposals to improve NAS performance.

Program work includes:

- Performing Airport modeling and analysis using data collected from ATC systems in the field to determine the value of potential improvements in airspace or airfield modifications;

- Developing new agency level metrics to enhance management awareness of, and response to system performance. Maintain and enhance the FAA Operational Metrics Web Page;
- Supporting key FAA International objectives to respond to inquiries on global flight efficiency performance targets for Air Traffic Management (ATM) or more general inquiries on the overall flight inefficiency that may be attributed to ATM.
- Providing analytical and modeling support for Commercial Space initiatives;
- Conducting airport capacity studies that provide assessment of procedural, technology, or infrastructure improvements;
- Developing a business case for enhanced surveillance and reduced oceanic separation as tasked by the ICAO North Atlantic Systems Planning Group and in support of NextGen Advisory Board; and
- Providing modeling and simulation support to assist in harmonizing separation standards among the flight information regions in the Caribbean and making the airspace more efficient for operators.

The program provides a collaborative means for experts from the FAA, academia, and industry to develop recommendations for improving capacity and system efficiency, and to reduce delays at specific airports. Using performance-based measurement systems and operations research capability, this group is able to quantify the efficiency of the NAS to form the basis of recommendations for system improvements.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core Airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program will facilitate the modeling, measurement, and analysis of airfield improvements, air traffic procedures, and other technological implementations to improve airport capacity and system efficiency. In advance of large-scale airport construction projects, capacity and delay impacts are also assessed in order to improve coordination between airports, aircraft operators, and ATC.

Program Plans FY 2018 – Performance Output Goals

- Conduct a workshop to examine development and coordination of international standardized measurement of system capacity, through-put, predictability and efficiency.
- Produce Joint Performance Benchmark Report with European Organization for the Safety of Air Navigation (EUROCONTROL)/the European Commission.
- Deliver performance modeling and economic analysis information to support the development of a business case with ICAO member states in the North Atlantic region for reduced oceanic separation using Automatic Dependent Surveillance-Broadcast (ADS-B) (Out).

Program Plans FY 2019 – Performance Output Goals

- Produce Joint Performance Benchmark Report with EUROCONTROL/the European Commission.
- Deliver performance modeling and economic analysis information to support the development of a business case with ICAO member states in the North Atlantic region for reduced oceanic separation using ADS-B (Out).

Program Plans FY 2020 – Performance Output Goals

- Produce Joint Performance Benchmark Report with EUROCONTROL/the European Commission.
- Deliver performance modeling and economic analysis information to support ICAO member states in the North Atlantic region.

Program Plans FY 2021 – Performance Output Goals

- Produce Joint Performance Benchmark Report with EUROCONTROL/the European Commission.
- Deliver performance modeling and economic analysis information to support ICAO member states in the North Atlantic region.

Program Plans FY 2022 – Performance Output Goals

- Produce Joint Performance Benchmark Report with EUROCONTROL/the European Commission.
- Deliver performance modeling and economic analysis information to support ICAO member states in the North Atlantic region.

C, Operations Concept Validation and Infrastructure Evolution – ATDP, M08.29-00

Program Description

Developing operational concepts is the first step in developing an Enterprise Architecture. This program develops and validates NAS level operational concepts that are key to the FAA modernization programs and the Next Generation Air Transportation System (NextGen). This program conducts the overall analysis and planning for NAS evolution by determining the required annual updates to the following NAS Enterprise Architecture products: Operational Improvements, Operational Sustainment, and Operational Requirements. It executes research, engineering analysis, and evaluation in support of mission analysis and investment analysis. This program conducts shortfall analyses as part of service analysis and ensures the linkage of proposed solutions back to validated operational needs to support budget planning and investment decisions. This program develops and maintains detailed second level concepts that support validation and requirements development. This work ensures that the NAS level operational concept and sustainment activities are integrated and consistent with the overall NAS Enterprise Architecture. This program supports the development and sustainment of analytical and computer models that are used to assess and validate operational changes to the NAS and supports the following activities:

- Conduct analyses to support assessments of new air traffic control operational concepts;
- Develop common concept development, validation, and measurement methodologies to support Single European Sky ATM Research Joint Undertaking;
- Develop concepts of use to describe the operational use of new communication, navigation, automation, surveillance and flight deck capabilities;
- Produce reports on concept development and validation findings including 2nd-level concepts, fast-time analyses and human-in-the-loop real time studies; and
- Develop operational, information and performance requirements.

This program contributes to the FAA's support for the RTCA, a non-profit association that develops standards based on manufacturers, government, and aviation operator inputs. RTCA also recommends operational improvements to increase the efficiency of air transportation.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Concept validation supports development, analysis, and simulation of new concepts to assess requirements and to evaluate the impact of the concept on system capacity, efficiency, safety and human performance. Evaluation criteria to include the following:

- Determine impact/improvement to Air Traffic Service Providers and airspace users from automation that could increase capacity;
- Determine impact/improvement to airspace structure which may increase productivity and hence capacity;
- Determine impact/improvement from communication, navigation, and surveillance requirements that support the FAA's efforts to reduce cost, increase capacity and efficiency; and
- Determine impact/improvement from changes to automation, display, and facility configuration elements designed to increase productivity and hence capacity.

Program Plans FY 2018-2022 – Performance Output Goals

- Develop and complete annual updates to the NAS Enterprise Level Operational Requirements based on prior year research and development.
- Develop and complete annual updates to the NAS Enterprise Architecture for NAS level Operational Improvements and operational sustainment activities based on prior year research and acquisition decisions.
- Conduct concept engineering activities and develop concept engineering/requirements validation artifacts, such as shortfall analyses, concept of operations, requirements, technical assessments, and evaluation documents.
- Develop technical papers and reports in support of RTCA. These artifacts include safety and performance requirements, operational services and environment definitions, minimum aviation system performance standards, minimum operational performance standards, NextGen implementation progress updates, and other reports as necessary.
- Support NextGen Advisory Committee priorities through various activities, such as:
 - Develop and complete a traffic flow management strategy to maintain capacity during PBN operations commensurate with the FAA’s implementation of the PBN Navigation Strategy; and
 - Complete review and assessment of FAA operational increments for NextGen planning commensurate with the FAA’s NextGen Vision.

D, Major Airspace Redesign – ATDP, M08.28-04

Program Description

The Major Airspace Redesign program supports increased efficiency and enhanced safety by funding physical changes in facilities necessary to accommodate airspace redesign. Implementation of an airspace redesign frequently results in changes to the number and span of control of operational positions or sectors, including changes to sector, area or facility boundaries. Transition to a new configuration resulting from airspace redesign requires changes in the supporting infrastructure. These infrastructure changes can include:

- Radio frequencies connecting a radio site to a control facility;
- Position to position connectivity;
- Surveillance infrastructure modifications to ensure proper radar coverage;
- Automation modifications to facility data and flight data processing;
- Inter-facility communication modifications;
- Additional consoles and communication backup needs; and
- Modifications to facility power and cabling.

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. Airspace redesign efforts seek to optimize Terminal, En Route, and Oceanic airspace by redesigning airspace via projects in major metropolitan areas with critical system wide impacts. Modernization of airspace through the Major Airspace Redesign Program is characterized by the migration from constrained ground-based navigation to the freedom of an Area Navigation / Required Navigation Performance based system. Airspace redesign efforts will modernize airspace in support of the full utilization of NextGen capabilities.

The program also supports the use of risk management and collaborative evaluation capabilities to identify requirements, opportunities and threats in the early stages of the design process.

Near term Major Airspace Redesign funding will be used to support airspace projects including, but not limited to, Caribbean Airspace under the control authority of Miami ARTCC (ZMA) and San Juan CERAP (ZSU). Additional near term focus will include multiple facilities managing air traffic in the New York Metropolitan Area. Future funding will be directed at operationally selected terminal airspace that would benefit from redesign. Any necessary sector or route changes associated with redesign cannot be implemented without support from this program, which makes the infrastructure changes needed to allow improvements in the efficient use of that airspace. Those changes require engineering, analytical and technical support of this program for safe and effective implementation.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The Major Airspace Redesign program will increase system efficiency in the NAS by reducing the constraints imposed by sub-optimal airspace structure in regions where air traffic demand often exceeds airspace capacity. Air traffic congestion, complexity, and sub-optimal airspace structure can result in traffic management restrictions that limit airspace throughput and airspace access. Airspace constraints can extend across large geographical regions causing departure/arrival delays at one or multiple airports and/or inefficient flight paths to circumvent constrained airspace. As such, system constraints attributable to airspace structure can adversely impact several of the more significant NAS performance metrics.

Program Plans FY 2018 – Performance Output Goals

- Conduct engineering analysis as needed for Caribbean airspace redesign implementation.
- Implement infrastructure changes resulting from airspace redesign.

Program Plans FY 2019-2022 – Performance Output Goals

- Conduct engineering analysis for candidate airspace redesign projects and implementation.
- Implement infrastructure changes resulting from airspace redesign.

E, Strategy and Evaluation – ATDP, M46.01-01

Program Description

The Strategy and Evaluation program develops and maintains mathematical models of the NAS which are used to help guide NextGen investments and other FAA enterprise-wide analyses. FAA's modeling suite includes models of varying scope, from systems dynamics models of the entire air transportation system to detailed airport surface models.

Several existing NAS models have become obsolete and no longer support the analysis needs for advanced Air Traffic Management (ATM) concepts. The Strategy and Evaluation program has been developing two new computer models to rectify these shortfalls. These models are being 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.

1. A NAS model, known as the System-Wide Analysis Capability (SWAC) is currently being used by FAA and contractors to analyze advanced 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.
2. 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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

In order to achieve this and other capacity metrics, the FAA is making a major long-term investment in the NextGen program; a wide-ranging transformation of the air transportation system. Numerous cost-benefit and engineering trade studies are required to support this complex undertaking. New models will be used for evaluating proposed operational improvements such as optimized profile descents, oceanic in trail procedures, trajectory-based operations, surface traffic management, collaborative ATM, closely-spaced parallel operations, advanced Required Navigation Performance (RNP) procedures, etc. New and improved models are needed to provide the analytical capabilities required to support these NAS improvements and help us realize our capacity objectives.

Program Plans FY 2018 – Performance Output Goals

- Deliver SWAC executable software incorporating advanced RNP concepts (e.g., dynamic RNP), integrating the Air Traffic Organization gate assignment model, and commercial space model.
- Deliver ADSIM+ executable software improving the movement rule-set used to limit aircraft interactions based upon wingspan and available space and the strategy rules-set used by an individual aircraft to guide response when airport resources are blocked by other aircraft.

Program Plans FY 2019 – Performance Output Goals

- Deliver SWAC (Beta version) executable software with improved integration and modeling of Unmanned Aircraft Systems (UAS) to analyze the future impact on the NAS.
- Deliver SWAC (Beta version) executable software capable of interacting with Geographical Information System (GIS) to better facilitate communication with stakeholders.
- Deliver ADSIM+ (Beta version) executable software capable of generating arrival/departure sequencing based on user-defined scenarios to support post-implementation analyses of recently deployed NextGen capabilities. To support this new capability, the Graphical User Interface (GUI) will be modified to incorporate input of the required data.

Program Plans FY 2020 – Performance Output Goals

- Deliver SWAC executable software capable of modeling more complex airspace flows, for example, time based metering.
- Deliver SWAC (production version) executable software updating the interface with GIS.
- Deliver ADSIM+ (production version) executable software updating the capability of generating arrival/departure sequencing based on user-defined scenarios to support post-implementation analyses of recently deployed NextGen capabilities.
- Deliver ADSIM+ (production version) executable software with an enhanced GUI to support user-defined scenarios.

Program Plans FY 2021 – Performance Output Goals

- Deliver SWAC (Beta version) executable software with capability of enhanced airport representation.
- Deliver SWAC (Beta version) executable software with enhanced command line interface.
- Deliver ADSIM+ (Beta version) executable software with a high-fidelity gate and taxiway model to more accurately model surface movement for post-implementation analyses of recently deployed NextGen capabilities. The GUI will be modified to perform taxi-path cloning and incorporate input of the required data to model the disaggregation of gate nodes.

Program Plans FY 2022 – Performance Output Goals

- Deliver SWAC (production version) executable software with capability of enhanced airport representation.
- Deliver SWAC (production version) executable software with enhanced command line interface.
- Deliver ADSIM+ (production version) executable software with a high-fidelity gate and taxiway model to more accurately model surface movement for post-implementation analyses of recently deployed NextGen capabilities.
- Deliver ADSIM+ (production version) executable software with an enhanced GUI to support the enhanced gate and taxiway model.

F, Dynamic Capital Planning, M47.01-01

Program Description

The Dynamic Capital Planning tools and support enable FAA to make optimal decisions based on best business practices. These tools and support provide verification that disciplined management of capital programs continues to be carried out. This program provides financial analysis tools and support for ongoing evaluation, tracking, and reporting of capital programs throughout the acquisition life cycle.

Dynamic Capital Planning supports FAA acquisition programs by:

- Validating quantitative and qualitative economic value and internal benefits for capital programs;
- Tracking NAS Plan schedules for all Capital Programs;
- Comparing financial performance for all major programs to approved baselines;
- Milestone tracking and schedule modeling;
- Tracking field implementation status of all NAS programs by site;
- Earned value monitoring throughout the program life cycle;
- Post implementation analysis for corporate lessons learned;
- Capitalizing NAS Plan installed equipment; and
- Disposal and closeout of retired assets in financial statements.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 8 – 90% of major baselined acquisition programs must be maintained within 10% of their current acquisition cost, schedule and technical performance baseline as of the end of fiscal year 2017. (FAA Business Planning Metric)*

Relationship to Performance Metric

Dynamic Capital Planning provides program tracking and analysis that support improved management of capital program baselines, baseline investment decisions, and early identification of programs not meeting performance expectations so that timely corrective action may be taken.

Program Plans FY 2018-2022 – Performance Output Goals

- Complete monthly capitalization report.
- Complete monthly program baseline status report.

G, Operational Analysis and Reporting System (OARS), M08.32-03

Program Description

The Air Traffic Organization's (ATO) Operational Analysis and Reporting System (OARS) will provide a collective approach to identify and manage NAS-wide safety trends and emerging risks before an accident or incident occurs. This initiative will deliver a suite of analytical capabilities and user interfaces to achieve the next level of safety required to support the introduction of NextGen technologies, operational concepts, and procedures into the NAS and to enhance the ATO's Safety Management System (SMS).

In order to identify safety trends and emerging risks, the ATO collects and analyzes operational data to identify and classify potential hazards. The results of these analyses are used to make decisions on how to best mitigate any unacceptable potential safety risks. OARS will provide the ATO with data sharing capability among legacy and future systems, databases, and tools utilized for safety risk analysis across the NAS. OARS will provide the end-user with quick and easy access to consistent, accurate and timely data and allow more efficient, comprehensive, and proactive analyses of risk in the NAS.

OARS will be implemented in three phases. The OARS initial implementation (Phase 1) will provide controllable, tiered levels of access to safety data aggregated from multiple databases. Phase 1 will:

- Establish the necessary design components to enhance current capabilities and enable existing systems to share data in a secure, reliable manner; and
- Automate several of the labor-intensive manual processes that occupy a large part of the analyst's resources.

OARS Phase 1 replaces legacy operational safety analysis systems with a single safety analysis platform that will streamline and replace work-intensive and inefficient manual data transfer processes while still ensuring that a user makes critical safety analysis decisions when necessary. In OARS Phase 1, the functions of a number of legacy systems and tools will be integrated and consolidated onto a common platform. Those systems and tools include the following:

- Comprehensive Electronic Data Analysis & Reporting;
- Rapid Air Traffic Replay Tool;
- Traffic Analysis and Review Program;
- Risk Analysis Process (RAP) Tools (Airborne (A-RAP), Surface (S-RAP) & Service Integrity (SI-RAP));
- Compliance Verification Tool;
- Runway Safety Systems;
- Safety Management Tracking System;
- Safety Applications and Analytics (key performance indicators, Dashboards, etc.);
- Aviation Common Taxonomy; and
- Processed Track (e.g. Threaded Track/Flight Story).

OARS Phase 1 will leverage role-based access to data internally in the ATO, between NAS Operations and ATO Safety Management, using data management and access capabilities provided by the agency's enterprise capabilities, such as Enterprise Data Control Services or the various enterprise operational data stores (warehouses). OARS will provide meta-data exchange capabilities to share data directly with both the Office of Aviation Safety and FAA Airports Safety.

The OARS program achieved a successful Investment Analysis Readiness Decision in FY 2015. The Initial Investment Decision is planned in FY 2017. The Final Investment Decision (FID) is planned in FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 5 – Reduce risks in flight by limiting the rate of the most serious losses of standard separation to 10 or fewer for every thousand (.01) losses of standard separation within the National Airspace System.*

Relationship to Performance Metric

To achieve the next level of safety, the traditional methods of identifying losses of separation and other hazardous events are not sufficient; the FAA must identify safety risks before they result in hazardous events. OARS will allow the FAA to identify the high risk events for all phases of flight. These data points will be used to identify corrective action plans to mitigate potential high risk events in the NAS before they occur. This will allow the strategic management of equipment and personnel resources in prioritizing efforts to obtain maximum safety improvements utilizing the most cost effective approach.

Program Plans FY 2018 – Performance Output Goals

- Achieve FID approval from the Joint Resources Council.

Program Plans FY 2019 – Performance Output Goals

- Pending FID approval:
 - Award prime solution development contract.
 - Conduct System Functional Review with prime development contractor.

Program Plans FY 2020 – Performance Output Goals

- Output goals will be determined at FID.

Program Plans FY 2021-2022 – Performance Output Goals

- None.

H, Operations Network (OPSNET) Replacement – ATDP, A37.01-01

Program Description

Accurate NAS metrics are needed to evaluate and improve the FAA's management of the NAS. The current Operations Network (OPSNET) is the official FAA system for collecting and reporting flight operations count and delay metrics. The OPSNET system measures the number of delays attributable by cause and includes weather, air traffic volume, equipment status, and runway conditions. Identifying all delays and attributing causal-factors is necessary to identify capacity-constraining scenarios, develop mitigation strategies, and improve efficiency of NAS operations. The OPSNET system provides automated facility-level flight-operations counts by user classification including air carrier, air taxi, general aviation, and military for FAA towered airports, TRACONS, and ARTCCs, whereas Federal contract towers provide manual traffic counts. Primary uses of OPSNET include the Administrator's weekly NAS performance status report (S-1 Report), measurement of post-implementation NextGen improvements, facility classifications, workforce planning, and performance analysis among the aviation community.

Few modifications have been made to OPSNET over the past 25 years and the system possesses significant limitations. Categories of current limitations include: Data Accuracy and Completeness, Information Availability, Data Input/System, and Data Harmonization. The reported delay data does not provide a comprehensive picture of delays and differs from the airline delay data reported to the Department of Transportation. The current collection of delay data is not fully automated, the storage capabilities are limited, and the system cannot easily adapt to regulatory changes.

The OPSNET Replacement program will expand the collection and recording of delay capabilities to improve reporting and it will provide a system that limits manual data entry and automates compilation of operational data received from FAA automation systems. These improvements, along with increased accuracy in reporting, will enable the FAA and the aviation community to measure causes of delay by phase of flight to improve air traffic operational services and procedures. By improving definitions for measuring NAS performance, and in coordination with the aviation community, the definition of the reported metrics can be standardized. Having accurate, standardized metrics for reporting will enable improved benchmarking and more accurate forecasting to facilitate analysis of NAS performance.

OPSNET Replacement Investment Analysis Readiness Decision is planned for 2017; the Initial Investment Decision (IID) is planned for FY 2018; and the Final Investment Decision (FID) is planned for FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Benefits include improved reliability in the reporting of operations data, reduced ATC workload of data input through automation systems and better reporting of NextGen performance metrics. Analysis and reporting provided by the OPSNET Replacement may identify opportunities for changes to NextGen Operational Improvements that allow more efficient use of NAS airspace.

Program Plans FY 2018 – Performance Output Goals

- Complete the Initial Implementation Strategy and Planning Document (ISPD).
- Perform Concept Engineering for requirements validation.
- Achieve IID.
- Develop the following products in support of the FID:
 - Final Program Requirements Document
 - Enterprise Architecture Products
 - Business Case documentation
 - Final ISPD
 - Acquisition Program Baseline (APB) (Execution Plan)

Program Plans FY 2019 – Performance Output Goals

- Achieve FID.
- Finalize Concept Engineering for requirements validation.
- Complete Activities to Award Contract and Enter Solution Implementation:
 - Award Contract
 - Produce the System Specification Document
 - Complete System Design Reviews
 - System Development and Integration
- Other output goals will be determined at FID.

Program Plans FY 2020 – Performance Output Goals

- Complete the following and achieve In-Service Decision:
 - Stakeholder Coordination and Review
 - Operational Testing
 - Information System Security Authorization

Program Plans FY 2021 – Performance Output Goals

- Conduct Post-Implementation Review Operational Analysis.
- Establish connectivity to external interfaces and SWIM.
- Complete analysis and development of system enhancements and document objective requirements.

Program Plans FY 2022 – Performance Output Goals

- Complete data acquisition and testing from external interfaces and SWIM.
- Complete system enhancements and objective requirements.

I, Enterprise Management, Integration, Planning, and Performance Evaluation for NextGen, M03.04-01

Program Description

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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

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.

Program Plans FY 2018 – Performance Output Goals

- Complete an annual business plan that supports the FAA's Strategic Priorities.
- Complete a long-term procurement plan that establishes a process and framework for determining and monitoring the effectiveness of contract vehicles.
- Complete a human capital management plan to assist management in developing a technical workforce for the future.

Program Plans FY 2019-2022 – Performance Output Goals

- Implement, assess and update the annual business plan that supports the FAA's Strategic Priorities.
- Implement and assess the long-term procurement plan that establishes a process and framework for determining and monitoring the effectiveness of contract vehicles.
- Implement and assess the human capital management plan to assist management in developing the technical workforce for the future.
- Conduct and assess long-term planning and technical analyses of the NextGen enterprise portfolio.

X, Operational Modeling Analysis and Data, M52.01-01

Program Description

The Operational Modeling Analysis and Data program provides support to 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 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).

The following products are planned:

- Enhancements to the NAS Data Warehouse (NAS-DW) through infrastructure improvements, both hardware and software;
- Enhancements to the NAS Data Warehouse through ingestion of new data sources;
- Enhancements to Aviation System Performance Metrics (ASPM) through integration of operational events data on a per-flight basis;
- Enhancements to ASPM through integration of operational events data by facility;
- Enhancements to ASPM through improved operational efficiency and performance;
- Technology transfer of MITRE developed tools for operational analysis; and

- Tools that provide reliable and comprehensive extraction of data from repositories of operational data.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Operational modeling and analysis are used by the FAA to understand the causes of delay, which are usually related to capacity constraints. Models are also essential tools for estimating the improvement to NAS performance resulting from capacity-enhancing programs. This program will allow the FAA to determine the potential benefits of capacity initiatives and identify the most promising investments to expand capacity.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete NAS-DW Requirements Assessment.
- Complete NAS-DW Shortfall Analysis.
- Complete ASPM Requirements Assessment.
- Complete ASPM Shortfall Analysis.
- Complete integration of ASPM processes into NAS-DW.
- Complete plan for FY 2020 transfer of MITRE developed technology.

Program Plans FY 2020 – Performance Output Goals

- Develop NAS-DW capability of processing data near real-time.
- Develop ASPM capability of reporting near real-time.
- Complete transfer of MITRE developed technology identified in FY 2019.
- Complete plan for FY 2021 transfer of MITRE developed technology.
- Identify NAS-DW and ASPM enhancements for FY 2021.

Program Plans FY 2021 – Performance Output Goals

- Complete NAS-DW enhancements identified in FY 2020.
- Complete ASPM enhancements identified in FY 2020.
- Identify NAS-DW and ASPM enhancements for FY 2022.
- Complete transfer of MITRE developed technology identified in FY 2020.
- Complete plan for FY 2022 transfer of MITRE developed technology.

Program Plans FY 2022 – Performance Output Goals

- Complete NAS-DW enhancements identified in FY 2021.
- Complete ASPM enhancements identified in FY 2021.
- Identify NAS-DW and ASPM enhancements for FY 2023.
- Complete transfer of MITRE developed technology identified in FY 2021.
- Complete plan for FY 2023 transfer of MITRE developed technology.

X, Enterprise Information Management, G05M.04-01

Program Description

The Enterprise Information Management (EIM) Enterprise Capability (EC) is a cloud-based platform in the Mission Support environment to deliver capabilities to enable the Agency to move away from silo-centric applications and move 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. There are substantial redundancies in data and information systems and inconsistencies in their management that increase agency costs. Specifically, the EIM EC will provide common storage, processing, and access to data sources included but not limited to the following information domains or systems: Aeronautical Information Products and Services, Safety, Airports, Logistics and Maintenance, System Wide Information Management enabled data sets, etc.

The existing technical infrastructure is aging and is not sustainable given 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 inhibit the synthesis and analysis of the agency's growing volume of data. Individual systems are resource constrained and are unable to leverage advancements in Big Data technology occurring in the commercial sector.

The program 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; and
- 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 EIM program will build out and extend capabilities associated with technology transfer of a cloud-hosted, enterprise capability to implement a “forward fit” strategy that scales to support requirements of new and modernized systems across the FAA. EIM will deliver improved capabilities in development, test, staging, and production environments, and continuation of the systems development life cycle including 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.

The build out and extension of the EIM EC will enable the integration and support of future and evolving systems and data resources to maximize operational impact by delivering enterprise scale services; and minimize overall costs by reducing the need for redundant development, deployment and operations of common enterprise data and information management infrastructure and services. An EIM EC delivers common data and information services that support, but are decoupled from specific systems, so that they are securely exposed and available to systems and users across the FAA. This shared approach reduces operational complexity for both the enterprise and the user as it promotes greater access and use of data and information services.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The FAA supports and implements new technologies to ensure that modernized systems are in place to support information assets across organizational and technological boundaries to improve efficiency, reduce costs, promote transparency, and enable business insight. EIM provides an enterprise capability that allows enterprise-level data/information to be more easily discoverable and securely accessible to consumers both internal and external to the FAA.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete delivery of core enterprise services for collection & storage, curation/preparation, analysis, and security.
- Enable/host common supportive services for analytics, visualization, and applications of relevance to users.

Program Plans FY 2020 – Performance Output Goals

- Provide an EIM EC, FAA Cloud Service (FCS) hosted development environment to support pre-production design integration needs of Operational Analysis and Reporting System.
- Complete the integration of five additional data sources required to support new systems/applications.
- Complete the integration of additional data curation and processing capabilities to support new systems/applications.
- Provide 4 additional common service tools to deliver analytic and/or visualization services for external systems/applications.
- Deliver updated security documentation to support and obtain authority to operate, for all newly integrated capabilities.

Program Plans FY 2021 – Performance Output Goals

- Provide EIM EC, FCS hosted development environments to support two additional system/application development and integrations efforts. Integrate 5 additional data sources required to support new systems/applications.
- Integrate 4 additional data curation and processing capabilities to support new systems/applications.
- Provide 2 additional services tools to deliver and support 1 advanced analytic and 1 advanced visualization service.
- Deliver updated security documentation to support and obtain authority to operate for all newly integrated capabilities.

Program Plans FY 2022 – Performance Output Goals

- Provide EIM EC, FCS hosted development environment to support three additional system/application development efforts.
- Provide access and control services to enable external/public access to designated FAA “open data sources”.
- Integrate 10 additional data sources to support new systems/applications.
- Deliver updated security documentation to support and obtain authority to operate for all newly integrated capabilities.

1A02/1A03, WILLIAM J. HUGHES TECHNICAL CENTER LABORATORY IMPROVEMENT

FY 2018 Request \$1.0M

FY 2018 Request \$18.0M

William J. Hughes Technical Center Laboratories, F14.00-00

Program Description

The William J. Hughes Technical Center (WJHTC) Laboratories program provides for the sustainment and modernization of FAA's centralized NAS laboratories located in Atlantic City, NJ. These laboratory facilities with supporting infrastructure provide an integrated platform for research, development, test, evaluation, and operational field support for all NAS and NextGen acquisition programs within the FAA. These laboratories are used to support development and test of prototype systems and NextGen solutions for integration into the NAS. Once operational, these systems become part of the FAA's laboratories and are used for future development, system upgrades, and testing necessary to support operational field sites. Sustaining these laboratories in system configurations and capabilities that match field sites is critical to providing around the clock operational support to En Route, Terminal, and other ATC facilities.

Testing and support facilities include:

- En Route System Support Facility;
- Terminal System Support Facility;
- Oceanic System Support Facility;
- Traffic Management Systems;
- Weather Systems;
- Communications Systems;
- Radar Systems;
- Navigation and Tracking Systems;
- Target Generator Facility;
- Cockpit and Tower Simulation Facilities; and
- Human Factors Laboratory.

The program uses shared support services to sustain the operation of the laboratories, including infrastructure engineering, technical services, laboratory networking, configuration management, test and simulation services, laboratory maintenance, scheduling support for multi-user laboratories, and laboratory management. The program provides for the hardware and software licenses and maintenance agreements for the NAS equipment and supporting infrastructure in the laboratories.

The Laboratory Services Division maintains a Space and Infrastructure Master Plan that provides for consolidation and segregation of Operational (Priority One) systems, isolating batteries in the labs containing electrolytes, reconfiguring laboratories to provide space for new labs, grouping equipment with similar functions, and ensuring the continuity of operations for the laboratory systems. Operational Priority One systems require an infrastructure that supports a 24/7 environment with resiliency provisions. Implementation of these type of projects will be conducted over 5 phases from FY 2016 through 2020.

This program also provides for the NAS Modernization of laboratory infrastructure and equipment by providing life-cycle replacement or upgrades of items, such as transient voltage surge suppression, raised floors, electrical distribution panels, power monitoring in electrical distribution panels, computer air conditioning units, main lighting panels, and computer room air conditioning monitoring systems.

This program is registered to the International Standards Organization (ISO) 9001:2008 standard for its processes and procedures in the management of computer systems laboratories in support of the NAS. This ensures that the laboratories are operated at their optimal level of efficiency, meeting customer requirements, maintaining scope and schedule, and continually improving.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

These centralized laboratories at the WJHTC serve as FAA's research, development, testing, evaluation, and operational field support. With centralization of the laboratories, programs do not need to establish and maintain separate laboratory facilities to support research, development, test, evaluation, and field support. Having centralized laboratories enables the FAA to evaluate concepts and programs that span more than one domain and integrate NextGen solutions into the NAS. This reduces the overall cost to the FAA, helps critical acquisition programs maintain cost and schedule targets, and improves the overall operational efficiency of the agency.

Program Plans FY 2018 – Performance Output Goals

- Implement the 3rd phase of the Space and Infrastructure Master Plan that reconfigures the labs and consolidates and segregates the priority one systems. Implementation projects include Weather systems consolidation area phase 2 of 2, reconfiguration lab system manager areas, finalization of the Priority One Rack Room design, and installation of Common Support Services-Weather (CSS-Wx).
- Complete a performance assessment of the laboratory management support services including engineering, configuration management, system design and installation, data management, and technical support services for NAS and NextGen programs.
- Complete 80% of the Quality Goals as part of the WJHTC Laboratory's ISO 9001:2008 quality management system. Validate by passing an independent audit.
- Achieve a Quality Management Customer Feedback response rating of 3.5 or higher (meets or exceeds customer requirements).
- Complete 70% of the NAS Modernization projects scheduled for completion in FY 2018.

Program Plans FY 2019 – Performance Output Goals

- Implement the 4th phase of the Space and Infrastructure Master Plan that reconfigures the labs and consolidates and segregates the priority one systems. The projects include the relocation of the NextGen Integration & Evaluation Capability (NIEC), expansion of the Unmanned Aircraft Systems (UAS) lab, and relocation of the Target Generation Facility.
- Complete a performance assessment of the laboratory management support services including engineering, configuration management, system design and installation, data management, and technical support services for NAS and NextGen programs.
- Complete 80% of the Quality Goals as part of the WJHTC Laboratory's ISO 9001:2008 quality management system. Validate by passing an independent audit.
- Achieve a Quality Management Customer Feedback response rating of 3.5 or higher (meets or exceeds customer requirements).
- Complete 70% of the NAS Modernization projects scheduled for completion in FY 2019.

Program Plans FY 2020 – Performance Output Goals

- Implement the 5th phase of the Space and Infrastructure Master Plan that reconfigures the labs and consolidates and segregates the priority one systems. The projects include completing the construction of the Priority One Rack Room and the relocation of the priority one equipment into the room.
- Complete a performance assessment of the laboratory management support services including engineering, configuration management, system design and installation, data management, and technical support services for NAS and NextGen programs.
- Complete 80% of the Quality Goals as part of the WJHTC Laboratory's ISO 9001:2008 quality management system. Validate by passing an independent audit.
- Achieve a Quality Management Customer Feedback response rating of 3.5 or higher (meets or exceeds customer requirements).
- Complete 70% of the NAS Modernization projects scheduled for completion in FY 2020.

Program Plans FY 2021 – Performance Output Goals

- Prepare plans, requirements, cost estimates and seek approval for the development of a mini Central Utility Plant as a source of 24/7/365 critical power distribution and redundant cooling at the WJHTC Laboratories.
- Complete a performance assessment of the laboratory management support services including engineering, configuration management, system design and installation, data management, and technical support services for NAS and NextGen programs.
- Complete 80% of the Quality Goals as part of the WJHTC Laboratory's ISO 9001:2008 quality management system. Validate by passing an independent audit.
- Achieve a Quality Management Customer Feedback response rating of 3.5 or higher (meets or exceeds customer requirements).
- Complete 70% of the NAS Modernization projects scheduled for completion in FY 2021.

Program Plans FY 2022 – Performance Output Goals

- Implement Phase 1 of the mini Central Utility Plant as a source of 24/7/365 critical power distribution and redundant cooling at the WJHTC Laboratories.
- Complete a performance assessment of the laboratory management support services including engineering, configuration management, system design and installation, data management, and technical support services for NAS and NextGen programs.
- Complete 80% of the Quality Goals as part of the WJHTC Laboratory's ISO 9001:2008 quality management system. Validate by passing an independent audit.
- Achieve a Quality Management Customer Feedback response rating of 3.5 or higher (meets or exceeds customer requirements).
- Complete 70% of the NAS Modernization projects scheduled for completion in FY 2022.

1A04, WILLIAM J. HUGHES TECHNICAL CENTER INFRASTRUCTURE SUSTAINMENT

FY 2018 Request \$10.0M

William J. Hughes Technical Center Building & Plant Support, F16.00-00

Program Description

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. The current value of the buildings and infrastructure is in excess of \$600 million. These facilities require an annual program of capital improvements and modernization. Example projects include: (1) replacing old heating, ventilation, and air-conditioning systems; (2) upgrading the electrical distribution systems; and (3) upgrading fire-suppression systems to current fire safety codes.

An infrastructure providing and sustaining a suitable, reliable environment (i.e. power, cooling, etc.) for the Technical Center's 24x7x365 operations supports mission critical systems hosted at the Technical Center such as Traffic Flow Management Production Center, FAA Telecommunications Infrastructure, and the Enterprise Data Centers that support FAA Information Technology operations. In addition to these operational systems at WJHTC, the Technical Center must provide 24x7 support to monitoring of systems and functions such as Reduced Vertical Separation Minimum, Wide Area Augmentation System, Automatic Dependent Surveillance-Broadcast and System Wide Information Management. The infrastructure also supports second level engineering support to resolve critical issues for operational NAS systems (e.g., En Route Automation Modernization, Standard Terminal Automation Replacement System, and Advanced Technologies and Oceanic Procedures).

The WJHTC developed a 20 year facility master plan for building infrastructure sustainment, which was completed in July of 2008 and updated in September of 2014. The master plan was developed based upon consideration of life safety issues, code compliance issues, equipment age, life expectancy, replacement part availability, and general condition for each system. Replacement strategies and priorities were developed based upon Condition Codes and Importance Factors. The Condition Codes indicate the need for modernization or replacement. The Importance

Factors address the importance of each building and project to WJHTC's mission. Projects have been programmed to reflect consideration of their respective Condition Codes (i.e., need for update or replacement) and Importance Factors (relative mission impact if not updated or replaced). For FYs 2018-2022, all planned projects have a Condition Code of "1" (poor) or "2" (fair/adequate) and an Importance Factor of "1" (are essential to mission or are life safety related) or "2" (are important to mission or have significant operational impact).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

Infrastructure Modernization at the WJHTC will control costs while delivering quality customer service by replacing aging facility systems /equipment before serious problems occur. It will also reduce energy consumption, and cost, on a per-square-foot basis. This line item will improve life cycle infrastructure planning as well as update facilities and facility support systems to ensure that the laboratories and associated buildings operate properly and can handle the utility loads of the systems being tested. As the WJHTC plays a key role in developing and testing new equipment that will be used in the NAS, it is critical that the facilities operate efficiently. WJHTC effectiveness in testing and approving equipment can result in earlier system deployment thereby reducing costs for system implementation.

Program Plans FY 2018 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 300 Mechanical Equipment Replacements (air conditioning unit 17) (Phase 2 of 10) (includes attendant mold remediation work).
- Complete Building 316 Electrical Substation Replacements (2 Substations plus Switch House) (Phase 1 of 2).
- Complete Building 316 Chiller Replacements (2 Chillers).
- Complete Life Safety Improvements to Buildings 27 and 28.
- Complete Building 303 Roof Replacement.

Program Plans FY 2019 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 300 Mechanical Equipment Replacements (air conditioning units 6, 7, and 8) (Phase 3 of 10) (includes attendant mold remediation work).
- Complete Building 316 Electrical Substation Replacements (3 Substations) (Phase 2 of 2).
- Complete Life Safety Improvements to Buildings 33, 56 and 270.
- Complete Central Utilities Plant Chiller (No. 2 of 3) Replacement.
- Complete Refurbishment of Elevators in Building 316.

Program Plans FY 2020 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 300 Mechanical Equipment Replacements (air conditioning unit 10) (Phase 4 of 10) (includes attendant mold remediation work).
- Complete Central Utilities Plant Chiller (No. 3 of 3) Replacement.
- Complete Refurbishment of Elevators in Buildings 27, 287 and 301.
- Complete Central Utilities Plant Electrical Switchgear Replacement.
- Complete Architectural, Mechanical and Electrical Systems Improvements to 20 Research and Development Buildings (Phase 1 of 2).

Program Plans FY 2021 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 300 Mechanical Equipment Replacements (air conditioning units 3, 4 and 5) (Phase 5 of 10) (includes attendant mold remediation work).
- Complete Architectural, Mechanical and Electrical Systems Improvements to 20 Research and Development Buildings (Phase 2 of 2).
- Complete Repair/Upgrade of Atrium Floor in Building 300 (Phase 1 of 2).

Program Plans FY 2022 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 300 Mechanical Equipment Replacements (air conditioning units 1, 2 and 13) (Phase 6 of 10) (includes attendant mold remediation work).
- Complete Repair/Upgrade of Atrium Floor in Building 300 (Phase 2 of 2).
- Complete Building 316 Fire Detection/Annunciation System Upgrades.
- Complete Water and Sanitary Sewer System Improvements (Phase 1 of 5).

1A05, NEXTGEN – SEPARATION MANAGEMENT PORTFOLIO

FY 2018 Request \$13.5M

- A, Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management, G01S.02-01
- B, Modern Procedures, G01A.01-01
- C, Wake Turbulence Re-Categorization, G06M.02-02
- D, Separation Automation System Engineering, G01A.01-06
- E, Closely Spaced Parallel Runway Operations, G06N.01-02
- F, Concept Development for Integrated NAS Design & Procedures Planning, G05A.02-04
- X, NextGen Oceanic Capabilities, G01A.01-07

A, Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management, G01S.02-01

Program Description

ADS-B In Applications – Interval Management (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 IM clearance that allows flight crews to manage spacing through speed adjustments generated by onboard IM avionics until reaching a planned termination point. IM operations require new flight-deck functions implemented in Flight Interval Management avionics to provide speed guidance to a flight crew to achieve and maintain a relative spacing interval from another aircraft. IM is applicable to en route and terminal airspace and will require investments in air traffic management and decision support automation systems as well as flight deck avionics. Changes to Data Communications (Data Comm), 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 IM operations.

Advanced Interval Management (A-IM) supports IM arrivals, approach, and cruise operations, and single runway and dependent runway operations. Pre-implementation activities for A-IM under this program include working with Industry through RTCA Special Committee 186 (SC-186) Working Group 4 (WG-4) to develop avionics standards for A-IM, specifically the Flight-deck based Interval Management Minimum Operational Performance Standards v2 (FIM MOPS v2) and Safety Performance Requirements (SPR).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

IM will optimize spacing resulting in maximizing the number of aircraft arriving in the proper sequence for landing. Reducing the variance in inter-aircraft spacing will result in more efficient use of runway capacity. The full benefits case is part of the analysis to be completed for the Final Investment Decision.

Program Plans FY 2018 – Performance Output Goals

- Complete the A-IM initial Program Requirements.
- Complete the initial draft of FIM MOPS v2.

Program Plans FY 2019 – Performance Output Goals

- Complete the Integrated Test Procedures for FIM MOPS v2.

Program Plans FY 2020 – Performance Output Goals

- Complete Final Review and Comment and Program Management Committee approval for FIM MOPS v2 and SPR.

Program Plans FY 2021-2022 – Performance Output Goals

- None.

B, Modern Procedures, G01A.01-01

Program Description

Modern Procedures will develop en route automation enhancements to support planned NextGen operational improvements. Enhancements will be developed by evaluating operational needs, defining operational concepts, developing requirements documents, testing and prototyping of proposed enhancements and developing acquisition documents to support a decision for implementation. To enhance automation separation management, controllers will be provided with decision support tools to more efficiently use available airspace and facilitate trajectory changes to avoid potential conflicts on an aircraft's planned flight path.

This program is currently planning activities in the following areas:

- Radar Position (R-Side) Trial Planning and Probed Menus
 - Trial Planning and Probed Menus prototype development
 - Trial Planning and Probed Menus prototype Subject Matter Expert (SME) assessment
- Intra-ERAM Controller-to-Controller Coordination Tools
 - Intra- En Route Automation Modernization (ERAM) Controller-to-Controller Coordination prototype development
 - Intra-ERAM Controller-to-Controller Coordination prototype SME Assessment
- Investment Analysis Readiness Decision (IARD) artifacts for Identified Modern Procedures Capabilities

Modern Procedures will complete activities to provide IARD Tech Transfer package to Air Traffic Organization Program Management Office for Future ERAM Enhancements Investment Analysis.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Enhancements to Air Traffic Control automation will allow controllers to more efficiently use available airspace by identifying potential conflicts or other complications on an aircraft's planned flight path and facilitate trajectory changes if advised. Trajectory Based Operations requires this capability to increase airspace capacity and provide more efficient routes and altitudes to accommodate demand.

Program Plans FY 2018 – Performance Output Goals

- Develop the IARD Tech Transfer package for the following capabilities following products for: R-Side Trial Planning and Controller-to-Controller Coordination:
 - Operational Scenarios
 - Use Case Document
 - Functional Analysis Document
 - Shortfall Analysis Report
 - Concept of Operations Document
 - Safety Management System Hazards Assessment
 - Preliminary Program Requirements

Program Plans FY 2019-2022 – Performance Output Goals

- None.

C, Wake Turbulence Re-Categorization, G06M.02-02

Program Description

The Wake Re-Categorization (RECAT) program will safely provide additional Airport throughput capacity for NAS users by reducing the required wake separation standards used by controllers in managing daily ATC operations. This program is being implemented in three phases based upon advanced research and analysis data of the vortices generated by aircraft based upon their size and weight; the influence of weather conditions on the transport and decay of these vortices; and their effect on in-trail aircraft based upon their characteristics. Each phase of this program will provide increasing throughput benefits to airports as our technical understanding of the effects of the wake vortices phenomena increases and corresponding revisions to existing separation standards are issued consistent with the safety margins required for these ATC operations. Changes in wake separation standards are tailored and implemented to specific airports based upon runway configurations local weather conditions (e.g. direction and strength of prevailing winds).

The RECAT Phase I wake separation standards have been completed and new standards for ATC operations at specific airport locations were implemented in November 2012. The NAS-wide implementation of Phase I (and now Phase II) wake separations standards products were requested by the RTCA's NextGen Advisory Committee based upon the throughput capacity increases and operating cost savings provided to air carriers such as FedEx, United Parcel Service (UPS), and Delta Air Lines through ATC's use of the Phase I wake separation standards with no additional aircraft equipage required.

The RECAT Phase II program has developed an airport specific set of wake separation standards tailored for the aircraft fleet mix operating at these airports with key site implementation in September 2016. Additional development efforts to refine the Phase II separations is now underway and will be incorporated into the RECAT Phase II waterfall at NextGen Core Airports and servicing TRACONS.

The RECAT Phase III program has the potential to realize an additional 5 to 10% airport throughput capacity (above that achieved by Phase II) based upon research analyses from the NextGen Wake Turbulence R,E&D project. This would require wake mitigation separations to be tailored in real-time to both the weather occurring along the flight path and to the individual aircraft receiving the ATC wake mitigation separations. Beginning in FY 2019, the program will begin the design of the chosen alternative(s) (RECAT Phase III) to include a detailed description of how ATC would use the Phase III wake mitigation separation product(s) and of the ATC decision support tools associated with

the Phase III product(s). The RECAT Phase III alternatives will include Time Based Separations which allow for the reduction of wake separation distances in high headwind conditions by using wake decay over time to determine the wake separation requirement. Other RECAT Phase III alternatives will include considerations for the use of crosswinds, other environmental factors, and unique aircraft characteristics to dynamically change wake separations. Design of Phase III product(s) and the development of the supporting safety assessment(s) will continue through FY 2021. Development of the RECAT Phase III product(s) is in concert with the RTCA's request to the FAA to develop the Operational Improvement 102152 "Dynamic Pairwise Wake Turbulence Separation."

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The RECAT program is focused on increasing the throughput capacity of airports and congested air corridors. Increased airport throughput capacity allows airports to achieve more arrivals and departures per hour during periods of heavy demand by the airport's major users thereby increasing the average daily capacity for the core airports. The RECAT Phase I product has updated the legacy wake turbulence separation standards to address changes in the aircraft fleet mix that have occurred over the last two decades at the NextGen core airports. The Phase I product has yielded significant arrival and departure runway throughput capacity increases for those airports whose aircraft fleet mix closely matched the design of the Phase I standards.

FedEx, the major air carrier at the Memphis International Airport (MEM), has received a double digit increase in departure runway throughput capacity since the introduction of the Phase I standards as well as significant fuel savings in their MEM arrival operations. UPS is seeing similar benefits at its major hub airport, Louisville International Airport. Delta Air Lines, the major air carrier at Hartsfield-Jackson Atlanta International Airport (ATL), is seeing greater runway throughput during periods of high runway demand at ATL. Delta has equated the throughput capacity increase at ATL to a yearly operating cost savings of \$14.8M.

The RECAT Phase II product is projected to provide an additional 4-7% increase in runway throughput capacity at those NextGen Core airports that would have received a smaller benefit from implementing the RECAT Phase I product. The RECAT Phase III product(s) has the potential to deliver an additional 5 to 10% increase in airport runway throughput capacity above what will be achieved by the use of the Phase II product.

Program Plans FY 2018 – Performance Output Goals

- Complete high level human factors analysis to determine the feasibility of ATC additional wake categories for RECAT operations, including the use of decision support tools to aid with wake separation requirements on departure.
- Complete additional analysis to assess increasing the number of categories available for RECAT operations to improve the achievable capacity benefit for RECAT Phase II implementation.
- Complete analysis of headwind conditions; their operational impacts in the NAS; and assess the need for Time Based Separations.

Program Plans FY 2019 – Performance Output Goals

- None.

Program Plans FY 2020 – Performance Output Goals

- Develop descriptions of the RECAT Phase III product(s) and their use by ATC, including the application of time based wake separations for capacity improvement in headwind conditions.
- Complete preliminary requirements for modification of ATC automation systems to support ATC utilization of the RECAT Phase III product(s).

Program Plans FY 2021 – Performance Output Goals

- Develop detailed design requirements for modification of ATC automation systems to support ATC utilization of the RECAT Phase III product(s).

Program Plans FY 2022 – Performance Output Goals

- Develop Safety Risk Management Document for ATC's operational use of the RECAT Phase III product(s).

D, Separation Automation System Engineering, G01A.01-06

Program Description

Separation Automation System Engineering (SASE) is a pre-implementation program that matures emerging NextGen Separation Management automation capabilities and develops automation enhancements for En Route, Terminal, and Oceanic domains to support planned NextGen operational improvements. Separation Management automation is defined to include all ATC automation capabilities that assist controllers in maintaining safe aircraft separation while optimizing use of airspace system capacity.

SASE will reduce the risks inherent with introducing new technology and operational procedures using System Engineering analysis that examines the integrated use of proven techniques and equipment necessary to maintain safe separation. System engineering techniques such as analysis, simulation and modeling, and human-in-the-loop simulations will identify, assess, and validate the impact of new technology and operational procedures on the NAS infrastructure. Throughout the product development lifecycle for NextGen Separation Automation systems, any required changes will be determined and specific products created to support the investment decision process for implementation of these changes. This program is currently planning concept exploration and development activities in the following areas:

Controller's Operational Decision Support Tools:

Automation provides the controller with tools to manage aircraft separation in a mixed navigation and wake performance environment operating with different performance characteristics within the same volume of airspace.

Controllers will use automation enhancements to obtain situational awareness of aircraft with differing performance capabilities (e.g., equipped vs. non-equipped aircraft, Area Navigation (RNAV), Required Navigation Performance (RNP), and trajectory flight data management). These enhancements enable Air Navigation Service Providers (ANSP) to manage the anticipated increase in complexity and volume of air traffic. Categories of separation management automation enhancements to be addressed include:

- Conflict prediction (tactical and strategic);
- Flight data display and data entry capabilities; and
- Conflict Resolution assistance (Provide controller multiple alternatives selection options in the trajectory and resolutions that promote improved operational decisions, reduced workload, and increased controller productivity).

These automation-based tools will enable controllers to proactively identify and resolve aircraft/airspace conflicts, a key enabler for advanced trajectory-based operations and the ability to handle expected growth in air traffic.

Trajectory Modeling:

Ground automation support for Trajectory Based Operation and other future NextGen concepts demand a higher fidelity Four Dimensional Trajectory (4DT) in En Route climb, cruise, descent, and airport surface phases of flight to reduce the uncertainty of an aircraft's future flight path. Accuracy will be improved through better evaluation of constraints and the integration of separation assurance and traffic management constraints based on precise knowledge of aircraft arrival times at points along the flight plan leading to more optimal routes and altitude profiles. Categories of Separation Management automation enhancements to be addressed include:

- **Improve Aircraft trajectory modeling accuracy:** The evolution of En Route Automation Modernization (ERAM) to include a kinetic vertical modeling (KVM) capability would allow the ERAM trajectory modeler to exploit flight-specific intent information, when available, to improve trajectory accuracy and conflict probe efficacy.

- **Improve Interoperability:** It is anticipated that there will be a need for data exchange or greater interplay between the ERAM and Time Based Flow Management decision support tools in support of the implementation of conflict-free scheduling solutions intended to increase the number of flights able to use Optimized Profile Descents (OPDs). This provides an additional motivation for examining trajectory prediction differences in the two systems, and to identify ways to make the two system's trajectories more compatible.
- **Optimize use of aircraft Performance-Based Navigation (PBN) data:** The current use of PBN procedures is limited across the NAS. The extent of RNAV and RNP route usage will remain constrained by the lack of automation and information exchange (Air to Ground and Ground to Ground). Without improvements in En Route and Terminal ground automation systems, and information exchange, utilization of PBN in the TRACON will be reduced, resulting in a significant reduction of PBN benefits across the NAS. Separation management enhancements will support the NAS PBN Strategy 2016.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program will refine the definition of proposed concepts, such as trajectory-based operations, the exchange and use of 4DT and others, to validate them as both viable and necessary additions to the NAS. The continuous growth of aircraft movement both in the air and on the ground is projected to exceed the capacity of the current system, resulting in delays and gridlock. New ATC automation capabilities will assist controllers in maintaining safe aircraft separation while optimizing the use of available system capacity. The results from this program will promote the safe and efficient use of airspace and airports.

Program Plans FY 2018 – Performance Output Goals

- Enhance controller operational decision support tools with the following activities:
 - Conduct an operational integration analysis to identify potential separation management issues due to introduction of multiple changes to the primary separation management platforms;
 - Develop an Operational Concept assessment within the scope of an air-ground trajectory synchronization/negotiation;
 - Develop an initial operational concept of rank-ordered conflict resolution based on efficiency of the maneuvers in the event of aircraft, airspace, or metering problem; and
 - Complete concept engineering efforts to improve terminal conflict alert and minimum safe altitude warning.
- Enhance the trajectory modeling capabilities with the following activities:
 - Update ERAM KVM prototype using Flight Management System Extended Projected Profile data downlinked via Automatic Dependent Surveillance-Contract; and
 - Exploit and prototype Flight-specific Aircraft Intent, from trajectory exchanged among ANSPs (including planned trajectory as proposed in Flight and Flow-Information for a Collaborative Environment, as well as Dynamic RNP, Flight Deck Interval Management-Spacing, and OPDs using Required Time of Arrival).
- Develop the following products in support of the Concept and Requirements Definition Readiness Decision (CRDRD) for ERAM Enhancements 3:
 - Preliminary shortfall analysis;
 - As-Is and To-Be functional analyses;
 - Preliminary concept of operations document; and
 - Concept and Requirements Definition plan.

Program Plans FY 2019 – Performance Output Goals

- Enhance controller operational decision support tools with the following activities:
 - Develop and operationally evaluate mitigations in response to the introduction of multiple capabilities that impact separation management platforms; and
 - Complete an operational concept of rank-ordered conflict resolution based on efficiency of the maneuvers.
- Enhance the trajectory modeling capabilities with the following activities:
 - Complete an operational evaluation of 4DT options and complex clearance and maneuvers in En Route airspace;
 - Develop and execute Human-in-the-Loop (HITL) simulation test plan to assess 4DT operations; and
 - Analyze HITL simulation test results and develop technical report on the impact of 4DT modeling.
- Develop the following products in support of Investment Analysis Readiness Decision (IARD) for ERAM Enhancements 3:
 - Shortfall Analysis/Quantification; and
 - Solution Concept of Operations.

Program Plans FY 2020 – Performance Output Goals

- Enhance controller operational decision support tools with the following activities:
 - Develop an initial operational concept to increase capacity and efficiency using Flight Management Computer (FMC) route offset in En Route airspace.
- Enhance the trajectory modeling capabilities with the following activities:
 - Complete enhancements capabilities of High Fidelity Trajectory Modeling.
- Develop the following products in support of Initial Investment Decision (IID) for ERAM Enhancements 3:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Products;
 - Initial Implementation Strategy and Planning Document (ISPD); and
 - Final Investment Analysis Plan.
- Conduct Concept Engineering activities to mature and validate new concepts for subsequent investment decisions:
 - Develop concepts and requirements for extended use of 3 nautical mile separation airspace;
 - Conduct service analyses across the domains to identify remaining separation management gaps; and
 - Based upon gaps, complete As-Is and To-Be functional analyses, and conduct concept validation activities to mature new enhancements.
- Develop the following IARD materials in support of Terminal Work Package 2:
 - Down-select suitable capabilities from previous concept exploration activities;
 - Develop Concepts of Operations document(s); and
 - Perform functional analyses and initial program requirements development.

Program Plans FY 2021 – Performance Output Goals

- Conduct Concept Engineering activities to mature and validate new concepts for subsequent investment decisions:
 - Complete concepts and requirements for extended use of 3 nautical mile (nm) separation airspace;
 - Conduct service analyses across the domains to identify remaining separation management gaps; and
 - Based upon gaps, complete As-Is and To-Be functional analyses, and conduct concept validation activities to mature new enhancements.
- Complete an operational evaluation of resolving conflicts with multiple maneuvers including use of rank-ordered maneuvers and full data communication services in En Route airspace.
- Complete an operational concept to increase capacity and efficiency using FMC route offset in En Route airspace.
- Conduct an operational evaluation of expanded use of 3nm separation in broader En Route airspace.
- Perform a feasibility study of wake re-categorization with dynamic, pair-wise wake separation standards applied in En Route airspace.
- Develop the following products in support of the Final Investment Decision (FID) for ERAM Enhancements 3:
 - Final Program Requirements (FPR) Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Develop the following products in support of the IARD for Terminal Work Package 2:
 - Shortfall Analysis/Quantification;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Develop the following products in support of the IID for Terminal Work Package 2:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Products;
 - Initial ISPD; and
 - Final Investment Analysis Plan.

Program Plans FY 2022 – Performance Output Goals

- Conduct Concept Engineering activities to mature and validate new concepts for subsequent investment decisions:
 - Complete concepts and requirements for resolving conflicts with multiple maneuvers including use of rank-ordered maneuvers and full data communication services in En Route airspace;
 - Conduct service analyses across the domains to identify remaining separation management gaps; and
 - Based upon gaps, complete As-Is and To-Be functional analyses, and conduct concept validation activities to mature new enhancements.
- Develop an operational concept to increase flexibility through creation of Flexible Airspace.
- Develop the following products in support of the FID for Terminal Work Package 2:
 - FPR Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final ISPD; and
 - Acquisition Program Baseline (Execution Plan).

E, Closely Spaced Parallel Runway Operations, G06N.01-02

Program Description

Closely Spaced Parallel Operations (CSPO) are simultaneous approaches and departures of aircraft to airports with parallel runways that are closely spaced; defined as less than 4300 feet apart. CSPOs have been implemented at several Metroplex airports to meet increased demand. When weather conditions cause airport visibility to fall below

minimums for visual operations, the airport arrival rate can be reduced by as much as half since aircraft arrivals are scheduled on the assumption of visibility above airport minimums. When weather conditions do not allow for visual approaches, the use of Simultaneous Independent Parallel Instrument Approach (SIPIA) operations significantly reduces the impact on the airport arrival rate by maximizing the use of available capacity.

Recently, dual SIPIA operations were approved for runways when centerlines are separated by 3600 feet or greater. If high update rate surveillance is used, independent approaches can be conducted to runways separated by at least 3400 feet or in some cases, down to 3000 feet if one of the approaches is offset from the opposite parallel runway approach path. In comparison, separation standards for dual simultaneous dependent approach operations, where aircraft are staggered along their respective parallel final approach path, can be used when runways are separated by 2500 feet or more. Dependent staggered approaches to runways separated by less than 2500 feet are approved for a limited number of airports under specific restrictions. Dependent staggered approaches provide an incremental increase in capacity but do not increase capacity as much as SIPIA.

The CSPO program will accelerate activities to provide increased arrival and departure operations to airports with Closely Spaced Parallel Runways (CSPR) in limited visual conditions. CSPO will develop the performance requirements that enable the implementation of innovative procedures, tools and controller or pilot aids that increase capacity at airports utilizing multiple independent and dependent operations. This initiative will enhance procedures that allow dependent operations using CSPR or converging approaches to runways greater than 700 feet apart, as well as supporting independent operations using parallel runways between 2500 feet and 4300 feet. Furthermore, CSPO will identify potential alternatives for meeting functional requirements such as applying existing and new technologies to current standards, evaluating high update rate surveillance requirements and sensors such as Automatic Dependent Surveillance-Broadcast, navigation system performance and pilot and controller response times used for risk assessments, and the development of new standards to facilitate NextGen applications. CSPO departure procedures will include the reduction of required divergence for simultaneous independent parallel departures from CSPR with centerline spacing less than 4300 feet and the reduction of required spacing for dependent departures from CSPR spaced less than 2500 feet between centerlines. This program will also finalize the safety analysis of conformance monitoring and blunder detection capabilities to facilitate validation of the Paired Approach Flight Deck Interval Management concept.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

CSPO is focused on finding safe ways to recover capacity lost by the current aircraft-to-aircraft separation procedures required for simultaneous operations to CSPR during limited visual conditions. The goal of CSPO analysis is to maintain the same arrival and departure rates regardless of weather conditions. Using CSPO, some airports may increase arrival rates by as much as 6 to 12 operations per hour but will vary based on local operations and procedures.

Program Plans FY 2018 – Performance Output Goals

- Finalize safety evaluation of conformance monitoring and blunder detection capabilities for the Paired Approach Flight Deck Interval Management concept.
- Finalize front gate safety analyses for Paired Approach (PA) to CAT I minima and provide technical report.

Program Plans FY 2019 – Performance Output Goals

- Complete inputs to the development of safety risk documentation and controller/pilot training materials to support the use of new standards for PA to CAT I approach minima at applicable airports.
- Finalize operational gate violations and breakout procedures safety analysis for Paired Approach to CAT I approach minima and provide technical report.

Program Plans FY2020 – Performance Output Goals

- Perform functional analysis and requirements development data collection through the use of HITL simulations assessing Integrated Closely Spaced Arrival Departure Operations concept feasibility.
- Finalize analysis of the CSPO Departures capability and provide technical report.

Program Plans FY2021 – Performance Output Goals

- Complete inputs to the development of safety risk documentation and controller/pilot training materials to support the use of new standards for CSPO Departures at applicable airports.
- Finalize analysis of the Integrated Closely Spaced Arrival Departure Operations capability.

Program Plans FY2022 – Performance Output Goals

- Complete inputs to the development of safety risk documentation and controller/pilot training materials to support the use of new standards for Integrated Closely Spaced Arrival Departure Operations procedures at applicable airports.
- Complete Integrated Closely Spaced Arrival Departure Operations technical report.

F, Concept Development for Integrated NAS Design & Procedures Planning, G05A.02-04

Program Description

The Integrated NAS Design and Procedures Planning (INDP) program is currently preparing for the future NAS-wide implementation of Performance Based Navigation (PBN) procedures with the initial focus on Established-on-Required Navigation Performance (RNP) (EoR) Instrument Approach Procedures. 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. 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.

EoR will allow air traffic controllers to clear an aircraft on an RNP approach with a curved turn to final (TF or RF) without providing standard radar separation between it and another aircraft that is established on an approach to a parallel runway. 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. In addition, EoR is expected to provide opportunities for increased efficiency including reduced track length, fuel burn, environmental footprint, and noise exposure. EoR may also provide opportunities for increased efficiency through the use of more repeatable and predictable operations. Following initial implementation of EoR at developmental sites, additional data will be collected to support final safety and benefits validation.

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. 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. Instrument Landing System, Global Positioning System Landing System or Microwave Landing System), and Established on Departure Operations.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program will contribute to the average daily airport capacity metric by providing the modeling and analysis needed to modify airspace and procedures. This will result in more efficient use of airspace through repeatable and dependable operations resulting in a more consistent daily capacity.

Program Plans FY 2018 – Performance Output Goals

- Complete RNP approach modeling and safety analysis report on RF Duals and Triples.
- Conduct initial validation of EoR operational concept scenarios at TF Duals and RF Duals launch sites.
- Complete Safety Risk Management artifacts to support separation standard change to allow more EoR operations in the NAS. Complete one Document Change Proposal (DCP) (e.g., combining TF Duals/Triples and RF Duals/Triples operations into a single DCP or a single TF DCP based on RF safety analysis results).
- Document analysis conclusions for possible inclusion into the PBN strategy update based on all EoR analysis information completed to date.
- Develop modeling, safety analysis, and data collection plan for one new RNP approach scenario (e.g., EoR to next Landing System (XLS)).

Program Plans FY 2019 – Performance Output Goals

- Conduct initial implementation of EoR scenarios at new launch site(s) to validate EoR operational concept (e.g., RF Triples).
- Provide updates to the PBN Strategy based on operational testing of improved PBN capabilities including all EoR updates.
- Complete modeling and safety analysis on one RNP approach scenario and deliver next EoR report (e.g., EoR to XLS).
- Conduct Advanced-RNP (A-RNP) assessment in support of PBN Strategy for A-RNP next steps (if any).
- Develop modeling, safety analysis, and data collection plan for one new RNP approach scenario (e.g., Dependent Operations).

Program Plans FY 2020 – Performance Output Goals

- Complete next RNP approach modeling and safety analysis report (e.g., Dependent or other priority EoR Operations).
- Conduct initial implementation of EoR scenarios at new launch site(s) to validate EoR operational concept (e.g., TF Triples Launch Sites).
- Complete Safety Risk Management artifacts to support separation standard change to allow more EoR operations in the NAS (e.g., XLS DCP or RF DCP or other EoR operations).
- Conduct concept validation studies based on the PBN strategy and document findings to reduce risks/uncertainties of NextGen Mid Term Operational Concepts (RF Duals concept validation).

Program Plans FY 2021 – Performance Output Goals

- Conduct initial implementation of EoR scenarios to validate operational concept at new launch site (e.g., EoR to XLS or other EoR geometry).
- Conduct concept validation studies based on PBN strategy and document findings to reduce risk/uncertainties of NextGen Mid Term Operational Concepts (e.g., TF Duals and RF Triples at one or more launch sites).
- Complete Safety Risk Management artifacts to support separation standard change to allow for more EoR operations in the NAS (e.g., Dependent Operations or other EoR geometry).

Program Plans FY 2022 – Performance Output Goals

- Conduct concept validation studies based of PBN strategy and document findings to reduce risks/uncertainties of NextGen Mid Term Operational Concepts (e.g., TF Duals and RF Triples).
- Conduct concept validation at one or more launch sites (e.g., TF Triples or EoR to XLS).
- Conduct initial implementation of EoR scenarios at new launch site(s) to validate EoR operational concept (e.g., Dependent Operations launch sites).

X, NextGen Oceanic Capabilities, G01A.01-07

Program Description

The NextGen Oceanic Capabilities program is a critical NextGen capability that addresses current performance gaps in the areas of capacity, productivity, efficiency, safety, and environmental impacts in the oceanic environment. The key objective of this program is to use trajectory-based operations to improve fuel efficiency, system predictability, and performance by enabling airlines and other operators to fly oceanic routes more closely aligned with the optimal, or preferred, 4D trajectories.

This program will provide the following operational improvements:

- User Tactical Trajectory Feedback
- Advanced Technologies and Oceanic Procedures (ATOP) in Transition Sectors

User Tactical Trajectory Feedback provides oceanic trajectory coordination that enables interactive flight plan collaboration between the airspace users and the FAA. The airspace user informs the FAA of his intended 4D oceanic trajectory and receives feedback on potential traffic conflict for the intended flight trajectory change while in U.S. oceanic airspace. Tactical trajectory feedback will allow airspace users to request clearance changes that increase their flight efficiency and user-preferred routing.

The use of ATOP will be expanded into domestic-to-oceanic radar transition sectors to provide the controllers with integrated tools for setting up transitioning traffic to and from oceanic airspace thereby providing more seamless operations; increasing flight efficiencies; and reducing controller workload. Enhancements include modifications needed to handle tactical 5-nm separation.

The Initial Investment Decision (IID) is planned for 2nd quarter FY 2017 and Final Investment Decision (FID) for 2nd quarter FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

With increased system precision and enhanced automation, aircraft can be assigned to more closely space oceanic routes that meet airline goals for fuel efficiency and schedule reliability. By reducing lateral and longitudinal separation for aircraft that provide shared state and intent data, the NAS will increase opportunities for aircraft operators to fly preferred routing. Reduced separation standards will also result in increased capacity using optimal tracks allowing more aircraft to fly fuel and time efficient altitudes and paths.

Program Plans FY 2018-2019 – Performance Output Goals

- None.

Program Plans FY 2020 – Performance Output Goals

- Complete System Requirements Review.

Program Plans FY 2021 – Performance Output Goals

- Complete Preliminary Design Review.
- Complete Critical Design Review for Build 1 Development and Integration.

Program Plans FY 2022 – Performance Output Goals

- Complete hardware and software development.
- Complete hardware unit and software development testing.

1A06, NEXTGEN – TRAFFIC FLOW MANAGEMENT PORTFOLIO**FY 2018 Request \$10.8M**

- A, Surface Tactical Flow, G02A.01-01
- B, Time Based Flow Management (TBFM) Work Package 4, G02A.01-08
- C, Strategic Flow Management Application, G05A.01-01
- D, Strategic Flow Management Engineering Enhancement (SFMEE), G05A.01-02
- E, Advanced Methods, G05A.02-02

A, Surface Tactical Flow, G02A.01-01**Program Description**

The Surface Tactical Flow (STF) program is developing trajectory-based surface operations in support of NextGen. It leverages the development efforts of the NASA Surface Management System (SMS) and provides guidelines for the development of a collaborative Surface Traffic Management (STM) system. The STM system will provide the tools necessary to achieve a fully collaborative surface environment where the input of airlines, airports and air traffic controllers are all used to provide a shared surface situational awareness. Shared awareness is required to safely expand the use of airport capacity by coordinating surface and airborne trajectory based operations. The STF program will support the Surface-Collaborative Decision Making (S-CDM) sub team of the CDM Stakeholder's Group to incorporate flight operator and airport authority stakeholder viewpoints for potential NAS-wide deployment of surface capabilities.

This program will demonstrate and document requirements for a series of new capabilities that build upon the NextGen vision for Surface Trajectory-Based Operations (STBO). Examples of capabilities include a local data exchange which leads to the sharing of flight readiness information enabling collaboration of pre-planned runway schedules integrated with airborne trajectory-based operations. Surface flow management will reduce operating time during surface operations saving fuel, reducing environmental impact, and avoiding surface gridlock.

The STF program will require changes to procedures in the flight operator and Tower environments. The program will follow incremental steps leading to the complete concept providing benefits at each step of the way while remaining aligned with the introduction of other NextGen technologies.

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

- Further increase the efficiency, throughput, and predictability of airport surface operations;
- Reduce the environmental impact of surface operations;
- Enhance benefits of operational surface data exchange among stakeholders;
- Meet time-based goals of NextGen surface operations; and
- Identify research issues and gaps to achieve STBO goals.

The STBO concept is expected to be implemented as a set of decision support tools in systems such as Terminal Flight Data Manager, Traffic Flow Management System, and Time Based Flow Management, called 3T.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The STF program will move aircraft to and from the runway in a more efficient, predictable, and coordinated manner complying with Traffic Management Initiatives and supporting user preferences. This will increase efficiency and capacity while reducing controller workload through the automated assignment of runways, taxi routes, and departure queues.

Program Plans FY 2018 – Performance Output Goals

- Update the concept maturity assessment (based on NASA and FAA research) for collaborative departure metering capability to support the technology transfer package to the Program Management Office.
- Deliver a FAA assessment of NASA's Airspace Technology Demonstration-2 collaborative departure metering capability including S-CDM and collaboration with flight operators, airport operators, and ATC.
- Complete technology transfer of lessons learned in departure metering for single airport with integrated scheduling in the NAS to the Air Traffic Organization Program Management Office, Decision Support Programs.

Program Plans FY 2019 – Performance Output Goals

- Conduct integrated departure scheduling cognitive walkthrough workshops based on operational scenarios including flight strip and airport surveillance events.
- Analyze and model integrated departure scheduling on a metroplex airport, focusing on characteristics of the combined airport environment.
- Complete and deliver a report on integrated scheduling in an operationally relevant environment.

Program Plans FY 2020 – Performance Output Goals

- Deliver a report summarizing NASA research efforts for NAS integrated scheduling, focusing on metroplex airports.
- Deliver a report analyzing quality of data for flow control for controllers to accept time-based flight controls, i.e. Conflict Probe.
- Complete and deliver a report on the analysis of NAS wide impacts of integrated departure scheduling.
- Conduct benefits analysis of integrated departure scheduling.

Program Plans FY 2021 – Performance Output Goals

- Deliver functional allocation of new integrated departure scheduling capabilities to 3T.
- Deliver an operational integration assessment report of 3T capabilities.
- Deliver updated maturity assessment of integrated departure scheduling capabilities.
- Complete Technical Transfer of integrated departure scheduling capabilities in a metroplex to Program Offices.

Program Plans FY 2022 – Performance Output Goals

- Deliver a report analyzing the potential for improving integrated departure schedules by using improved departure trajectories (more accurate arrival times) to departure meter points.
- Deliver a report analyzing integrated departure scheduling scenarios to evaluate common rules and hierarchies for consistent scheduling times and alignment of times between scheduling functions. Analyze sources of flight information and predictive time horizon of the scheduling function to align times.
- Complete and deliver a report analyzing the unique constraints encountered for integrated departure scheduling at airports of varying capacities, capabilities, and different geographic regions across the NAS. Include an assessment of the possible benefits this understanding could yield for the implementation process.
- Complete and deliver a report analyzing requirements for controller tools needed to manage precise departure trajectories to meet flight scheduling objectives.

B, Time Based Flow Management (TBFM) Work Package 4, G02A.01-08

Program Description

The Time Based Flow Management (TBFM) system uses time-based metering to better utilize NAS capacity by improving traffic flow management of aircraft approaching and departing congested airspace and airports. TBFM has been deployed and is operational at the 20 Air Route Traffic Control Centers and adapted for most major airports served by those centers. TBFM is a vital part of the NAS and enhances air traffic operations, by reducing delays and increasing efficiency of airline operations. Enhancements to the TBFM system will directly support NextGen Performance Based Navigation (PBN) concepts.

TBFM Work Package 4 (WP4) will build upon core TBFM capabilities already in place to increase benefits of time-based metering across the NAS and enable expansion of PBN operations in the NAS. TBFM Work Package 4 candidate capabilities include:

- **Path Stretch:** An automation-based advisory to controllers to meet time-based metering schedule in cruise that will enable aircraft to absorb assigned delay laterally when speed control alone is insufficient. This will reduce the use of vectoring to maintain delivery accuracy to the meter point and allow continuation of an Optimized Profile Descent (OPD). This will enhance flight efficiency, reduce emissions and noise, and increase system predictability.
- **Terminal Sequencing & Spacing (TSAS) Dashboard:** Monitors TSAS and en route time-based metering schedule conformance to assist Traffic Managers in anticipating necessary schedule adjustments. This will optimize the use of TSAS and in turn, further optimize arrival throughput.
- **System-Wide What-If Capability:** Automation decision support tool for terminal and en route Traffic Managers to inform tactical management decision-making and coordination for arrival operations when schedule adjustments are needed. This will optimize time-based metering operations by allowing Traffic Managers to model several scenarios when schedule adjustments are necessary; assess the impact on overall system performance; and implement the most optimal solution that allows aircraft to increasingly fly PBN procedures.
- **Fleet Prioritization:** Dynamically incorporate and where feasible, grant user preferences for airspace when assigning time-based metering slots and associated delay. This will improve collaborative decision making and user efficiency.
- **Improved TBFM-Traffic Flow Management System (TFMS) Data Integration:** Increase data sharing between TBFM and TFMS systems to enhance demand capacity prediction and the integration of time-based metering. This will enable coordination of proposed Traffic Management Initiatives (TMI) before implementation to minimize unintended and potentially disruptive TMI interactions; improving collaborative decision making, user efficiency, and system predictability.
- **TSAS Expansion:** Deploy TSAS to additional sites beyond those that will receive TSAS via TBFM WP3. Geographical expansion of TSAS will improve flight efficiency and system predictability in the NAS and increase the utilization of PBN procedures.
- **Integrated Departure/Arrival Capability (IDAC) Expansion:** Deploy IDAC to additional sites, beyond the sites that will receive IDAC via TBFM WP2 and WP3. Geographical expansion of IDAC will reduce departure release coordination time/effort, improve flight efficiency, and enhance system predictability.
- **Weather Source Migration:** Using the System Wide Information Management system, obtain weather data from the FAA's Common Support Service-Weather system. This will decrease FAA's operating costs and minimize future costs associated with incorporating new weather products into TBFM.

Investment Analysis Readiness Decision (IARD) for TBFM WP4 is planned in FY 2019. Final Investment Decision (FID) for TBFM WP4 is planned in FY 2020. In parallel with the Investment Analysis process, a contract re-compete will complement the path moving forward for TBFM WP4.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

TBFM will expand the use of time-based metering solutions to additional locations and phases of flight to support the performance metric to maintain average daily airport capacity. TBFM will improve flight efficiency by allowing controllers to sequence and space arriving aircraft to optimize the use of airport capacity thereby avoiding last minute maneuvering of aircraft as they approach the airport. Time-based metering through TBFM has provided an average 3-5% increase in throughput at the airports where it is installed.

Program Plans FY 2018 – Performance Output Goals

- Complete concept engineering/technical analysis of candidate capabilities.
- Deliver Concept documentation for each WP4 candidate capability.
- Conduct market survey for new prime TBFM contract.

Program Plans FY 2019 – Performance Output Goals

- Complete the required AMS documentation for IARD:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Achieve IARD for TBFM WP4.
- Complete market analysis for new TBFM contract.
- Release the Screening Information Request (SIR) for new contract.

Program Plans FY 2020 – Performance Output Goals

- Complete development of the following documentation required for FID:
 - Final Program Requirements document;
 - Business Case;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for TBFM WP 4.
- Pending FID approval:
 - Complete evaluation of prime contractor proposals received in response to new prime TBFM SIR.
 - Award TBFM WP4 contract.

Program Plans FY 2021 – Performance Output Goals

- Pending FID approval:
 - Complete Engineering Analysis for IDAC hardware.
 - Complete System Requirements Review.

Program Plans FY 2022 – Performance Output Goals

- Pending FID approval:
 - Complete System Design Review.
 - Complete site surveys for IDAC expansion (number of sites to be determined).

C, Strategic Flow Management Application, G05A.01-01

Program Description

The Strategic Flow Management Application (SFMA) program will leverage automation to improve traffic flow management (TFM) operations by addressing system-wide demand and capacity imbalances to improve support for NextGen capabilities and objectives. SFMA will conduct the following work to improve TFM capability:

- Identify system-wide constraints and provide effective and efficient trajectory revisions for affected flights;
- Improve NAS constraint prediction;

- Provide enhanced automation support for developing operational responses to constraints;
- Provide NAS Users and Air Traffic Management (ATM) with a common understanding of NAS constraints; and
- Provide enhanced post-operational analysis.

SFMA supports the development of several candidate capabilities for Collaborative Air Traffic Management Technology (CATMT) Work Package 5 (WP5) to address selected shortfalls. Remaining shortfalls after CATMT WP5 will be addressed in the future work of SFMA. Candidate capabilities for CATMT WP5 include Advanced Flight-Specific-Trajectories and Monitoring and Alerting; both are described in detail below.

Advanced Flight-Specific Trajectories (AFST) Capability – AFST will identify operational shortfalls and gaps for rerouting of airborne and pre-departure flights that remain after implementation of the Airborne Reroute Automation (ABRR) and the Collaborative Trajectory Options Program. SFMA will develop capabilities designed to provide traffic managers and controllers with more automated flight-specific trajectory advisory functions that will consider a wide range of input factors such as weather impacts, resource capacity, operator preferences, and meter time assignments. AFST will help resolve air traffic flow problems, reduce delays, unnecessary flying time, and improve metering operations. These advisories will also capitalize upon Data Comm-enabled complex reroutes and clearances to improve the generation, delivery, and execution of reroutes.

The OI increments supported by AFST include:

- Advanced Flight-Specific Trajectories (AFST) – This capability provides traffic managers and controllers with integrated and automated tools to resolve constraints with advanced flight-specific trajectory advisories that are generated by automation.
- Negotiate Mitigations – This capability establishes the airborne component of trajectory evaluation that provides airspace users the option to update their ranked trajectory option sets and preferences throughout the flight in response to constraints.
- Aircraft Equipment Eligibility During Traffic Management Initiatives (TMIs) – This capability provides traffic managers the ability to create capability-aware TMIs based on aircraft ability (equipment, crew training, procedures, certifications) of conducting PBN. These advanced avionics improve aircraft capabilities and enable the benefits of increased access, enhanced throughput, and increased predictability in the NAS.
- Airborne Trajectory Negotiations with Flight Operations Centers – This capability provides preferences for airborne reroutes to enable the users to choose the reroute that best meets their business objectives.

Monitoring and Alerting Capabilities

- Enhanced Sector Alert Metric – This alerting capability considers demand patterns over a number of minutes, rather than a single peak minute, to better reflect the practice of traffic managers in evaluation and perception of sector alerts.
- Single Source for Issued Traffic Management Initiatives – This capability includes two primary features; Display of Issued TMIs and Display of Flights Impacted by Issued TMIs; both of which can be toggled on or off. These features are expected to be used in conjunction with each other operationally.
- Integrate User Interface Components – This capability consolidates traffic management functions and systems into a unified set of interfaces with a consistent approach and more efficient workflow. This is expected to include an integrated user interface that allows traffic managers to display and manage data obtained from multiple underlying systems and to allow traffic managers to customize the layout of the workspace and the content of each component.

SFMA will collaborate with NASA on their Airspace Technology Demonstration (ATD) projects; comprised of a collection of critical technology development and demonstration activities geared toward delivery of near-term benefits to air transportation system stakeholders. Specifically, the AFST capability will benefit from and leverage capabilities developed by NASA's Applied Traffic Flow Management (ATFM) activity. This activity will explore concepts and develop technologies to execute more efficient flight paths for en route airspace.

Candidate capabilities for future AMS investment after CATMT WP5 are:

- Enhanced Trajectory Capability:
 - Dynamic Required Navigation Performance (RNP)
 - Integration of Traffic Flow Management System (TFMS) and Time-Based Flow Management (TBFM) to support NASA Advanced Technology Demonstration 3 (ATD-3) tech transfer
 - Support of advanced trajectory-based operations
- Weather-Impacted Sector Capacity Prediction Capability:
 - Predict the effective capacity of en route sectors in the presence of severe convective weather activity (thunderstorms)
 - Support tactical traffic management.
- TFM System Performance Analysis Capability:
 - Identify improvements to capture and store relevant TFM data;
 - Provide ability to assess weather forecast performance, capacity/demand prediction accuracy, TMI compliance/execution precision and the effectiveness of TMIs against their performance objectives;
 - Provide capabilities to cluster similar historical events and TMI strategies;
 - Provide what-if modeling of alternate resolution strategies; and
 - Investigate the creation of a training simulation environment to sector simulation problems that controller trainees may experience.

Capabilities developed through SFMA will provide concepts and requirements to the Strategic Flow Management Engineering Enhancements program (SFME) (G05A.01-02) which will progress them through the AMS process as part of future investments for CATMT.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program addresses the CATMT performance objectives of increased capacity and flexibility. Increased capacity is achieved by the integration of strategic flow management with Trajectory Based Operations which provides a more structured traffic flow so that the capacity of a given airspace can be used more efficiently to meet demand. Flexibility is improved by more frequent use of dynamic reroutes which allows controllers and pilots to react more efficiently to changing operational conditions. New rerouting concepts provide controllers, pilots, and flight operators with more choices when negotiating dynamic reroutes for active aircraft.

Program Plans FY 2018 – Performance Output Goals

- Complete development of NAS Enterprise Architecture products, updated Con Ops, and requirements document in support of CATMT WP5 Investment Analysis Readiness Decision (IARD) in December 2018.
- Complete development of updated ConOps, updated cost analysis, updated benefits analysis and updated requirements document in support of CATMT WP5 Initial Investment Decision (IID)/Final Investment Decision (FID).
- Complete leveraging of NASA's ATD-3 Technical Transfer artifacts in support of CATMT WP5, e.g., human in the loop simulation (HITL) results, requirements, benefits assessments.

Program Plans FY 2019 – Performance Output Goals

- Complete Technical Transfer of applicable capabilities developed under NASA’s ATFM to the program office.
- Conduct engineering activities for capabilities needed for the next segment after CATMT WP5, Enhanced Trajectory Capability that will include dynamic RNP, integration of TFMS and TBFM to support NASA ATD-3 tech transfer, and support of advanced trajectory-based operations:
 - Preliminary shortfall analysis;
 - Preliminary capability ConOps;
 - HITL planning, development, evaluation, and report for the capability; and
 - Preliminary capability Functional Analysis.
- Perform Concept Exploration for Weather-Impacted Sector Capacity Prediction capability.
- Conduct Concept Validation for TFM System Performance Analysis Capability.

Program Plans FY 2020 – Performance Output Goals

- Conduct engineering activities for Enhanced Trajectory Capability that will include dynamic RNP, integration of TFMS and TBFM to support NASA ATD-3 tech transfer, and support of advanced trajectory-based operations:
 - HITL planning, development, evaluation, and report for the capability;
 - Capability Operations Requirements;
 - Quantitative Shortfall Analysis for the capability; and
 - Capability Solution ConOps.
- Develop Preliminary ConOps, Preliminary Function, and Preliminary Requirements for Weather-Impacted Sector Capacity Prediction capability.
- Develop Preliminary Function and Preliminary Requirements for TFM System Performance Analysis Capability.

Program Plans FY 2021 – Performance Output Goals

- Conduct engineering activities for Enhanced Trajectory Capability that will include dynamic RNP, integration of TFMS and TBFM to support NASA ATD-3 tech transfer, and support of advanced trajectory-based operations:
 - Refined Capability Preliminary Functional Analysis;
 - Updated Capability Solution ConOps; and
 - Capability Preliminary Program Requirements.
- Conduct Concept Validation for Weather-Impacted Sector Capacity Prediction capability.
- Develop Quantitative Shortfall and Solution ConOps for TFM System Performance Analysis Capability.

Program Plans FY 2022 – Performance Output Goals

- Conduct engineering activities for Enhanced Trajectory Capability that will include dynamic RNP, integration of TFMS and TBFM to support NASA ATD-3 tech transfer, and support of advanced trajectory-based operations:
 - Benefit analysis and estimate for the capability;
 - Cost analysis and estimate for the capability;
 - Safety assessment; and
 - Enterprise Architecture (EA) products.
- Develop Quantitative Shortfall, Solution ConOps, Updated Function, EA Products, Updated Requirements, and Range of Alternatives for Weather-Impacted Sector Capacity Prediction capability.
- Develop Updated Function, Updated Requirements, EA Products, and Range of Alternatives for TFM System Performance Analysis Capability.

D, Strategic Flow Management Engineering Enhancement (SFMEE), G05A.01-02

Program Description

The Strategic Flow Management Engineering Enhancement (SFMEE) program will support future work packages for Traffic Flow Management (TFM) enhancements. SFMEE will develop products to support an Acquisition

Management System (AMS) investment up to investment analysis for concepts addressing operational TFM shortfalls and then progressing with these concepts through the AMS process as part of Collaborative Air Traffic Management Technologies (CATMT) future investments.

The concept engineering work for the individual capabilities will be conducted primarily through the Strategic Flow Management Application (SFMA) (G05A.01-01) and Advanced Methods (G05A.02-02) programs. TFM enhancements, implemented principally by the CATMT program, will reside in the Traffic Flow Management System and will be available to Traffic Managers at Air Route Traffic Control Centers (ARTCCs), Terminal Radar Approach Control (TRACONs) and the Air Traffic Control System Command Center (ATCSCC). Candidate capabilities for future TFM work packages include:

- Constraint Evaluation Feedback;
- Negotiate Mitigations;
- User Tactical Trajectory Feedback;
- Collaborative Airport and Airspace Configuration Management;
- Airborne Trajectory Negotiations with Flight Operations Centers;
- Aircraft Equipment Eligibility During Traffic Management Initiatives (TMIs);
- Probabilistic Constraint Prediction;
- Enhanced Post Operations;
- Improved Statistical Methods for Departure Predictions; and
- Daily Objectives Exchange.

The fundamental goal of TFM is to manage the flow of air traffic to minimize delays and congestion due to system constraints such as weather or equipment outages. Operations could be more efficient by establishing strategic plans for mitigating delay and capacity issues and may also provide some predictability to support future decisions. Operations could be further improved by implementing more effective solutions, i.e., flights affected by constraints would maintain their current paths until they are closer to a constraint and required to move thereby reducing unnecessary delay and additional flying time.

As systems and capabilities in TFM evolved, insufficient attention was paid to their integration. The Traffic Management Units of today provide piecemeal operational information and tools that cannot be combined to create a dynamic and complete view of the operation, nor provide optimal support for operational decision-making. Many of the functions performed by Traffic Managers require manual assimilation of data from various sources. The potential impact of some TMIs may not be apparent until after the initiative is implemented. Traffic Managers currently estimate potential impact by gathering data and relying on personal knowledge and past experience of how well an initiative has performed in the past. This process is cognitively demanding, workload-intensive, and dependent upon the Traffic Manager's skill level and experience.

Providing a comprehensive view in real-time of the current NAS status and initiatives already in place will provide Traffic Managers with the information they need to identify traffic flow problems sooner and make better decisions. Better modeling capabilities will improve decision-making by providing expected outcomes and possible unintended consequences before an alternative is implemented.

The Investment Analysis Readiness Decision (IARD) for CATMT WP5 is planned in FY 2018 and the Final Investment Decision (FID) is planned in FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Implementation of improved TFM capabilities will provide traffic managers with the tools and information they need to implement better, more efficient TMIs. More efficient TMIs translate to the improved usage of available NAS capacity.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of IARD for CATMT WP5:
 - Finalized Solution ConOps;
 - Finalized Functional Analysis;
 - Appropriate Enterprise Architecture products;
 - Safety Assessment;
 - Range of Alternatives;
 - Rough-Order of Magnitude (ROM) lifecycle costs;
 - Preliminary Program Requirements; and
 - Initial Investment Analysis Plan.
- Achieve IARD for CATMT WP5.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the FID for CATMT WP5:
 - Final Program Requirements (FPR) Document;
 - Enterprise Architecture Artifacts;
 - Final Business Case documentation;
 - Final Implementation Strategy and Planning Document (ISPD); and
 - Acquisition Program Baseline (Execution Plan)
- Achieve FID for CATMT WP5.

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the Concept & Requirements Definition Readiness Decision (CRDRD) for a targeted AMS investment for the next segment of traffic flow management improvements:
 - Preliminary Shortfalls Analysis; and
 - Concept & Requirements Definition Plan.
- Achieve CRDRD for the next segment of traffic flow management improvements.
- Develop the following products in support of the IARD for the next segment of traffic flow management improvements:
 - Quantified Shortfall Analysis;
 - Solution Concept of Operation;
 - Functional Analysis;
 - Enterprise Architecture products; and
 - Preliminary Program Requirements.

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of IARD for targeted AMS investment for the next segment of traffic flow management improvements:
 - Range of Alternatives;
 - ROM lifecycle costs;
 - Updated Functional Analysis;
 - Updated Enterprise Architecture Products;
 - Updated Preliminary Program Requirements; and
 - Safety Assessment.
- Achieve IARD for the next segment of traffic flow management improvements.

Program Plans FY 2022 – Performance Output Goals

- Develop the following products in support of the Initial Investment Decision (IID) for the next segment of traffic flow management improvements:
 - Initial Program Requirements;
 - Initial Business Case Analysis Report;
 - Enterprise Architecture Products;
 - Initial ISPD; and
 - Final Investment Analysis Plan.
- Achieve IID for the next segment of traffic flow management improvements.
- Develop the following products in support of the FID for the next segment of traffic flow management improvements:
 - FPR Document;
 - Enterprise Architecture Artifacts;
 - Final Business Case Analysis documentation;
 - Final ISPD; and
 - Acquisition Program Baseline (Execution Plan).

E, Advanced Methods, G05A.02-02

Program Description

Advanced Methods will explore technologies, infrastructure enhancements, and procedural changes to meet current and future traffic management needs. This program will support improvements to increase airport capacity, sector throughput, and reduce sector delays by providing NAS users and Air Traffic Management with a common understanding of NAS constraints. The program will develop and test prototype improvements and provide operational concepts and requirements for implementation by automation programs and operational organizations. Advanced Methods will explore the use of advanced coordination and data storage solutions to drive post operational analysis of Traffic Management coordination.

The capabilities defined by this program are grouped in the following enhancement areas:

- Constraint Prediction, Monitoring, and Alerting:
 - Develop prototype capabilities such as: Enhanced Sector Alert Metric, Single Source for Issued Traffic Management Initiatives (TMI), High-level Alert Manager, and Integrate User Interface Components;
 - Refine and determine which methods should be used in different operational contexts and planning horizons; and
 - Consolidate monitoring and alerting functions, incorporate probabilistic data into alerting, and improve user-customization of what is monitored, how information is presented, and how/when alerts are triggered.
- Operational Response Development:
 - Incorporate probabilistic capacity and demand information into decision support capabilities to provide enhanced risk assessment information to users conducting “what-if” analyses on the parameters of potential TMI strategies; and
 - Continue to enhance models by correlating a current operational event to similar historical events and associated TMI strategies. Engage operational Subject Matter Experts (SME) to identify and capture relevant attributes to develop models for decision support capabilities
- Traffic Flow Management (TFM) Advanced Coordination Analysis Capability:
 - Identify methods of TMI coordination data structuring and TFM data capture improvements.
 - Investigate the potential improvement of existing TM training programs through the analysis coordination data; and
 - Develop comparative analysis of TMI objective, coordination process, and eventual resolution.

- Advanced coordination capability for TFM recording and logging:
 - Identify areas of improvement within the current system of TFM coordination;
 - Provide linguistics and operational trends from SMEs and current decision recording systems; and
 - Provide speech recognition capability or advanced coordination solution within the Traffic Flow Management System that can understand human speech linguistics and non-standard phraseology for traffic flow operations to record and log actions taken by traffic managers.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Advanced Methods will analyze different technologies, infrastructure enhancements, and procedural changes to support more efficient use of airport capacity, increases in sector throughput, and reductions in sector delays.

Program Plans FY 2018 – Performance Output Goals

- Develop and complete requirements for the development of a prototype TFM Advanced Coordination Analysis Capability.

Program Plans FY 2019 – Performance Output Goals

- Develop and complete a Concept of Operations (ConOps) for speech recognition for TFM recording and logging.
- Complete development report on TFM linguistics and operational trends based on SME input and current decision recording systems.
- Develop two TFM Advanced Coordination Analysis Capabilities such as historical TMI data grouping and TFM data capture improvements.

Program Plans FY 2020 – Performance Output Goals

- Complete development report of a proof of concept emulation/prototype for a speech recognition capability for TFM recording and logging.
- Complete development of speech recognition prototype for TMI coordination logging.
- Develop TMI coordination forecasting method based on historical and current data.

Program Plans FY 2021 – Performance Output Goals

- Complete Speech Recognition Validation Test Report qualitatively comparing the performance of the capability against SME analysis.
- Complete recommendations report detailing coordination logging project lessons learned and recommendations to other Lines of Business.
- Develop recommendation report detailing training and simulation improvements that can be identified based on Advanced Coordination and TFM Advanced Coordination Analysis lessons learned.

Program Plans FY 2022 – Performance Output Goals

- Develop prototype TFM Advanced Coordination Analysis Capability such as “what-if” modeling of alternate resolution strategies. Capability could forecast sector impact based on current and historical data.
- Develop model enhancement recommendation report detailing improvements that can be identified based on Advanced Coordination.

1A07, NEXTGEN – ON DEMAND NAS PORTFOLIO

FY 2018 Request \$12.0M

- A, Flight Object, G05A.02-03
- B, Common Status & Structure Data, G05A.02-01
- C, Flight Object Exchange Services (FOXS), G05A.02-08
- D, Dynamic Airspace, G05A.04-01
- X, Flight Deck Collaborative Decision Making, G05A.02-11

A, Flight Object, G05A.02-03

Program Description

NAS systems currently operate as separate entities servicing different flight domains; Preflight, Departure, Arrival, En Route, and Oceanic. Similarly, International Air Navigation Service Providers also operate as separate entities servicing their own airspace. Even though flight information resides in multiple NAS systems, a unified, complete, accurate, up-to-date, and easily accessible picture of all flights does not exist today. The Flight Object program is developing an International data standard, “FIXM” (Flight Information Exchange Model) and supports systems implementation of this data standard. This data standard will support the exchange of flight information between systems across multiple domains including the NAS and International systems.

The Flight Object program will define the mechanisms for capturing and sharing the most up-to-date information on any flight. Additionally, the program will develop a single common reference for all system information about a flight, and will seek to eliminate exchange of flight information that is redundant or inconsistently defined. Flight-specific information from different sources will be reconciled to ensure that it is associated with the correct flight. The standards for flight information definitions must align with emerging International Civil Aviation Organization (ICAO) standards such as Flight and Flow-Integrated Collaborative Environment (FF-ICE); the FIXM standard will be the basis for that information exchange. The FIXM content does not include environment or weather information data since these are system-wide elements that affect multiple flights. The information contained in the FIXM flight structure will contain more detail than what is currently available in today’s flight data construct.

The FIXM data model is a large and complex specification. To manage this complexity, FIXM was developed with a “core & extensions” architecture. The core contains the base flight information that is globally applicable and expected to be used by any application in international settings. Extensions are accompanying but separate data models and schemas that add additional elements to supplement the FIXM core to support additional regional requirements. Concepts and data elements from regional extensions may be promoted to “core” if they demonstrate global applicability. FAA publishes and manages the FIXM U.S. extension, which contains flight data specific to NAS operations.

For versions of FIXM v4.0 and beyond, the core is expected to include additional sets of data elements to support the ICAO FF-ICE step 1 (FF-ICE/1) concept. FF-ICE defines international information requirements for flight planning, flow and trajectory management, and aims to be a cornerstone of Trajectory Based Operations. A series of operational scenarios were developed and coordinated with the ICAO provisions team. Future FIXM content may also include changes to align with the emerging ICAO Aeronautical Information Reference Model and other data requirements derived from other global concepts being developed as a part of the Global Air Navigation Plan; i.e. Air Traffic Flow Management CONOPs, Trajectory-Based Operations CONOPs, and System Wide Information Management CONOPs. This international effort embraces the FIXM standard to facilitate a successful collaboration and will also require FIXM data elements and supporting services to implement provisions planned for the future.

The Flight Object program will be composed of two major components, development of the FIXM standard and FIXM Operational Analysis. The FIXM core standard and U.S. extension will be updated as needed to support NextGen capabilities and the FF-ICE international initiative. Each version will create a FIXM Operational Data Description and a FIXM Logical Model and Extensible Markup Language schema. The updates will be created with collaboration with FAA stakeholders, International partners, industry, ICAO, and International Air Transport Association. FAA

operational analysis will assess various ATM capabilities and identify the data requirements to be considered for inclusion in each release of FIXM. Operational scenarios will be developed to define operational context of FIXM artifacts and verify that their contents accurately address the operational needs. To assist FIXM developers to understand and utilize the FIXM standard, the program will provide global guidelines for constructing and exchanging FIXM compliant messages and guidance for FIXM message construction. A FIXM Global Implementation Strategy will be developed to provide a projected overview on implementing FIXM for global data exchanges. The program will also support NAS systems, as they become FIXM compliant and mediate legacy data format transitions necessary to meet the FIXM required standard.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Use of FIXM will facilitate a unified, complete, accurate, up-to-date, and easily-accessible picture of any and all flights. The use of standardized flight data will increase data quality and availability between stakeholders enabling operational benefits such as increased coordination, common situational awareness, and collaborative decision-making across all phases of flight; improving planning, decision making, and NAS capacity.

Program Plans FY 2018 – Performance Output Goals

Development of FIXM Standard:

- Complete report assessing the impacts of an ICAO Reference Model on the FIXM Standards.
- Complete report assessing the impacts of the ICAO FF-ICE/1 Implementation Manual on FIXM.
- Develop draft FIXM Core v5.0 artifacts. This release may include Unmanned Aircraft Systems (UAS) or Commercial Space Operations.
- Develop draft FIXM US extension v5.0 artifacts.

FIXM Operational Analysis:

- Develop Operational Scenarios to support FIXM core and US extension v5.0.

Program Plans FY 2019 – Performance Output Goals

Development of FIXM Standard:

- Develop and complete FIXM v5.0 Core artifacts. This version may include UAS or Commercial Space Operations. In addition, there may be new requirements to reflect the ICAO Reference Model.
- Develop and complete FIXM US extension v5.0 artifacts.
- Complete the 1st update of the FIXM messaging standard based on FIXM content changes.

FIXM Operational Analysis:

- Develop Operational Scenarios to support FIXM US extension v5.1 (if needed).

Program Plans FY 2020 – Performance Output Goals

Development of FIXM Standard:

- Develop and complete draft FIXM Core v6.0 artifacts.
- Develop and complete draft FIXM US extension v6.0 artifacts.

FIXM Operational Analysis:

- None.

Program Plans FY 2021 – Performance Output Goals

Development of FIXM Standard:

- Develop and complete final FIXM core v6.0 artifacts.
- Develop and complete final FIXM US extension v6.0 artifacts.
- Complete the 2nd update of the FIXM messaging standard based on FIXM content changes.

FIXM Operational Analysis:

- None.

Program Plans FY 2022 – Performance Output Goals

Development of FIXM Standard:

- Develop custom US extensions (as required) to support FF-ICE/1 implementation in NAS.

FIXM Operational Analysis:

- Support data mediation for NAS systems converting to FIXM format and provide data analysis and data mapping report.
- Develop Operational Scenarios to support FIXM core and US extension v7.0.
- Initiate a concepts engineering study with ICAO FF-ICE step 2 (FF-ICE/2) and develop an impact assessment report.

B, Common Status & Structure Data, G05A.02-01

Program Description

The Common Status and Structure Data (CSSD) program will establish the requirements and information flows for the collection, management, and maintenance of Aeronautical Information (AI) 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. To support NextGen capabilities, this program enables the FAA to improve situational awareness through better access to aeronautical information and a common language. This allows external users including Department of Defense, Airline Operations Centers, Flight Operation Centers, pilots and Air Navigation Service Providers to make more informed decisions and base their plans on the most current information available with respect to planned NAS constraints such as SAA, airport configurations, static airspace constraints, and NOTAMs.

Key elements of the CSSD program include:

- The Aeronautical Common Services (ACS) platform, implemented as part of Aeronautical Information Management Modernization (AIMM) Segment 2, will be used to accept data from authoritative databases; process and combine data from these sources; and distribute data via the System-Wide Information Management (SWIM) infrastructure. The ACS, SWIM network, and authoritative NAS databases will provide an enterprise level platform for accessing and delivering both authoritative data, and or products, from multiple authoritative data sources;
- Capturing and maintaining digital information about flow constraints, reference data, and NAS status information affecting operations;
- Publishing aeronautical status information digitally using international standards;
- Providing more accurate, complete, standardized and digitized AI, and greater AI integration into the NAS ATM environment to support capabilities including constraint-aware flight planning using digitized airspace constraints contained in Standard Operating Procedures and Letters of Agreement, real-time SAA status information, integrated SAA schedule/status information, integrated NOTAM processing, improved adaptation data generation, and digitized charting; and
- Using the SAA schedule, status and legal description information to improve operational performance metrics calculations and forecasting of airspace system performance.
- Enhancing the Aeronautical Information eXchange Standard (AIXM) to describe aeronautical information elements that are associated with future operations both in the NAS and relevant to the ICAO Aviation System Block Upgrades (ASBU).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter.*
- *FAA performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

CSSD provides support for the information, systems and tools necessary to implement comprehensive NAS safety management. CSSD will achieve this by establishing the requirements and information flows for the collection, transformation, distribution, integration, and maintenance of aeronautical information in a standardized digital format between systems. When fully realized, the FAA will have the ability to model how new procedures, regulations, airspace changes, and dynamic SAA information may affect the current and future safety of the NAS.

Identifying the requirements and benefits of integrated flight planning and briefing (including flight constraint information) will lead to better flight planning and arrival/departure safety plans. Supporting preflight, during flight and post-operational aeronautical information for exchange and use by NAS automation systems will enable the FAA to maximize safety and may reduce the number of incidents.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the Investment Analysis for AIMM S3:
 - Initial Program Requirements;
 - Initial Business Case Analysis Report;
 - Enterprise Architecture Products; and
 - Initial Implementation Strategy and Planning Document (ISPD).
- Complete a qualitative shortfall analysis of aeronautical information elements currently described from those that do not have a current digital description in AIXM.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the Final Investment Decision (FID) for AIMM S3:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case Analysis Report;
 - Final ISPD;
 - Acquisition Program Baseline (Execution Plan);
 - Independent Evaluation Review; and
 - Project Management and Communications Plan.
- Achieve FID for AIMM S3.
- Produce engineering development report and updated data schema of new aeronautical information elements to be included in the next release of the AIXM.

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the Concept and Requirements Definition Readiness Decision (CRDRD) for AIM Modernization Segment 4 (AIMM S4), which will focus on expanding the digitization of AI and integrating AI data into additional operational decisions and enabling tools:
 - Preliminary Shortfall Analysis
 - CRD Plan
- Achieve CRDRD for AIMM S4.
- Conduct a gap analysis report between enhancements made to AIXM to support ASBU/ Flight and Flow Information for a Collaborative Environment (FF-ICE) Step 1 and future ASBU segments.

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of the IARD for AIMM S4:
 - Shortfall Analysis/ Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Range of Alternatives;
 - Investment Analysis Plan;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Achieve IARD for AIMM S4.
- Develop aeronautical information element enhancement data requirements report utilizing a list of data elements for future AIXM versions.

Program Plans FY 2022 – Performance Output Goals

- Develop the following products in support of the Investment Analysis for AIMM S4:
 - Initial Program Requirements;
 - Initial Business Case Analysis Report;
 - Enterprise Architecture Products; and
 - Initial ISPD.
- Produce engineering development report of future enhancements to aeronautical information elements to comply with ICAO ASBU/FF-ICE Step 2 requirements.

C, Flight Object Exchange Services (FOXS), G05A.02-08

Program Description

The FOXS/Common Support Services - Flight Data (CSS-FD) program will work towards standardization of flight information exchange in the NAS by defining and delivering a service that updates exchanges:

- Between operators and the FAA, using Flight and Flow Integrated Collaborative Environment (FF-ICE) and Flight Information Exchange Model (FIXM) as the primary standards; and
- Between NAS systems and flight data clients using an integrated, FIXM-based flight data sharing service.

NAS systems currently operate as separate entities servicing different flight domains. Similarly, International Air Navigation Service Providers also operate as separate entities servicing their own airspaces. Each NAS system has been developed separately within its domain, without close coordination on the definition of information elements or the technology and standards used to publish them. The capabilities to allow various types of flight data to be easily shared between domains and among various users and stakeholders do not exist. While a specific flight can be found in NAS systems today, a unified, complete, accurate, up-to-date, and easily-accessible picture of any and all flights does not currently exist. These processes are not well integrated, requiring separate networks and incompatible interfaces to communicate with each domain. This reduces the ability of flight operators, TFM and ATC personnel to work together to develop and implement plans that deal with predicted system constraints.

In addition to recognizing the need to improve flight data management and exchange within the NAS, the International Civil Aviation Organization (ICAO) Air Traffic Management Requirements and Performance Panel delivered to ICAO the *Manual on Flight and Flow - Information for a Collaborative Environment*, which was released in 2012. This concept describes the evolution of the ICAO flight planning provisions in a more dynamic and integrated information exchange environment. Implementing the ICAO standards for FF-ICE therefore provides a path towards improving the current flight planning situation in the NAS.

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 Common Service (FDCS) – A SWIM service that disseminates and exchanges strategic planning flight data between NAS systems and external users.

- Flight Object Exchange Services (FOXS) – A SWIM service that creates and exchanges the Flight Object in FIXM format that internal and external NAS users will use to coordinate flight progress and status during the lifecycle of a flight.
- Unified Flight Plan and Filing (UFPF) – A SWIM service that provides a consolidated and enhanced flight planning and filing capability for NAS users. This service will not only provide a single point of presence for internal and external NAS users to file flight plans, it will also provide a toolset that provides more information for users planning flights and includes a route evaluation tool that evaluates a user's requested flight plan route against current NAS constraints and plans.

The FOXS/CSS-FD program will be ready for Investment Analysis Readiness Decision (IARD) in FY 2018, Initial Investment Decision (IID) in FY 2019 and a Final Investment Decision (FID) by FY 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

FOXS/CSS-FD will define the services that support standardized flight planning and flight data exchange. These services will work in concert with application systems (e.g. En Route Automation Modernization, Traffic Flow Management System, etc.) and infrastructure services (such as the NAS Enterprise Messaging Services) to provide a standardized methodology for NAS systems to exchange data with each other and with external systems, such as flight operator and international ATM systems. The standardized flight planning service will implement collaborative, integrated flight planning that follows the international standards established by FF-ICE. The flight data exchange service will provide standardized flight information sharing that integrates information from multiple systems, consolidates redundant services, and reliably associates information to the appropriate flight.

The FOXS/CSS-FD program will enhance collaborative decision making through improving exchange of NAS state data and providing better flight planning process. The system will also improve predictability, system efficiency, and flight efficiency via more accurate trajectory generation, enhanced demand predictions, and increased execution of airspace user trajectory preferences.

Program Plans FY 2018 – Performance Output Goals

- Conduct engineering development reports of:
 - FDCS; and
 - UFPF.
- Complete the following products in support of the FOXS/CSS-FD IARD:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Complete engineering and investment analysis planning to incorporate FIXM changes into FOXS/CSS-FD and SWIM services.
- Achieve IARD for FOXS/CSS-FD.

Program Plans FY 2019 – Performance Output Goals

- Complete the following products in support of the FOXS/CSS-FD IID:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Products;
 - Initial Implementation Strategy and Planning Document (ISPD); and
 - Final Investment Analysis Plan.
- Achieve IID for FOXS/CSS-FD.

Program Plans FY 2020 – Performance Output Goals

- Complete the following products in support of the FOXS/CSS-FD FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for FOXS/CSS-FD.

Program Plans FY 2021 – Performance Output Goals

- Pending JRC FID, initiate FOXS/CSS-FD implementation, including:
 - System Decomposition; and
 - System/Subsystem Architecture Design.

Program Plans FY 2022 – Performance Output Goals

- Pending JRC FID, develop the FOXS/CSS-FD services:
 - Software Development;
 - Hardware Infrastructure; and
 - System Acceptance Test.

D, Dynamic Airspace, G05A.04-01

Program Description

Dynamic Airspace will provide the necessary research and investment 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.

The present NAS automation and communications, navigation and surveillance (CNS) infrastructure limit the degree to which dynamic airspace can be applied. It is generally used only where well known, recurring or anticipated problems exist. As the NAS is required to deal with more and more complicated traffic situations, a higher degree of flexibility will be needed to allow rapid response to changing conditions. In coming years, changes to the NAS associated with the NextGen will help alleviate some of the limitations that inhibit application of dynamic airspace today. Advances in CNS and automation will facilitate implementation and use of dynamic airspace, which in turn will increase the resiliency of the NAS.

Pre-implementation activities and acquisition management system milestones through Final Investment Decision (FID) for Dynamic Airspace are funded under this program. A Concept & Requirements Definition Readiness Decision (CRDRD) for this program is planned for FY 2018. An Investment Analysis Readiness Decision (IARD) is planned for FY 2019. Initial Investment Decision (IID) is planned for FY 2020. A FID is planned in FY 2021.

Post FID implementation activities will be funded and executed under the Airspace Resource Management System (ARMS) program, G05A.02-09.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Ensuring that system automation gaps are closed will improve NAS resilience and facilitate capabilities that support the dynamic reconfiguration of the NAS. The Dynamic Airspace program will allow traffic managers to optimize airspace configuration across the NAS to decrease congestion in workload-constrained airspace and address unexpected events, such as weather and Special Use Airspace restrictions, thereby supporting the average daily capacity performance metric.

Program Plans FY 2018 – Performance Output Goals

- Complete the following products in support of the Dynamic Airspace CRDRD:
 - Updated Service Thread Analysis Document;
 - Preliminary Operational Requirements;
 - Interdependencies Document;
 - Functional Description Document;
 - Initial Concept of Operations; and
 - Concept and Requirements Definition Plan.
- Conduct concept validation activities, such as a human-in-the-loop simulation.
- Achieve CRDRD for Dynamic Airspace.

Program Plans FY 2019 – Performance Output Goals

- Complete the following products in support of the Dynamic Airspace IARD:
 - Solution CONOPS;
 - Quantified Shortfall Analysis;
 - Enterprise Architecture products;
 - Safety Risk Management Guidance for System Acquisitions required documents;
 - Information System Security risk factor assessment;
 - Preliminary Program Requirements Document; and
 - Initial Investment Analysis Plan.
- Achieve IARD for Dynamic Airspace.

Program Plans FY 2020 – Performance Output Goals

- Complete the following products in support of the Dynamic Airspace IID:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Products;
 - Initial Implementation Strategy and Planning Document; and
 - Final Investment Analysis Plan.
- Achieve IID for Dynamic Airspace.

Program Plans FY 2021-2022 – Performance Output Goals

- None.

X, Flight Deck Collaborative Decision Making, G05A.02-11

Program Description

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 flight deck and support the flight crew decision-making by providing Electronic Flight Bag applications that enable future capabilities such as surface monitoring, advanced trajectory modeling, Four Dimensional Trajectory negotiations, and synchronization of air/ground procedures. Leveraging research conducted in previous years and advancements in SWIM and ground

automation systems, 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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

Flight Deck CDM supports on-time arrivals by improving collaboration of traffic managers with an aircraft's flight deck. Using flight crew input, the incorporation of aircraft performance and aircraft intent information into NAS automation and decision support tools will result in increased predictability of future aircraft position, allowing traffic managers to strategically manage the airspace based on where the aircraft will be located at a future time.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Develop initial technical and operational assessment report.
- Deliver report on coordination with key stakeholders and organizations.
- Develop shortfall analysis document for Flight Deck CDM applications.

Program Plans FY 2020 – Performance Output Goals

- Develop initial concept and requirements document.
- Develop functional analysis for Flight Deck CDM applications.
- Develop prototype environment to display system functionalities.

Program Plans FY 2021 – Performance Output Goals

- Develop implementation strategy plan for Flight Deck CDM applications.
- Develop detailed technology testing and evaluation plan.
- Determine data exchange format and performance standards for flight deck automation.

Program Plans FY 2022 – Performance Output Goals

- Develop training plan and material for advanced services and applications.
- Develop operator implementation checklist.
- Obtain operational approval for Flight Deck CDM applications.

1A08, NEXTGEN – NAS INFRASTRUCTURE PORTFOLIO

FY 2018 Request \$17.5M

- A, Weather Observation Improvements, G04W.02-01
- B, Weather Forecast Improvements – Work Package 1, G04W.03-01
- C, NextGen Navigation Engineering, G06N.01-03
- D, New ATM Requirements, G01M.02-02
- E, Information Management, G05M.03-01

A, Weather Observation Improvements, G04W.02-01

Program Description

This program will manage the evolution of the existing aviation weather observation sensor networks to one that provides the optimal quantity and quality of ground, air, and space-based sensors. A consistent and effective aviation weather sensor network is fundamental to NextGen. Of primary focus is the surface weather sensor network in the Terminal environment. A comprehensive list of weather observation shortfalls is continuously refined and prioritized based on feedback from key stakeholders and user groups. The program uses this information to explore potential NextGen-enabled concepts and to mitigate high priority shortfalls. Technical studies are underway to identify methods to optimize existing ground-based surface platforms. In the near term, this program will continue to focus on mitigating shortfalls associated with terminal wind observations. Terminal winds are surface and boundary level winds along the runway, approach and departure areas that may affect the efficiency and safety of aircraft operations during the takeoff and landing phases of flight. A decision to change the direction for takeoffs and landings at an airport, due to a shift in the prevailing winds, is both complex and costly. Decisions to “turn” an airport require accuracy in both forecasts and local observations of current conditions. The National Transportation Safety Board has established that adverse wind conditions (defined as gusts, crosswinds or tailwinds) are a factor in over 50% of all weather related incidents. Identified improvements to the aviation weather-observation sensor network may require collaboration between the FAA and other NextGen partners including the National Oceanic and Atmospheric Administration and the Department of Defense.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program provides the analysis and engineering to improve aviation weather observations to enable improvements in forecasts; and the integration of weather data into decision support tools for collaborative and dynamic NAS decision-making. It will enhance capacity by expanding the use of weather information for operational decision-making. This will include support for optimal selection of aircraft routes and precise spacing for arriving and departing aircraft. The increased accuracy of forecasts and improved observations will also enable individual trajectory-based profiles and optimized use of available airspace.

Program Plans FY 2018 – Performance Output Goals

- Complete the documentation of the physical and environmental conditions that are negatively impacting effective wind observations at the subject airports.
- Perform and complete engineering studies to determine the optimal locations and enabling technologies to affordably relocate wind sensors within existing network infrastructures.
- Conduct demonstrations of how decision-making during adverse wind conditions will improve as a result of mitigating existing wind sensing shortfalls.
- Perform and complete technical maturity studies of new wind observing technologies to support runway orientation management and may provide other economic benefits (i.e. equipment consolidation, improved situational awareness, improved weather forecast initialization, etc.).

Program Plans FY 2019 – Performance Output Goals

- Deliver results, analysis, and recommendations of wind measuring technologies and siting/installation alternatives.
- Deliver feasibility report for expanding technical maturity studies of wind mitigation concepts to select demonstration locations.
- Develop risk mitigation plan to address technical issues associated with adverse terminal winds concept.
- Develop and complete document identifying demonstration locations.

Program Plans FY 2020 – Performance Output Goals

- Issue Screening Information Requests for equipment and services required for airport wind studies.
- Develop web-based tools and techniques to articulate demonstration results and potential operational benefits.
- Conduct equipment installation at identified location(s) and initiate data collection activities.
- Develop report of initial model and simulation activities of legacy vs. improved wind measuring technologies employed at demonstration locations.

Program Plans FY 2021 – Performance Output Goals

- Complete multi-season data collection at selected demonstration sites.
- Deliver initial results report from model and simulation activities of legacy vs improved wind measuring technologies.
- Initiate technical transfer package of siting guidelines, installation procedures, and validated equipment and integration procedures.
- Remove evaluation equipment from demonstration locations.

Program Plans FY 2022 – Performance Output Goals

- Deliver final results report from model and simulation activities of legacy vs improved wind measuring technologies and formulate operational performance requirements.
- Deliver technical transfer package to the Program Management Organization for incorporation into Aviation Surface Weather Observation Network.
- Deliver draft report documenting other locations that would benefit from Terminal Winds concept implementation.
- Deliver project closeout materials such as a lessons learned document and final stakeholder register.

B, Weather Forecast Improvements – Work Package 1, G04W.03-01

Program Description

The Weather Forecast Improvements (WFI) program seeks to improve weather predictions and determine how to improve the use of that information. The overall complexity of high demand NAS operations makes many weather-constrained traffic management problems difficult to define and even harder to resolve. Even the most seasoned professionals are challenged by the many variables impacting the decision-making process during a weather-constrained event.

In today's NAS, both traffic managers and users must mentally interpret weather conditions and determine the potential impact of weather on ATC decision-making. Currently, there is minimal automation available to assist with identifying, analyzing, and developing mitigation strategies for weather-constrained airports and airspace. This program will improve the decision-making process and the accuracy of aviation weather information to include an automated translation of weather information into constraints placed on the NAS. It will enable the integration of aviation weather information into a collaborative and dynamic decision-making process by implementing advanced aviation weather forecasting models to determine and reduce weather's effects on traffic forecasts. Metrics will be developed and applied to evaluate how effective weather forecast improvements may increase NAS capacity.

The program will also develop the necessary policies, standards, and guidance in providing aeronautical meteorological services under U.S. commitments to the International Civil Aviation Organization (ICAO). Specific work elements under WFI include the following:

- **ATM Weather Integration (AWI)** – This work includes exploration of weather translation techniques for non-convective weather constraints, weather advisory and collaborative lab experiments designed to explore AWI concepts and capabilities. Output from these activities will be directly transferable to future Collaborative Air Traffic Management Technologies and to Time Based Flow Management work packages. This work also supports the evaluation of remaining shortfalls in support of service analysis for future NextGen Weather Processor (NWP) and Common Support Services-Weather (CSS-Wx) work packages

and includes AWI activities necessary to support data exchange standards such as for the Weather Information Exchange Model (WXXM).

- International – This effort develops and coordinates globally-harmonized requirements for the production and dissemination of meteorological information to support international air navigation for adoption as ICAO Standards and Recommended Practices (SARPs) and inclusion in ICAO Annex 3 Meteorological Services and other guidance documents.
- NWP & CSS-Wx Future Work Package Analysis – This work will prepare analysis products in support of investment decisions for future NWP and CSS-Wx work packages. The Investment Analysis Readiness Decision (IARD) is planned in FY 2019, the Initial Investment Decision (IID) in FY 2020, and the Final Investment Decision (FID) in FY 2021.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The WFI program translates aviation weather data for integration into decision support tools and collaborative and dynamic NAS decision-making. It supports the efficient use of capacity by identifying and displaying airspace constraints that may impact NAS operations and with the selection of optimal aircraft routing and spacing for arriving and departing aircraft. The increased accuracy of aviation weather observations and forecasts enables trajectory-based profiles that optimize the usage of available airspace.

Program Plans FY 2018 – Performance Output Goals

ATM Weather Integration:

- Complete concept evaluation report for integrating weather products into NWP/CSS-Wx WP2 including, but not limited to:
 - Turbulence: Graphical Turbulence Guidance (GTG) 3.X
 - Numerical Model: Report on Rapid Refresh and High Resolution Rapid Refresh
 - Icing: Current Icing Product/Forecast Icing Product
 - Ceiling & Visibility: CONUS Ceiling & Visibility (C&V) grids
 - Wind predictions
 - Microburst

International:

- Complete SARPs for Amendment 79 to Annex 3 for Space Weather (SWx), Volcanic Ash (VA), and World Area Forecast System (WAFS), information under the ICAO Meteorology Panel (METP) for approval by the ICAO Air Navigation Commission (ANC).
- Complete draft guidance material for SWx information.
- Complete U.S. response to adopt final version of Amendment 78 to ICAO Annex 3.
- Complete report on U.S. differences with Amendment 78 to ICAO Annex 3.
- Complete action 4.2.4 in the National Space Weather Action Plan to develop requirements for a real-time reporting system that increases operator situational awareness of the radiation environment.
- Complete U.S. Transition plan for ICAO Meteorological Information Exchange Model (IWXXM) weather messages.
- Complete routine exchange of weather products in IWXXM format internationally.
- Complete SARPs for Amendment 79 to Annex 3 for IWXXM.

NWP & CSS-Wx Future Work Package Analysis:

- Develop the following products in support of the Investment Analysis Readiness Decision (IARD) for NWP WP2/CSS-Wx WP2:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operation;
 - Functional Analysis Document;
 - Enterprise Architecture products;
 - Preliminary program requirements;
 - Safety Assessment;
 - Alternatives & Rough-Order of Magnitude Costs; and
 - Investment Analysis Plan.

Program Plans FY 2019 – Performance Output Goals

International:

- Complete status document on the initiation of the implementation of the U.S. IWXXM transition plan, in accordance with National Oceanic and Atmospheric Administration, National Weather Service, Department of Defense, and the Office of Federal Coordinator Meteorology.
- Complete the current cycle of U.S. inputs to Amendment 79 to ICAO Annex 3 for SWx, VA, and WAFS, information under the METP.

NWP & CSS-Wx Future Work Package Analysis:

- Achieve IARD for NWP WP2/CSS-Wx WP2.
- Conduct systems engineering work on candidate concepts for inclusion in NWP and CSS-Wx Work Package 2 and future work packages.

Program Plans FY 2020 – Performance Output Goals

ATM Weather Integration:

- Complete concept evaluation report for integrating weather products into a future NWP/CSS-Wx WP including, but not limited to:
 - Turbulence: GTG-Nowcast.
 - Numerical Model: Report on High Resolution Ensemble Forecast (HREF) and Next Generation Global Prediction System (NGGPS)
 - Convective Weather: Ensemble Prediction of Oceanic Convective Hazards, Convective Weather Avoidance Model (CWAM)

International:

- Complete draft SARPs for Amendment 80 to Annex 3 for SWx, VA, and WAFS, information under the METP for approval by the ICAO ANC.
- Complete draft SARPS for use of IWXXM in support of ICAO Global SWIM for Amendment 80 to Annex 3.
- Complete routine exchange of weather products in IWXXM format internationally.
- Operationally deliver ICAO 6 Annex 3 Meteorology (MET) products (Meteorological Terminal Aviation Routine report, Special report, Terminal Aerodrome Forecast, Significant Meteorological Information, Volcanic Ash Advisory, Tropical Cyclone Advisory) in accordance with National Oceanic and Atmospheric Administration, National Weather Service, Department of Defense, and the Office of Federal Coordinator Meteorology.

NWP & CSS-Wx Future Work Package Analysis:

- Develop the following products in support of the IID for targeted NWP WP2 / CSS-Wx WP2 investment:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Artifacts; and
 - Implementation Strategy and Planning Document (ISPD).
- Achieve IID for NWP WP2/CSS-Wx WP2.

Program Plans FY 2021 – Performance Output Goals

ATM-Weather Integration:

- Complete concept evaluation report for integrating weather products into a future NWP/CSS-Wx WP including, but not limited to:
 - Turbulence: Turbulence Avoidance Model Development
 - Numerical Model: High Resolution Rapid Refresh (HRRR) upgrades
 - Icing: Icing Products Alaska (IPA – Forecast and Diagnosis)
 - Ceiling & Visibility: C&V Alaska grids
 - Convective Weather: CWAM

International:

- Complete draft guidance material to support the SARPs for SWx, VA, WAFS, and Release of Radioactive Material included in Amendment 80 to ICAO Annex 3.
- Complete draft of ICAO Procedures for Air Navigation – Meteorology under the METP.
- Complete U.S. position on draft version of Amendment 80 to ICAO Annex 3.
- Deliver U.S. Weather information (e.g., Space Weather Advisory, SIGWX, etc.) in IWXXM (both non-Annex 3 and new Annex 3 MET products) to support the global exchange of Meteorological information in support of international air navigation.

NWP & CSS-Wx Future Work Package Analysis:

- Develop the following products in support of the FID for targeted NWP WP2 / CSS-Wx WP2 investment:
 - Final Program Requirements documentation;
 - Enterprise Architecture Artifacts;
 - Business Case documentation;
 - ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for NWP WP2/CSS-Wx WP2.

Program Plans FY 2022 – Performance Output Goals

ATM-Weather Integration:

- Develop concept evaluation report for integrating weather products into future NWP/CSS-Wx WP including, but not limited to:
 - Turbulence: GTG Turbulence Upgrade – Convectively-induced turbulence
 - Numerical Model: HREF and NGGPS upgrades
 - Ceiling & Visibility: C&V version2 with Helicopter Emergency Medical Services tool improvements
 - Icing: Model of Icing Conditions for Real-Time Operations

International:

- Complete draft SARPs for Amendment 81 to ICAO Annex 3 under the METP for approval by the ANC.
- Complete report on U.S. difference with Amendment 80 to ICAO Annex 3.
- Complete draft SARPS for use of IWXXM in support of ICAO Global SWIM for Amendment 81 to Annex 3.

C, NextGen Navigation Engineering, G06N.01-03

Program Description

The NextGen Navigation Engineering program supports the NextGen goal to increase NAS efficiency, capacity, and access to airports through innovation. The activities in NextGen Navigation Engineering are: Area Navigation (RNAV) Distance Measuring Equipment (DME)-DME and NextGen Navigation Support Enhanced Low Visibility Operations (ELVO) Phase 3.

RNAV DME-DME:

This activity supports RNAV through the use of DME-DME, which is the use of 2 or more distance measuring navigational aids down to 2000 feet above ground level and potentially to the final approach fix, with or without the need for an Inertial Reference Unit (IRU) in the aircraft. The success of this work will allow expansion of NextGen RNAV benefits to all properly equipped aircraft, including regional jets and business jets that are not equipped with an IRU. It also will ensure that the DME infrastructure can support NAS-wide performance based navigation (PBN)

as envisioned by NextGen by identifying capacity and availability shortfalls. Spectrum modeling and testing results from previous years already show that additional Class A and Class B airspace could be supported through DME-only defined airspace. The United States standard for DMEs is not currently in alignment with the International Civil Aviation Organization standard but could be changed to be the same. Ongoing work to define the Very High Frequency Omnidirectional Range (VOR) system, the Minimum Operational Network supports sites where the VOR is removed but the DME is still required for operations. This activity will develop the new spectrum service volume required to support implementation of NAS-wide Performance-Based Navigation and planning documentation for NextGen DME. This activity supports the investment analysis for NextGen Distance Measuring Equipment (DME) Support for PBN Strategy program, G01N.01-02. Implementation of NextGen DMEs will occur under the G01N.01-02 program.

NextGen Navigation Support – ELVO Phase 3:

This activity supports 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. LVOs below 1,200 feet visibility will require the use of a HUD. The activity will determine the need for improvements to ground-based navigational aids or lighting systems such as Runway Visual Range to support ELVO Phase 3. This activity will support the investment analysis activities for ELVO Phase 3 program to be established.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program supports the average daily capacity performance metric by enabling more users to use PBN and by increasing the number of landing and departures during low visibility conditions.

Program Plans FY 2018 – Performance Output Goals

RNAV DME-DME:

- None.

NextGen Navigation Support – ELVO Phase 3:

- Complete operational concept validation for diverse airports to determine requirements.
- Develop the following draft products in support of the Investment Analysis Readiness Decision (IARD):
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operation;
 - Functional Analysis;
 - Enterprise Architecture Products;
 - Preliminary Program requirements; and
 - Safety Assessment.

Program Plans FY 2019 – Performance Output Goals

RNAV DME-DME:

- None.

NextGen Navigation Support – ELVO Phase 3:

- Develop the following final products in support of the IARD:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products;
 - Preliminary Program Requirements; and
 - Safety Assessment.
- Achieve IARD for ELVO Phase 3.

Program Plans FY 2020 – Performance Output Goals

RNAV DME-DME:

- None.

NextGen Navigation Support – ELVO Phase 3:

- Develop the following draft products in support of the Final Investment Decision (FID):
 - Final Program Requirements (FPR) Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Implementation Strategy and Planning Document (ISPD); and
 - Acquisition Program Baseline (Execution Plan).

Program Plans FY 2021 – Performance Output Goals

RNAV DME-DME:

- Develop the following draft products in support of the FID for NextGen DME Phase 2:
 - FPR Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - ISPD; and
 - Acquisition Program Baseline (Execution Plan).

NextGen Navigation Support – ELVO Phase 3:

- Develop the following final products in support of the FID:
 - FPR Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for ELVO Phase 3.

Program Plans FY 2022 – Performance Output Goals

RNAV DME- DME:

- Develop the following final products in support of the FID for NextGen DME Phase 2:
 - FPR Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for NextGen DME Phase 2.

NextGen Navigation Support – ELVO Phase 3:

- None.

D, New ATM Requirements, G01M.02-02

Program Description

The New Air Traffic Management (ATM) Requirements program identifies new opportunities to improve the efficiency and effectiveness of air traffic management. It supports the NextGen goal of expanding capacity by developing decision support tools that improve the strategic management of operations in the NAS. New ATM requirements activities include:

Enterprise Information Protocol & Exchange Standards:

This project addresses the need for harmonization protocols, governance, and standards for using enterprise information both internally and with external agency partners including the Department of Defense, the National Weather Service, and international partners. This research will identify the shortfalls in moving from direct data sharing to a network environment. It includes protocols for enterprise information, criteria for managing and

developing incremental versions for exchange standards, and conformance monitoring techniques. After this analysis is complete, the activities will shift to development and implementation of baseline versions of exchange models and continued conformance monitoring to ensure compliance. Enterprise information protocol and exchange standards are necessary to coordinate information standards work and achieve global harmonization of standards and protocols; especially as they relate to engagement with Open Geospatial Consortium and harmonization with International Civil Aviation Organization (ICAO) standards. Additionally, this project addresses the necessary governance for current and future information services that are exchanged with NAS stakeholders. The project will evaluate industry and government best practices; identify the minimum level of information services to be provided; define the required operational standards for implementation; and inform the development of policies and governance structure to manage services, procedures, processes, and tools while maintaining interoperability with the ICAO System Wide Information Management and Information Services concepts.

Future Collision Avoidance System (Future CAS):

Future CAS will complement work planned under the Airborne Collision Avoidance System (ACAS) X program (M54.01-01) to include new user classes such as Unmanned Aircraft Systems (Xu) and General Aviation /Rotorcraft Systems (Xp). This activity will conduct research to develop requirements for these new classes of users to ensure future collision avoidance systems are interoperable within the NAS.

Weather Transition:

This activity ensures that aviation weather research concepts are matured and technically developed under FAA guidelines to a level of readiness for operational use in the NAS. This includes Concept Maturity and Technology Development based work in support of the Research for Service Analysis and Service Analysis AMS lifecycle phases. The matured capabilities developed will support future weather information enabled decision support for the NAS. Weather Transition will manage appropriate weather related activities to:

- Conduct users' needs analysis for weather information support to NAS operations;
- Conduct engineering studies and determine the performance level of current weather information support;
- Analyze shortfalls in weather information support to NAS operations;
- Develop, validate, and allocate preliminary requirements for weather information needed to address shortfalls;
- Develop and mature initial operational concepts; and
- Create, test, and conduct evaluations and demonstrations of new weather information support to NAS operations.

Synchronization of Air/Ground Procedures:

The Air/Ground Procedure Synchronization project will explore trajectory synchronization concept of use and validate proposed solutions in collaboration with industry partners and operational stakeholders through simulations and flight trials. The project will document and provide recommendations for the implementation of trajectory synchronization mechanism to enable Trajectory Based Operations.

Advanced Air Ground Communications:

In collaboration with international partners, this project will support the development of advanced communication technologies such as the NextGen Satellite Communications System (SATCOM) standards for operational usage and the Aeronautical Telecommunications Network (ATN) Internet Protocol Suite (IPS) for operational usage. This activity will result in the development and validation of Standards for each of these Future Communications Infrastructure technologies. These advanced communications technologies will help to alleviate spectrum congestion issues, support domestic operation using SATCOM, and enable the achievement of more stringent NextGen performance requirements needed for future applications. Finally, this work will support the development of Air-Ground Security Standards to support the new IPS based systems of the future.

Command & Control in a Cloud Environment:

This activity will evaluate technical assumptions based on safety, mission criticality, and the ability of current and planned cloud architecture to provide command and control services in the future.

Common Displays/Commercial-Of-The-Shelf (COTS):

As part of this effort, requirements definition for displaying strategic decision data will be completed and development of a transition strategy for the possible use of COTS displays as Common Displays in the NAS will be initiated.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The service analysis and operational demonstration activities within this program support the development of operational improvements that will increase the number of arrivals and departures at major airports.

Program Plans FY 2018 – Performance Output Goals

Enterprise Information Protocol and Exchange Standards:

- Assess Weather Information Exchange Model (WXXM) compliance with ICAO Reference Model and develop transition plan for WXXM.
- Complete enterprise information exchange governance artifacts in compliance with the ICAO standards.
- Conduct analyses to support the development of governance for the use of information services based on best practices.
- Complete documentation of information services governance charter/FAA Order.

Future CAS:

- Develop interoperability requirement of collision avoidance systems.
- Develop ACAS Xp system requirements specifications.

Weather Transition:

- Analyze current wind information support capabilities in operations to determine unmet FAA needs and develop report.
- Conduct studies surrounding the operational usage of wind information support capabilities and determine the performance level of current weather products and develop report.
- Analyze service shortfalls and perform service analysis for wind information support capabilities and develop report.
- Develop and mature the wind Concept of Operations.
- Develop, validate, and allocate preliminary wind information support requirements.
- Create, test and evaluate wind information support prototypes and conduct operational demonstrations to display pre-service functionality.

Synchronization of Air/Ground Procedures:

- Develop air/ground trajectory Synchronization simulation plan.
- Complete air/ground trajectory Synchronization simulation system architecture integration.
- Initiate air/ground trajectory Synchronization simulation execution.
- Document lessons learned and recommendations for operational demonstration and flight trials.

Advanced Air/Ground Communications:

- Conduct IPS prototype measurements and document in a report to support the development of Minimum Operational Performance Specifications and International Civil Aviation Organization Standards and Recommended Practices (SARPS).

Command & Control in a Cloud Environment:

- Develop engineering study evaluating the command & control capability for NAS Systems in a cloud environment and complete report on this evaluation.
- Complete update of technical assumptions documentation based on safety and mission criticality, and ability of cloud architecture to provide command and control services.

Common Displays/COTS:

- Complete report evaluating performance requirements for NAS information systems displays.
- Complete report conducting assessment of strategic decision displays data requirements.

Program Plans FY 2019 – Performance Output Goals

Enterprise Information Protocol and Exchange Standards:

- Complete draft guidance material for the implementation of information services governance.
- Complete draft artifacts to support ICAO Information Management Panel.

Future CAS:

- Develop ACAS Xp system concept and requirements (including rotorcraft) to inform ongoing ACAS X development activities.

Weather Transition:

- Analyze operational needs, usage, and service shortfalls for in-flight icing information support capabilities and develop report.
- Develop and mature the in-flight icing Concept of Operations.
- Develop, validate, and allocate preliminary in-flight icing information support requirements that feed future investments in weather capabilities in the NAS.

Synchronization of Air/Ground Procedures:

- Conduct Air/Ground Trajectory Synchronization validation.

Advanced Air/Ground Communications:

- Develop IP Standards to support the FAA's Data Comm Segment 2 and Future Communication Systems.
- Complete draft Security standards development for future ATN/IP Air-Ground Communication Systems.

Command & Control in a Cloud Environment:

- Assess gaps in current cloud architecture to support command and control capability for NAS systems.

Common Displays/COTS:

- Evaluate existing commercial common display/COTS capabilities.

Program Plans FY 2020 – Performance Output Goals

Enterprise Information Protocol and Exchange Standards:

- Complete final guidance material for the implementation of information services governance.
- Complete final artifacts to support ICAO Information Management Panel.
- Assess gaps between FAA information services governance and ICAO information management SARPS.

Future CAS:

- Complete ACAS-Xp (rotorcraft) interoperability assessment and updates to applicable encounter models to include trajectory considerations.
- Complete ACAS-Xp (rotorcraft) proof of concept to inform standards development activities.

Weather Transition:

- Analyze current Winter Weather information support capabilities in operations to determine unmet FAA needs and develop report.
- Conduct studies surrounding the operational usage of Winter Weather information support capabilities and determine the performance level of current weather products and develop report.
- Analyze service shortfalls and perform service analysis for Winter Weather information support capabilities.
- Develop and mature the Winter Weather Concept of Operations.
- Develop, validate, and allocate preliminary Winter Weather information support requirements.
- Create, test and evaluate Winter Weather information support prototypes and conduct operational demonstrations to display pre-service functionality.

Synchronization of Air/Ground Procedures:

- Compile and publish Air/Ground Trajectory Synchronization implementation recommendations, including required performance guidelines for automation systems.

Advanced Air/Ground Communications:

- Complete draft of ICAO Class A SATCOM Standards to support full Four Dimensional (4D) trajectory operations.
- Complete final Security standards development for future ATN/IP Air-Ground Communication Systems.

Command & Control in a Cloud Environment:

- Identify and evaluate NAS Systems potentially suitable for command and control in a cloud environment.
- Develop transition strategy document for NAS Systems identified as potentially suitable for command and control in a cloud environment.

Common Displays/COTS:

- Assess and validate previously identified gaps in common display/COTS.
- Develop common display/COTS transition strategy for NAS systems.
- Perform feasibility study of common display/COTS transition strategy and document findings.

Program Plans FY 2021 – Performance Output Goals

Future CAS:

- Develop System Requirements Specification (SRS) document for ACAS Xp (rotorcraft).
- Complete ACAS-Xp (rotorcraft) Operational Capability Flight Demonstration of system specified in the SRS.

Weather Transition:

- Analyze current ceiling and visibility information support capabilities in operations to determine unmet FAA needs and develop report.
- Conduct studies surrounding the operational usage of ceiling and visibility information support capabilities and determine the performance level of current weather products and develop report.
- Analyze service shortfalls and perform service analysis for ceiling and visibility information support capabilities.
- Develop and mature the ceiling and visibility Concept of Operations.
- Develop, validate, and allocate preliminary ceiling and visibility information support requirements.
- Create, test and evaluate ceiling and visibility information support prototypes and conduct operational demonstrations to display pre-service functionality.

Advanced Air/Ground Communications:

- Complete development of ICAO Class A SATCOM Standards to support full 4D trajectory operations.
- Complete report documenting requirements for a Software Defined Radio to support multi-modal operation.

Command & Control in a Cloud Environment:

- Develop prototype command and control instance in the cloud for a selected demonstrator system.

Common Displays/COTS:

- Build prototype common display.
- Complete report on shadow-mode testing of prototype display at an operational facility.

Program Plans FY 2022 – Performance Output Goals

Future CAS:

- Complete report on Operational Tuning for ACAS-Xp (rotorcraft) logic.
- Complete safety and operational suitability analysis report for ACAS-Xp (rotorcraft).

Weather Transition:

- Analyze current convective weather information support capabilities in operations to determine unmet FAA needs and develop report.
- Conduct studies surrounding the operational usage of convective weather information support capabilities and determine the performance level of current weather products and develop report.
- Analyze service shortfalls and perform service analysis for convective weather information support capabilities.
- Develop and mature the convective weather Concept of Operations.
- Develop, validate, and allocate preliminary convection information support requirements.
- Create, test and evaluate convective weather information support prototypes and conduct operational demonstrations to display pre-service functionality.

Advanced Air/Ground Communications:

- Complete a report on the findings of investigating further usage of Software Defined Radios to support Multi-modal operations in the NAS environment.

E, Information Management, G05M.03-01

Program Description

Information Management (IM) is a proof of concept and technology demonstration program that is in the pre-implementation phase. Recent experience in sharing surface data information with users through new service-oriented

architecture, coupled with the proliferation of data repositories to perform post-analysis, has highlighted the need to move from data sharing to full information management. This requires services to deliver information by type and amount based on business case analysis to establish performance requirements, monitoring, and governance of how and when the information is provided. Improvements to information management approaches are necessary to ensure the efficient use of FAA Telecommunications Infrastructure and System Wide Information Management (SWIM) as conduits of information. The Executive Order (13642) and cloud first mandates also require improvements to the information management infrastructure of the NAS.

Research initiated within the IM program will identify the shortfalls in moving from data sharing to a network environment and will address authoritative operational data stores, the use of emerging technologies in machine learning and analytics, information management governance and evaluation techniques, performance monitoring techniques, and policies to ensure compliance. Research will also identify existing hardware and software that would be used to resolve the identified shortfalls. After this analysis and preliminary engineering design is complete, the activities will shift to development and implementation of the required capabilities and governance. The concepts demonstrated within IM could be leveraged by other information driven FAA programs to support requirements for data storage, search, extraction, and analysis.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

In the transformation to NextGen, the IM program ensures the necessary and required information sharing to improve situational awareness is provided with guaranteed performance. Implementation of Information Management will allow the FAA to more efficiently manage NAS resources to optimize capacity in the system. Achieving capacity goals requires increased sharing of data with guaranteed delivery and performance. To assure this delivery is cost effective; the agency needs to migrate from data sharing to full-scale data management using SWIM as a component.

Program Plans FY 2018 – Performance Output Goals

- Complete transfer of initial NAS Enterprise Repository to Office of Information Technology's cloud services.
- Develop Enterprise capabilities that support National Offload Program messages.
- Assess Operational Analysis & Reporting System (OARS) use cases and determine if there are data sources that can be used at Enterprise level. If so, provide Enterprise level data sources that support OARS.
- Develop capability to produce integrated flight data and metrics across multiple datasets.

Program Plans FY 2019 – Performance Output Goals

- Develop initial high level architecture and high level functional requirements for enhancement of SWIM service delivery.
- Perform initial concept engineering for communications protocol between the FAA and external users such as commercial space and Unmanned Aircraft Systems users.

Program Plans FY 2020 – Performance Output Goals

- Develop enhancements to security requirement for user access of data in the next package of SWIM.
- Develop the following products in support of the Concept and Requirements Definition Readiness Decision (CRDRD) for the next SWIM package:
 - Preliminary shortfall analysis;
 - As-Is and To-Be functional analyses;
 - Preliminary concept of operations; and
 - Concept and Requirements Definition plan.

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of the Investment Analysis Readiness Decision (IARD) for the next SWIM package:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.

Program Plans FY 2022 – Performance Output Goals

- Develop the following products in support of the Initial Investment Decision (IID) for the next SWIM package:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Products;
 - Initial Implementation Strategy and Planning Document; and
 - Final Investment Analysis Plan.

1A09, NEXTGEN – SUPPORT PORTFOLIO

FY 2018 Request \$12.0M

NextGen Laboratories, G03M.02-01

Program Description

NextGen Laboratories provide the NAS environments required to validate the broad framework of NextGen concepts, technologies, and systems and to test the integration, development, and operations functions before they are introduced into the NAS. As a part of NextGen Laboratories - Operational Assessment supports the transition to NextGen by providing a comprehensive evaluation of fielded improvements, reporting of post-implementation performance information and the yearly update of the NAS Segment Implementation Plan.

NextGen Integration and Evaluation Capability (NIEC):

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. This program includes 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.

Florida NextGen Test Bed (FTB):

The FTB is located at the Daytona Beach International Airport in Florida and provides a platform where early-stage NextGen concepts can be integrated, demonstrated and evaluated. A primary focus of the Florida NextGen Test Bed is to provide an open-access location for connecting industry, users, and vendors to demonstrate new capabilities and harness NAS architecture solutions through large-scale modeling and demonstration. These activities promote government – industry partnership by demonstrating NextGen capabilities for adoption.

NextGen Operational Assessment – Performance:

This activity supports NextGen implementation in three areas: Systems Analysis, NextGen Performance Snapshots (NPS), and NAS Segment Implementation Plan (NSIP).

- System Analysis will focus on quantitative assessments of the operational impacts of fielded NextGen components as they become available. Aspects contributing to quantitative estimates of anticipated operational benefits, such as avionics cost will also be studied.

- NPS website was created to provide post-implementation performance information at 21 Metroplexes, as well as at selected airports and airspace. It is a reporting tool designed to show the progress that has been made at specific locations after the implementation of NextGen programs.
- NSIP development will aid the planning and deployment of NextGen portfolios in the mid-term and far-term timeframes. The objective of the NSIP is to identify and manage incremental improvements necessary to develop, integrate, and implement NextGen capabilities and NAS Current Operations activities.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The NIEC provides the capability to conduct early proof of concept studies, rapid prototyping, concept validation and maturation, risk reduction, and improved operational performance across all NextGen Portfolios. The rapid prototyping and integration capabilities of the NIEC are able to conduct early phase concept assessments and simulations, thereby enabling the FAA to implement cost efficiency measures by reducing risks, costs and overall time to implementation. The NIEC is able to replicate all domains of the NAS, as well as integrate with any of the other laboratories provided by the WJHTC to provide a high fidelity simulation environment. In addition, the NIEC is able to leverage the infrastructure and expertise gained from previous simulations to support future sponsor requests at reduced cost to the agency.

The FTB provides a platform for early stage NextGen demonstrations to be quickly and efficiently conducted without affecting NAS operations. This reduces risk and overall costs by enabling the FAA to evaluate the viability of these new technologies and concepts before making further investments and decisions on potential implementation into NAS operations. In addition, the FTB leverages industry's capabilities which provides cost avoidance to the FAA and helps to accelerate NextGen development.

The NextGen Operational Assessment – Performance program supports cost efficiency initiatives by investigating impacts and benefits from the fielded NextGen improvements. It starts by tracking against implementation plan and schedule for NextGen portfolios in the mid-term and far-term timeframes, including information on benefit mechanisms and projected benefits, system dependencies, success criteria, identified integration challenges for implementation, established follow-on activities, and deployment progress reports. It continues by conducting comprehensive operational performance assessments of fielded capabilities, and providing lessons learned for sound investment decision-making. Finally, it supports communications with our partners and oversight organizations, and reporting of progress and benefits of achieved NextGen improvements on the NPS website.

Program Plans FY 2018 – Performance Output Goals

NIEC:

- Provide engineering support for the infrastructure and NextGen concept research.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the necessary licenses, maintenance agreements, and equipment of the laboratory.
- Modify the laboratory infrastructure to support NextGen research projects and simulation requirements.
- Provide a near real time data collection, analysis and replay capability to better support simulations and demonstrations.

FTB:

- Provide engineering support for the infrastructure and NextGen demonstrations.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the necessary licenses, maintenance agreements, and equipment of the laboratory.
- Provide for the facility operations of the laboratory.
- Modify the laboratory infrastructure to support a NextGen integration platform which will meet project demonstration requirements.

NextGen Operational Assessment – Performance:

- Evaluate the operational performance impacts of NextGen technologies and procedures, and publish an annual report. In addition to updating avionics equipage estimates, proposed candidate capabilities for performance studies include:
 - Triple Independent Parallel Operations – triple simultaneous operations for runways spaced greater than approximately 3,900 feet (Atlanta, GA (ATL) and Dulles, VA (IAD)).
 - Metroplex Project – an integrated solution comprising of Performance Based Navigation procedures and airspace redesign that address unique needs of a system of airports that operate in close proximity of each other (ATL and Charlotte, NC (CLT)).
 - In the Multiple Runway Focus Area, candidate assessments include Wake RECAT; Dependent Parallel Operations with Runways between 2,500 and 3,600ft apart or with Runways more than 4,300ft apart;
- Develop documentation and data sources for new and/or updated NPS information including any new metrics.
- Complete annual NSIP update to include information on: operational capabilities planned for implementation, projected qualitative benefits, system dependencies, success criteria, identify integration challenges for implementation, and deployment progress reporting.

Program Plans FY 2019 – Performance Output Goals

NIEC:

- Provide engineering support services for the infrastructure and capabilities to support NextGen research.
- Provide the necessary licenses, maintenance agreements, and equipment of the laboratory.
- Develop Four Dimensional Trajectory Based Operations (4D TBO) conceptual interfaces on the Distributed Environment for Simulation, Rapid Engineering and Experimentation ERAM simulation platform.

FTB:

- Provide engineering support services for the infrastructure and capabilities to support NextGen demonstrations.
- Provide the necessary licenses, maintenance agreements, and equipment of the laboratory.
- Provide the FTB facility which includes leases, utilities, maintenance, inspections and other facility related expenses.
- Enhance Trajectory Based Operations capabilities in conjunction with 4D TBO to support NextGen demonstrations.

NextGen Operational Assessment – Performance:

- Evaluate the operational performance impacts of NextGen technologies and procedures, and publish an annual report. In addition to updating avionics equipage estimates, proposed candidate capabilities for performance studies include:
 - Wake RECAT at additional deployment sites (Philadelphia, PA (PHL), San Antonio, TX (SAT), Honolulu, HI (HNL), Detroit, MI (DTW), and Seattle–Tacoma, WA (SEA)).
 - TBFM Decision Support Tools – Ground Interval Management–Spacing and Integrated Departure Arrival Capability (sites: TBD).
- Develop documentation and data sources for new and/or updated NPS information including any new metrics.
- Complete annual NSIP update to include information on: operational capabilities planned for implementation, projected qualitative benefits, system dependencies, success criteria, identify integration challenges for implementation, and deployment progress reporting.

Program Plans FY 2020-2022 – Performance Output Goals

NIEC:

- Provide engineering support services for the infrastructure and NextGen research.
- Provide the necessary licenses, maintenance agreements and equipment of the laboratory.
- Install upgrades to the laboratory infrastructure to support a research platform for NextGen activities.

FTB:

- Provide engineering support services for the infrastructure and capabilities to support NextGen demonstrations.
- Provide the necessary licenses, maintenance agreements and equipment of the laboratory.
- Provide the FTB facility which includes leases, utilities, maintenance, inspections and other facility related expenses.
- Install upgrades to the laboratory infrastructure to support a demonstration platform for NextGen activities.

NextGen Operational Assessment – Performance:

- Evaluate the operational performance impacts of NextGen technologies and procedures, and publish an annual report.
- Develop documentation and data sources for new and/or updated NPS information including any new metrics.
- Complete annual NSIP update to include information on: operational capabilities planned for implementation, projected qualitative benefits, system dependencies, success criteria, identify integration challenges for implementation, and deployment progress reporting.

1A10, NEXTGEN – UNMANNED AIRCRAFT SYSTEMS (UAS)

FY 2018 Request \$15.0M

- A, Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development, G01A.05-02
- B, Unmanned Aircraft Systems (UAS) Flight Information Management, G01A.05-01

A, Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development, G01A.05-02

Program Description

The UAS Concept Validation and Requirements Development program conducts the overall analysis and planning for the development, integration, and subsequent implementation of UAS enabling technologies within the NAS infrastructure. The program will examine, develop, and validate concept and requirements in support of expanding UAS access to the NAS. This work is foundational to inform development of new air traffic policies, procedures, automation functionality, and training requirements to enable safe UAS integration. The work adopts a disciplined systems engineering approach to ensure that all air traffic-related requirements are adequately addressed and implemented and proposed solutions maintain traceability back to validated operational needs to support budget planning and investment decisions.

UAS operations have increased dramatically in both the public and civil sectors. Air Traffic products, policies, and procedures must be reviewed and refined, or developed through supporting research, to permit UAS operations in the NAS. These UAS operations can be grouped into five categories:

- Hobbyist operations – UAS flown for hobby or recreation within visual line-of-sight, in accordance with Part 101-E;
- Low altitude, visual line-of-sight commercial small UAS operations that operate in accordance with Part 107;
- Low altitude, Expanded Operations (commercial) – UAS that operate within extended visual line-of-sight or beyond visual line-of-sight (and outside other Part 107 limits) in remote locations, outside areas typically used for manned aircraft;
- Public UAS operations (all sizes and airspace) – UAS that operate in accordance with Certificates of Waiver or Authorization, with risk controls tailored to the operation; and
- Integrated UAS operations – UAS that operate in airspace widely used by manned aircraft.

The efforts undertaken will enable public and integrated UAS operations, and will also support aspects of commercial Expanded Operations. Issues involved with UAS integration include the inability to comply with traditional see and avoid requirements, unique communication needs, lost link procedures, and other challenges which dictate that concept engineering activities address all aspects of how UAS operations fit with other NAS operations. This program will address existing FAA shortfalls associated with the provision of air traffic services to UAS airspace users in the mid-term and beyond. These activities must be completed in order to define and allocate specific requirements to existing and future NAS capabilities/systems and services. The activities addressed are:

1. Maturation of UAS Concepts and Requirements – Develop concepts and requirements for non-segregated UAS operations (predominantly medium to large UAS operations).

2. UAS Flight Information Management Concepts – Develop ConOps and requirements for various UAS operations for common situational awareness.
3. UAS Traffic Management (UTM) Data Exchange Analysis – Define data requirements and necessary support for UAS operational data.
4. Strategy Development for UAS Operations-Enabling Programs – Develop implementation strategy and conduct investment analysis for UAS operations in the NAS.

The artifacts developed from Activities 1 and 2 above will lead to tech transfer packages incorporated into Activity 4 for investment analyses. The artifacts from Activity 3 serve as data exchange standards that will be utilized as part of the implementation strategy in Activity 4. See the CIP program UAS Flight Information Management, G01A.05-01, for details on Activities 2 and 3.

The UAS Concept Validation and Requirements Development program is composed of two major activities:

- Maturation of UAS Concepts and Requirements
- Strategy Development for UAS Operations-Enabling Programs

Maturation of UAS Concepts and Requirements:

Work to address existing UAS shortfalls will be completed to support initial Acquisition Management System (AMS) decision points for changes/enhancements to FAA automation systems required to support UAS operations. FY 2016-2018 efforts are focused on validating and maturing existing concept-level UAS requirements. Based on the results from FY 2016-2018 concept maturation efforts, requirements will be finalized and allocated to NAS capabilities/systems and services. FY 2019-2020 will focus on performing AMS analysis and generating artifacts to support subsequent investment analysis for necessary modifications to FAA automation systems. The UAS Concept and Requirements Definition Readiness Decision (CRDRD) is planned for FY 2019 and the Investment Analysis Readiness Decision (IARD) is planned for FY 2020. The UAS Program will also take advantage of windows of opportunity, where available, to affect system changes earlier (if certain requirements mature before others and may be allocated to specific systems prior to FY 2019).

Strategy Development for UAS Operations-Enabling Programs:

UAS solution sets will be identified for each category of UAS operations as needed to support rulemaking activities. This work will assess alternative business models and acquisition strategies to determine the best approach to enable safe UAS integration. FY 2021-2022 will focus on performing AMS analysis and generating artifacts to support implementation of necessary modifications to FAA automation systems. The Initial Investment Decision (IID) is planned for FY 2021 and the Final Investment Decision (FID) is planned for FY 2022. In order to ensure effective coordination of the tightly-coupled activities necessary to address and resolve these and other issues, a centralized Air Traffic Organization program management function will be utilized.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 9 – Safely and efficiently integrate new types of operations, such as commercial space and unmanned aircraft, into the NAS and enable the benefits these operations will provide. (FAA Business Planning Metric)*

Relationship to Performance Metric

Successful integration of UAS into the NAS provides benefits to both public and civil users 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 activity which will lead to the safe integration of UAS in the NAS.

Program Plans FY 2018 – Performance Output Goals

Maturation of UAS Concepts and Requirements:

- Complete annual update of existing UAS concept maturation products (e.g., mid-term and mature state scenarios, allocation tables) based on findings from FY 2017-2018 work.

- Complete annual update of UAS shortfalls, operational requirements, and the UAS Concept Maturation Plan based on findings from FY 2017-2018 work.

Strategy Development for UAS Operations-Enabling Programs:

- Develop ATO UAS Strategic Plan for Automation Update.

Program Plans FY 2019 – Performance Output Goals

Maturation of UAS Concepts and Requirements:

- Complete annual update of existing UAS concept maturation products.
- Finalize UAS shortfalls and operational requirements.
- Complete development of AMS artifacts to support CRDRD for UAS Enhancements 1:
 - Preliminary Shortfall Analysis;
 - Enterprise Architecture Products and Amendments; and
 - Concept and Requirements Definition Plan.
- Achieve CRDRD for UAS Enhancements 1.

Strategy Development for UAS Operations-Enabling Programs:

- Develop Infrastructure Impact Plan for identifying NAS systems that may require augmentation to support emerging UAS capabilities.

Program Plans FY 2020 – Performance Output Goals

Maturation of UAS Concepts and Requirements:

- Complete development of AMS artifacts to support IARD for UAS Enhancements 1:
 - Functional Analysis;
 - Solution Concept of Operations (ConOps);
 - Final Shortfall Analysis;
 - Enterprise Architecture Products and Amendments;
 - Preliminary Program Requirements Document;
 - Preliminary Alternatives Description; and
 - Investment Analysis Plan.
- Achieve IARD for UAS Enhancements 1.

Strategy Development for UAS Operations-Enabling Programs:

- Maintain and update ATO-specific Line of Business plan with UAS program artifacts such as an integrated schedule and risk register, with specific attention to enable integrated (non-segregated) operations.

Program Plans FY 2021 – Performance Output Goals

Strategy Development for UAS Operations-Enabling Programs:

- Complete development of AMS artifacts to support IID for UAS Enhancements 1:
 - Enterprise Architecture Products and Amendments;
 - Initial Program Requirements Document;
 - Initial Business Case;
 - Initial Implementation Strategy and Planning Document (ISPD); and
 - Final Investment Analysis Plan.
- Achieve IID for UAS Enhancements 1.
- Maintain and update ATO-specific Line of Business plan with UAS program artifacts such as an integrated schedule and risk register, with specific attention to enable integrated (non-segregated) operations.

Program Plans FY 2022 – Performance Output Goals

Strategy Development for UAS Operations-Enabling Programs:

- Complete development of AMS artifacts to support FID for UAS Enhancements 1:
 - Enterprise Architecture Products and Amendments;
 - Final Program Requirements Document;
 - Final Business Case;
 - Final ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for UAS Enhancements 1.
- Maintain and update ATO-specific Line of Business plan with UAS program artifacts such as an integrated schedule and risk register, with specific attention to enable integrated (non-segregated) operations.

B, Unmanned Aircraft Systems (UAS) Flight Information Management, G01A.05-01

Program Description

The UAS Flight Information Management program supports various UAS operations. The FAA, as the purveyor of aviation-related information, including known and potential hazards, has a need to know at some level when and where these operations are occurring. From a regulatory and safety perspective, notification of UAS operations provides a means of traceability to: (1) inform other NAS users, if needed, of UAS activity in the vicinity of the airspace in which they are operating; (2) ensure operators are complying and conforming to regulatory standards; and (3) identify and hold accountable those who are responsible during accident/incident investigations. From an Air Traffic Control (ATC) / Air Traffic Management (ATM) perspective, notification of UAS activity enables the FAA to provide safe and efficient flight services to both manned and unmanned aircraft in the NAS.

UAS operations have increased dramatically in both the public and civil sectors. Air Traffic products, policies, and procedures must be reviewed and refined, or developed through supporting research, to permit UAS operations in the NAS. These UAS operations can be grouped into five categories:

- Hobbyist operations – UAS flown for hobby or recreation within visual line-of-sight, in accordance with Part 101-E;
- Low altitude, visual line-of-sight commercial small UAS operations that operate in accordance with Part 107;
- Low altitude, Expanded Operations (commercial) – UAS that operate within extended visual line-of-sight or beyond visual line-of-sight (and outside other Part 107 limits) in remote locations, outside areas typically used for manned aircraft;
- Public UAS operations (all sizes and airspace) – UAS that operate in accordance with Certificates of Waiver or Authorization, with risk controls tailored to the operation; and
- Integrated UAS operations – UAS that operate in airspace widely used by manned aircraft.

The efforts undertaken will enable public and integrated UAS operations while also supporting aspects of commercial Expanded Operations. Issues involved with UAS integration include the inability to comply with traditional see and avoid requirements, unique communication needs, lost link procedures, and other challenges which dictate that concept engineering activities address all aspects of how UAS operations fit with other NAS operations. This program will address existing FAA shortfalls associated with the provision of air traffic services to UAS airspace users in the mid-term and beyond. These activities must be completed in order to define and allocate specific requirements to existing and future NAS capabilities/systems and services. The activities addressed are:

1. Maturation of UAS Concepts and Requirements – Develop concepts and requirements for non-segregated UAS operations (predominantly medium to large UAS operations).
2. UAS Flight Information Management Concepts – Develop ConOps and requirements for various UAS operations for common situational awareness.
3. UAS Traffic Management (UTM) Data Exchange Analysis – Define data requirements and necessary support for UAS operational data.

4. Strategy Development for UAS Operations-Enabling Programs – Develop implementation strategy and conduct investment analysis for UAS operations in the NAS.

The artifacts developed from Activities 1 and 2 above will lead to tech transfer packages incorporated into Activity 4 for investment analyses. The artifacts from Activity 3 serve as data exchange standards that will be utilized as part of the implementation strategy in Activity 4. See the CIP program Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development, G01A.05-02, for details on Activities 1 and 4.

The UAS Flight Information Management program is composed of three capabilities:

- UAS Flight Information Management Concepts
- UAS Traffic Management (UTM) Data Exchange Analysis
- Low Altitude Authorization and Notification Capability (LAANC)

UAS Flight Information Management Concepts:

While an Instrument Flight Rules (IFR) flight plan provides sufficient notification of UAS flight and requisite data to the FAA, applying this requirement is not always practical, doable, or necessary given the (1) location, nature, and/or dynamics of UAS operations; and (2) the existing regulations and requirements for operating under IFR (Title 14 Code of Federal Regulations Part 91, Subpart B). This program builds upon the existing FAA information sharing infrastructure to satisfy the expected significant increase of UAS operations. This program will enable the exchange of information among all stakeholders in globally standardized exchange protocols to ensure seamless and interoperable data management.

The UAS Flight Information Management (FIM) Concepts activity will conduct the necessary concept and scenario development and documentation for various UAS operations. This includes supporting UAS Traffic Management Research Transition Team activities that provide oversight of the proposed UTM system, which includes FIM. The outcomes of this activity will support the tech transfer of UTM data exchange elements and information architecture from NASA and the operational implementation of a UTM capability.

UAS Traffic Management (UTM) Data Exchange Analysis:

This activity will develop the UAS Traffic Management concept, evaluate and establish information exchange requirements, develop the necessary architecture and prototypes, conduct operational evaluation of the established systems, and integrate the necessary information exchange systems. As outlined in the congressionally mandated NASA/FAA joint research plan, the activity will enable UAS traffic management beginning with segregated low altitude small UAS operations in uncontrolled airspace over rural areas and extend to heterogeneous operations at higher altitudes, controlled airspace, and possibly over urban areas as appropriate.

Low Altitude Authorization and Notification Capability (LAANC):

This activity will support initial delivery of a prototype with refined requirements and subsequent enhancements to LAANC. 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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 9 – Safely and efficiently integrate new types of operations, such as commercial space and unmanned aircraft, into the NAS and enable the benefits these operations will provide. (FAA Business Planning Metric)*

Relationship to Performance Metric

The FAA must adopt a proactive approach to prepare for the rapidly increasing demand for UAS access to the NAS, particularly access to low altitude airspace. The FAA has a need to know when and where UAS operations are being conducted, and bears the responsibility of notifying other airspace users of potential hazards along a flight route or at a location that could affect the safety of the flight. This program will develop and implement a system where UAS flight intent can be submitted, stored, and shared with those who need to know for operations where IFR flight plans

are not required or applicable. Through knowledge and distribution of flight intent, this system will provide safe management of UAS operations in the NAS.

Program Plans FY 2018 – Performance Output Goals

UAS Flight Information Management Concepts:

- Develop UTM Concept of Operations to include Heterogeneous Traffic.

UAS Traffic Management (UTM) Data Exchange Analysis:

- Establish Expanded Operations UTM System Prototype.
- Complete Expanded Operations Operational Evaluation Final Report.
- Complete Heterogeneous Traffic Concept Analysis Report.
- Complete Heterogeneous Traffic Scenarios Validation Report.
- Complete update of Expanded Operations UTM Data Exchange Requirements.
- Complete Heterogeneous Traffic Operational Evaluation Plan.
- Complete UTM Functional Analysis and Decomposition.

Low Altitude Authorization and Notification Capability (LAANC):

- Conduct phased development and implementation planning for LAANC prototype.

Program Plans FY 2019 – Performance Output Goals

UAS Flight Information Management Concepts:

- Complete update of UTM Concept of Operations to include Urban Operations.

UAS Traffic Management (UTM) Data Exchange Analysis:

- Complete update of the UTM System Prototype for Heterogeneous Traffic.
- Complete Heterogeneous Traffic Operational Evaluation Final Report.
- Complete Urban Operations Concept Analysis Report.
- Complete Urban Operations Validation Report.
- Complete update Heterogeneous Traffic UTM Data Exchange Requirements.
- Complete Urban Operations Operational Evaluation Plan.
- Complete Initial Functional Allocation Report.

Program Plans FY 2020 – Performance Output Goals

UAS Flight Information Management Concepts:

- Complete update of UTM Concept of Operations to include High Altitude Operations.

UAS Traffic Management (UTM) Data Exchange Analysis:

- Complete update of the UTM System Prototype for Urban Operations.
- Complete Urban Operations Operational Evaluation Final Report.
- Complete High Altitude Operations Concept Analysis Report.
- Complete High Altitude Operations Validation Report.
- Complete update of Urban Operations UTM Data Exchange Requirements.
- Complete UTM High Altitude Operations Operational Evaluation Plan.
- Complete update initial UTM Functional Allocation Report.

Program Plans FY 2021 – Performance Output Goals

UAS Flight Information Management Concepts:

- Develop draft FAA Integrated UTM Concept of Operations.

UAS Traffic Management (UTM) Data Exchange Analysis:

- Complete update of the UTM System Prototype for High Altitude Operations.
- Complete UTM High Altitude Operational Evaluation Final Report.
- Complete Integrated Operations Concept Analysis Report.
- Complete Integrated Operations Validation Report.
- Complete update of High Altitude Operations UTM Data Exchange Requirements.
- Complete Integrated Operational Demonstration Plan.
- Complete update of final UTM Functional Allocation Report.

Program Plans FY 2022 – Performance Output Goals

UAS Flight Information Management Concepts:

- Complete final FAA Integrated UTM Concept of Operations.

UAS Traffic Management (UTM) Data Exchange Analysis:

- Complete update of the UTM System Prototype for Integrated Operational Demonstration.
- Execute Integrated UTM Operational Demonstration.
- Complete FAA Final Data Exchange Requirements.
- Complete FAA Final Functional Requirements.
- Complete FAA Final Implementation Strategy.
- Complete FAA Final Integrated Architecture.
- Achieve Product Demonstration Decision.

1A11, NEXTGEN – ENTERPRISE, CONCEPT DEVELOPMENT, HUMAN FACTORS, & DEMONSTRATIONS PORTFOLIO

FY 2018 Request \$9.0M

- A, Enterprise Concept Development, G05A.02-10
- B, Enterprise Human Factor Development, G01M.02-05
- C, Stakeholder Demonstrations, G08M.01-04

A, Enterprise Concept Development, G05A.02-10

Program Description

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. This program will define a detailed concept for the TBO environment required to implement trajectory-based coordination and performance optimization during all phases of flight. This program will develop a TBO concept for the NAS; define the framework needed for concept evolution; develop operational concepts; and create a roadmap for NAS evolution to TBO.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program aims at validating TBO concepts for improving the sharing of trajectory information, providing access to the most accurate 4 dimension data, eventually leading to a common more accurate view of the trajectory. Using Collaborative Decision Making, shared trajectory information will improve flight management by providing common intent information as the flight proceeds towards its objective. It will evaluate whether the proposed benefits for new operational concepts can be achieved and assess new and other related TBO concepts and technologies.

Program Plans FY 2018 – Performance Output Goals

- Complete concept maturation activities and develop a report assessing the delivery of vertical rate information to air traffic controllers (Vertical Conformance Verification (VCV)), the increase on NAS efficiency (through decreased controller workload), and the increase of controller reliance on automation.
- Develop initial TBO framework components (i.e., Airspace User Operations, Airspace Organization and Management, Aerodrome Operations and Demand Capacity Balancing).

Program Plans FY 2019 – Performance Output Goals

- Complete validation of VCV concept for departure aircraft.
- Finalize the TBO framework and complete an associated report.
- Apply the TBO frame work concept into associated procedures, actors, and process, and develop a report.

Program Plans FY 2020 – Performance Output Goals

- Determine/deconstruct the ICAO TBO concept elements and document in an associated report for NAS application.
- Develop the Concept of Use for the TBO elements in reference to NAS actors, and procedures.
- Support initial development of NAS operation procedures for TBO.

Program Plans FY 2021 – Performance Output Goals

- Conduct and document early validation of concept of use for TBO concept elements.
- Conduct early validation of requirements; write early validation requirements document.

Program Plans FY 2022 – Performance Output Goals

- Develop initial operational transfer documents.
- Finalize operational transfer documentation.
- Complete operational transfer.

B, Enterprise Human Factor Development, G01M.02-05

Program Description

The Enterprise Human Factor Development program will provide integrated guidance on human performance considerations to concept development and validation teams. The proactive identification of potential human performance issues and mitigation strategies supports the usability, acceptability, and safety of NextGen concepts and systems. This work will be conducted in close collaboration with concept development and validation teams to ensure any human factors risks and issues are documented and mitigated early in the concept design and validation process.

Research efforts to identify and mitigate systemic human factors considerations during concept design and validation may yield the following benefits:

- Increasing the utilization rate of concepts and systems among controllers
- Ensuring controller acceptance of concepts and systems
- Increasing safety through the mitigation of known human factors risks
- Decreasing controller workload through improved tools and techniques

Without identifying and mitigating human factors risks at the concept development and validation stages, concepts will mature without appropriate human performance guidance, resulting in fielded capabilities that may be underutilized or rejected by controllers. Specific impacts of not funding this program include:

- Underutilization of procedures leading to losses in efficiency
- Untested controller “work-arounds” to utilize the concept or system leading to unidentified safety risks
- Increased cognitive workload due to poor alignment of information needs

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The Enterprise Human Factor Development program supports maintaining average daily capacity for core airports. 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.

Program Plans FY 2018 – Performance Output Goals

- Identify, assess, and mitigate human factors considerations during concept design and validation of selected NextGen projects and prepare report.
- Develop and provide the final framework for the collection of human performance metrics.
- Apply human performance metrics during human-in-the-loop simulations of NextGen concepts and prepare report.
- Develop criteria for assessing human performance impacts from the use of 3-nm separation in the en route environment and address potential impact to wake mitigation procedures and separation standards for various aircraft classes en route.
- Develop change management approach for advanced Performance-Based Navigation (PBN) procedures to ensure controller acceptance of the concept.

Program Plans FY 2019 – Performance Output Goals

- Validate the information and design requirements evaluation criteria to assess human performance impacts when implementing 3-nm separation operations en route.
- Conduct evaluation of human performance impacts for en route separation standards.
- Develop evaluation criteria to assess the rank-ordered conflict resolutions recommendations that the decision support tools (DST) provide and analyze the impact on the human performance, in the context of nominal and off-nominal operations adding stress on the overall system.
- Conduct assessment of air traffic controller ability to adapt to changing airspace (i.e. dynamic airspace).
- Validate and finalize the change management approach for advanced PBN procedures.

Program Plans FY 2020 – Performance Output Goals

- Provide human factors guidance for advanced PBN procedures in the Performance Based Navigation Implementation Process (7100.41) and procedure design review.
- Complete Human Errors Assessment of Segment Charlie.
- Consolidate identified impacts and issues from assessment on 3-nm separation operations en route and deliver a report that provides guidance for enhancing human performance to accommodate and comply with 3-nm separation in en route airspace.
- Validate and consolidate criteria used for evaluating human performance impacts related to using automated rank-ordered conflict resolutions from DST and provide additional recommendations to the design of these tools.
- Identify impacts and provide report of concepts on controller tasks.

Program Plans FY 2021 – Performance Output Goals

- Develop and provide final documentation for the identification of human factors requirements applied to automation systems and DSTs supporting PBN procedures.
- Conduct the field site surveys, and evaluate human factors' recommendations for the development and implementation of the new PBN procedure and prepare report.
- Develop change management approach for 3-nm separation operations en route to ensure controller acceptance of the concept.
- Develop mitigation strategies to address Segment Charlie human error conditions.

Program Plans FY 2022 – Performance Output Goals

- Validate and finalize the change management approach for 3-nm separation operations en route.
- Validate mitigation strategies to address Segment Charlie human error conditions and provide final documentation for human factors requirements.
- Consolidate identified impacts and issues from PBN field site surveys, and provide final documentation of human factors recommendations to the development and implementation of new PBN procedures.

C, Stakeholder Demonstrations, G08M.01-04

Program Description

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.

Timelines for the evolution of NextGen improvements may change such that specific demonstration activities will be proposed and clearly defined closer to budget formulation. Currently, the FAA's demonstration activities in the FY 2018 timeframe and beyond are anticipated to include the following:

4D Trajectory (4DT) Flight Trials Demonstration:

This demonstration will include live flight trials to demonstrate the feasibility of utilizing Aeronautical Telecommunications Network (ATN) Baseline 2 (ATN-B2) capabilities with aircraft in the NAS exhibiting advanced Trajectory Based Operations (TBO) concepts. The validation of air/ground (ATN Baseline 2 data communication), and ground/ground (flight object used in the air traffic flow management and Flight Operation Center automation) capabilities will support advanced trajectory exchange with curved path and time of arrival control including operational sufficiency of data sets.

Paired Approach Demonstration:

This demonstration will include live testing of an Advanced Flight Deck Interval Management avionics prototype to demonstrate the capability of the Paired Approach concept that leverages the Automatic Dependent Surveillance-Broadcast Out 2020 rule to safely conduct dependent-like instrument approaches in all weather conditions to very closely spaced parallel runways.

Flight and Flow Information for a Collaborative Environment (FF-ICE) Block 2 Integration of Flight Validation:

The International Civil Aviation Organization update of the Procedures for Air Navigation Services ATM and associated annexes in support of the Aviation System Block Upgrades 1 and 2 will encourage Air Navigation Service Providers (ANSPs) to provide new capabilities supporting pre-flight (Block 1) and in flight (Block 2) operations. The FF-ICE validation will investigate the impacts the future mixed mode (ANSPs) and mixed equipage operating environment.

Planning is ongoing for future demonstrations.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

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.

Program Plans FY 2018 – Performance Output Goals

4D Trajectory (4DT) Flight Trials Demonstration:

- Conduct safety risk assessment and complete Safety Risk Management Document.
- Conduct flight trial and prepare report.
- Capture lessons learned and recommendations.

Paired Approach Demonstration:

- Complete demonstration of Paired Approach for CAT I capability.
- Complete demonstration evaluation report and performance assessment.

FF-ICE Block 2 Integration of Flight Validation:

- Complete initial plan of FF-ICE Block 2 Integration and develop the initial validation plan.
- Assess NAS impacts due to future mixed equipage operating environment and prepare report.

Program Plans FY 2019 – Performance Output Goals

4D Trajectory (4DT) Flight Trials Demonstration:

- Complete demonstration of 4DT Live Flight.
- Complete 4DT Live Flight demonstration evaluation report.

FF-ICE Block 2 Integration of Flight Validation:

- Complete validation activities and prepare draft report.
- Assess NAS impacts due to future mixed equipage operating environment and prepare report.
- Capture Lesson Learned and Recommendations and prepare report.

Program Plans FY 2020 – Performance Output Goals

FF-ICE Block 2 Integration of Flight Validation:

- Complete validation activities and prepare final report.
- Complete the assessment of NAS impacts due to future mixed equipage operating environment and prepare report.
- Develop recommendations document, and complete the transition package.

Program Plans FY 2021-2022 – Performance Output Goals

- Conduct demonstration activities and prepare updated report for enhanced avionics capabilities.
- Conduct demonstration and prepare updated report for enhanced navigation capabilities.
- Conduct demonstration and prepare updated report of mid-term to far-term end-to-end trajectory based operations.
- Develop reports on the management and integrate NextGen demonstrations, projects, and products in support of the NextGen Segment Implementation Plan.

ACTIVITY 2: AIR TRAFFIC CONTROL FACILITIES AND EQUIPMENT

A: En Route Programs

2A01, NEXTGEN – EN ROUTE AUTOMATION MODERNIZATION (ERAM) – SYSTEM ENHANCEMENTS AND TECHNOLOGY REFRESH

FY 2018 Request \$76.7M

- A, En Route Automation Modernization (ERAM) Sustainment 2, G01A.01-10 / X, En Route Automation Modernization (ERAM) Sustainment 3, G01A.01-11
- B, En Route Automation Modernization (ERAM) Enhancements 2, G01A.01-08
- X, En Route Automation Modernization (ERAM) Enhancements 3, G01A.01-12

A, En Route Automation Modernization (ERAM) Sustainment 2, G01A.01-10 / X, En Route Automation Modernization (ERAM) Sustainment 3, G01A.01-11

Program Description

Technology refresh of the ERAM system will be accomplished by a series of programs to replace original ERAM hardware installed between 2003 and 2008. In FY 2017, the System Enhancements and Technology Refresh program, G01A.01-05, completed replacement of a small subset of ERAM system equipment that had become obsolete.

ERAM Sustainment 2 (G01A.01-10):

Sustainment 2 will replace a larger subset of ERAM system equipment that is near the end of its service life or otherwise contributing to increased ERAM sustainment risk due to increasing failure rates or degraded performance. A Final Investment Decision (FID) for ERAM Sustainment 2 occurred in December 2016 with a four year period of performance from FY 2017 through FY 2020. This program baseline includes the following currently planned technology refresh activities:

- Refresh the existing analog tactical position, i.e., the Radar Position (R-Side), display; approximately 1,650 units;
- Refresh the Keyboard/Video/Mouse switches for the tactical position, R-Side; approximately 1,500 units;
- Refresh the IBM Power PC/RISC based processor with x86 based processor for both the R-Side and Radar Associate Position (D-Side) positions; approximately 3,150 units;
- Migrate the R-side and D-Side positions processors' operating system (OS) from IBM's AIX to Linux Open Source OS; approximately 2,900 licenses;
- Software Refresh the Display capture and recording technology for R and D-Sides; approximately 3,000 software licenses;
- Refresh the display graphics adaptor for the R-Side displays; approximately 1,650 units; and
- Add operational supplemental processors to the existing backroom processor farm to mitigate emerging increased demand for ERAM system processing capacity; approximately 186 units

ERAM Sustainment 3 (G01A.01-11):

ERAM Sustainment 3 program is the third currently planned technology refresh update to the ERAM equipment sustainment program. The program will replace the remaining ERAM infrastructure hardware, network equipment, and operating system at operational, training, and support environments that were not replaced in the ERAM System Enhancement / Technology Refresh and ERAM Sustainment 2 programs. The ERAM Sustainment 3 program also includes security adaptation to align security and network communication features with current FAA Telecommunication Infrastructure standards. Execution of the ERAM Sustainment 3 program will be from FY 2019 to FY 2025.

This program is scoped for the following ERAM infrastructure items:

- Enterprise Storage and Tape Backup units replacement;
- IBM P5/6 Series processors (Flight Data Processor/Surveillance Data Processor Servers) running AIX (Operational Systems, Support, and En Route System Support Complex (ESSC)) replacement;
- ARTCC and support environment ERAM Network Equipment (i.e., Application Local Area Network);
- ESSC Servers, Configuration Management, and Support tools replacement;
- Selected Security / Plan Of Action and Milestones items:
 - Provide maintenance support for edge security devices (Enterprise Router Firewall is end of support in 2020)
 - Provide centralize (channel) network device management (Radius on Security Workstation)
 - Support OS for all ERAM (step up to Red Hat Enterprise Linux)
- En Route Information Display System servers, workstations, and networks sustainment/replacement; and
- Low Resolution Keyboard/Video/Mouse switches for D-Side replacement.

Three separate national site waterfall schedules are planned to implement the full complement of ERAM Sustainment 3 equipment at all operational sites. The priority of the equipment implementation will be determined during the FID phase. The program is planned to start in FY 2019 assuming achievement of an Investment Analysis Readiness Decision (IARD) in early FY 2018 and FID in 4th quarter FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The ERAM Sustainment programs will update the ERAM system by replacing a subset of ERAM equipment in critical need of replacement at the 20 Air Route Traffic Control Centers (ARTCC) sites. The upgrade will maintain the ERAM system's ability for en route controllers at each center to track up to 1,900 aircraft at a time which is critical for meeting FAA Strategic Priority 2. The upgrade will also enable the ERAM system to meet its operational availability and performance requirements which are critical to meeting FAA Performance Metric 1.

Program Plans FY 2018 – Performance Output Goals

ERAM Sustainment 2 (G01A.01-10):

- Complete the procurement of D-Position processor technology refresh equipment.
- Complete the installation of D-Position processor technology refresh equipment.

ERAM Sustainment 3 (G01A.01-11):

- Complete Investment Analysis Plan in support of FID.
- Complete Shortfall Analysis Report in support of IARD.
- Achieve FID for ERAM Sustainment 3.

Program Plans FY 2019 – Performance Output Goals

ERAM Sustainment 2 (G01A.01-10):

- Complete the procurement of technology refresh equipment for remaining equipment.

ERAM Sustainment 3 (G01A.01-11):

- Pending FID approval:
 - Complete the engineering/design prototyping activities for the first national site waterfall implementation effort
 - Other output goals will be developed at FID

Program Plans FY 2020 – Performance Output Goals

ERAM Sustainment 2 (G01A.01-10):

- Complete the installation of technology refresh equipment for remaining equipment

ERAM Sustainment 3 (G01A.01-11):

- Pending FID approval:
 - Complete the ERAM software for the first national site waterfall implementation effort
 - Other output goals will be developed at FID

Program Plans FY 2021 – Performance Output Goals

ERAM Sustainment 2 (G01A.01-10):

- None.

ERAM Sustainment 3 (G01A.01-11):

- Pending FID approval:
 - Complete the key site installation for the first national site waterfall implementation effort
 - Complete the engineering/design prototyping activities for the second national site waterfall implementation effort
 - Other output goals will be developed at FID

Program Plans FY 2022 – Performance Output Goals

ERAM Sustainment 2 (G01A.01-10):

- None.

ERAM Sustainment 3 (G01A.01-11):

- Pending FID approval:
 - Complete the ERAM software for the second national site waterfall implementation effort
 - Complete the first national site waterfall implementation at 12 ERAM sites
 - Other output goals will be developed at FID

B, En Route Automation Modernization (ERAM) Enhancements 2, G01A.01-08

Program Description

The ERAM Enhancements 2 program provides software enhancements for the en route sector controller team. It is a multi-year effort to improve the efficiency and effectiveness of en route sector operations through enhanced trajectory management and improved collaboration between the Radar Position (R-Side) and Radar Associate Position (D-Side) controllers. It also involves upgrades to flight data management and system support functions. Current automation capabilities are limited in providing the requisite accuracy, consistency, and usability needed during high demand scenarios which can result in decreasing the efficient use of airspace. ERAM Enhancements 2 will develop and implement improvements to en route automation and procedures, building upon existing ERAM capabilities and leveraging previous NextGen pre-implementation activities.

Final Investment Decision (FID) was achieved in December 2016. Prime contractor system engineering, software development, and implementation activities are ongoing and per the original baseline, were planned to complete in FY 2023; however, due to recent funding adjustments a baseline change will be required along with revisions to the program milestones.

A preliminary allocation of each enhancement to a specific ERAM release has been determined, however refinements are ongoing. The specific enhancements are listed below and will be deployed as a series of ERAM releases throughout the program lifecycle.

- Conflict Probe Enhancements - Improve Conflict Probe through better representation of the adherence bounds used to determine the need for computing a new aircraft trajectory, minimize false alerts, and apply a 3-nautical mile separation standard;
- ERAM Enhancements to Support Unmanned Aircraft Systems (UAS) - Improve the processing of UAS flight information, including routes, aircraft types, and performance characteristics;

- International Common Harmonization - Expand the automated coordination of flight data and aircraft control with the Canadian Air Navigation Service Provider (NavCanada);
- ERAM Adaptation Refinements - Improve the ability of the Air Route Traffic Control Center (ARTCC) support personnel to efficiently and dynamically change adaptation data; and
- Technical Operations Enhancements - Provide maintenance support at the Monitor and Control system.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The ERAM Enhancement 2 program will implement new ERAM functional capabilities for the NAS at the 20 Air Route Traffic Control Centers (ARTCC) sites. These capabilities will support maintaining average daily capacity for core airports by enabling automated radar handoff to NavCanada, our international Air Navigation Service Provider partner, reducing controller workload, and possibly delays, by reducing phone calls during handoff. An adaptation refinement capability designed to establish automated handoff at a specific site following National release of the adaptation will reduce the time required to implement this automation. Support for UAS operations in the NAS will be provided by establishing a direct link to continue incorporation of UAS operational characteristics into the flight plan processing.

Program Plans FY 2018 – Performance Output Goals

- Authorize prime contract software development Contract Line item Number (CLIN) for the ERAM Adaptation Refinement capability.
- Authorize system engineering documentation (A and B level specifications) for the UAS capability under prime contract Task Order.
- Authorize system engineering documentation (A and B level specifications) for the NavCanada capability under prime contract Task Order.

Program Plans FY 2019 – Performance Output Goals

- Complete software development, testing, and deployment of the ERAM Adaptation Refinement capability.
- Complete system engineering documentation (A and B level specifications) for the UAS capability.
- Complete system engineering documentation (A and B level specifications) for the Automated Radar Handoff to NavCanada capability.

Program Plans FY 2020 – Performance Output Goals

- Complete software development and testing of the UAS capability.
- Authorize Prime Contract software development CLIN for the Automated Radar Handoff to NavCanada capability.

Program Plans FY 2021 – Performance Output Goals

- Complete deployment of the UAS capability.
- Complete software deployment and testing of the first phase of the Automated Radar Handoff to NavCanada capability.
- Authorize system engineering documentation (A and B level specifications) for the Conflict Probe Enhancements (3-Nautical Mile Separation) and additional trajectory modeling enhancements under prime contract Task Order.
- Authorize System engineering documentation (A and B level specifications) for the Automated Point Out to NavCanada capability under prime contract Task order.

Program Plans FY 2022 – Performance Output Goals

- Complete deployment of the first phase of the Automated Radar Handoff to NavCanada capability.
- Complete software development and testing of the second phase of the Automated Radar Handoff to NavCanada capability.
- Complete system engineering documentation (A and B level specifications) for the Conflict Probe Enhancement (3-Nautical Mile Separation) and trajectory modeling enhancements.
- Complete system engineering documentation (A and B level specifications) for the Automated Point Out to NavCanada capability.

X, En Route Automation Modernization (ERAM) Enhancements 3, G01A.01-12

Program Description

ERAM Enhancements 3 program provides separation management automation enhancements to assist en route controllers in managing safe aircraft separation in a mixed environment of varying navigation equipment and wake performance capabilities. This program is a multi-year effort to improve the efficiency and effectiveness of en route sector operations through enhanced trajectory management and improved interoperability. It also involves upgrades to flight data management and supports emerging NextGen automation and aircraft Performance-Based Navigation (PBN) capabilities consistent with the NAS Navigation Strategy 2016. Current automation capabilities are limited in providing the requisite accuracy, consistency, and usability needed during high demand scenarios which can result in decreasing the efficient use of airspace. ERAM Enhancements 3 will develop and implement improvements to en route automation and procedures, building upon existing ERAM capabilities and leveraging previous NextGen pre-implementation activities.

Planned Final Investment Decision (FID) is September 2021. Prime contractor system engineering, software development, and implementation activities are planned to begin in FY 2022 and complete in 2027.

A baseline for the specific capabilities that will be deployed as a series of ERAM releases throughout the program lifecycle and the planned allocation of enhancements to a specific ERAM release will be determined at FID.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The ERAM Enhancements 3 program will improve trajectory modeling, enhance conflict probe processing and detection, and optimize use of aircraft PBN data, among other improvements. These improvements will enable implementation of NextGen capabilities which will allow for increased efficiency and capacity benefits.

Program Plans FY 2018-2020 – Performance Output Goals

- None.

Program Plans FY 2021 – Performance Output Goals

- Complete development of the Acquisition Program Baseline.
- Complete Final Program Requirements document.
- Complete Final Implementation Strategy and Planning Document.
- Complete Updated Architecture products and amendments.
- Achieve FID for ERAM Enhancements 3.

Program Plans FY 2022 – Performance Output Goals

- Pending FID approval:
 - Complete engineering and design document for the Radar Position (R-Side) Trial Planning enhancements.
 - Complete engineering and design document for the Automation assisted Controller-to-Controller Coordination capabilities.
 - Complete engineering and design document for the Conflict Probe Enhancements to process PBN procedure constraints.
 - Complete development, test, and deployment of the Flight Plan Processing capabilities.
 - Complete development, test, and deployment of the Aircraft Trajectory Modeling Enhancements to process PBN procedure constraints.

2A02, EN ROUTE COMMUNICATIONS GATEWAY (ECG)

FY 2018 Request \$2.7M

En Route Communications Gateway (ECG) – Sustainment, A01.12-02

Program Description

The En Route Communications Gateway (ECG) system is a fully operational computer system that formats and conveys critical air traffic data to the En Route Automation Modernization and the Enhanced Backup Surveillance System at the Air Route Traffic Control Centers (ARTCC). The ECG increases efficiency in the use of NAS capacity and allows air traffic facilities to expand the use of airspace for air traffic control by enabling the current automation systems to use new surveillance technology, such as Automatic Dependence Surveillance-Broadcast and Wide Area Multilateration. ECG introduced new interface standards and data formats which are required for compatibility with International Civil Aviation Organization standards. ECG also increased capacity to process data to accommodate inputs from additional remote equipment such as radars. ECG provides better use of the system capacity and the ability to expand coverage to support anticipated increases in air traffic and changes in the operational environment.

This program is structured into two activities – Performance Monitoring and Sustainment.

Performance Monitoring:

The ECG Operational Analysis (OA) and Sustainment and Technology Evolution Plan (STEP) activities monitor the actual performance of the ECG system and provide valuable input to the ECG Technology Refresh activity. OA monitors system availability and performance and documents the results with a quarterly ECG OA Report. STEP facilitates Post Production Support of the ECG system and identifies the processes/procedures that will be implemented to support the evolution and sustainment of the ECG system. ECG STEP provides a monthly report detailing product End-of-Life (EOL), End-of-Service (EOS), support termination and performance or supportability limitations.

Sustainment:

Based on input from ECG OA, STEP, and the evolving operational needs of the NAS, the ECG Sustainment activity plans, procures, and deploys ECG hardware or software components to maintain a high level of system availability. The items refreshed can be for EOL, EOS, or performance issues as well as modifications to increase capacity and add new interface and data formats. Upgrades can be required due to various product factors that may include cost of maintaining the existing system, system failures, licenses, spare quantities, and repair turn-around time. Work will continue to upgrade the following components to address EOL and EOS status: replacement of Redundant Array of Independent Disks (RAID) with Sky Data Sentry; deployment of these components will be completed in FY 2018.

The next phase of ECG Sustainment will begin in FY 2019. It will address EOL and EOS issues for the Terminal Server and Maintenance local area network (LAN) Switch. The program will continue to use engineering analysis data from the monthly STEP EOL and quarterly OA Reports to determine the next technology refresh components.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The ECG Sustainment program will replace some of the hardware and update critical software in this operational air traffic control automation system. This investment will reduce supportability limitations by keeping the system up-to-date to avoid failures and system outages to ensure the ECG system maintains its availability and reliability. Quarterly ECG OA Reports indicate an operational availability of 100% from first site Operational Readiness Demonstration (ORD) in 2004 through May 31, 2017.

Program Plans FY 2018 – Performance Output Goals

Performance Monitoring:

- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Sustainment:

- Complete replacement of RAID with SKY Data Sentry.

Program Plans FY 2019 – Performance Output Goals

Performance Monitoring:

- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Sustainment:

- Complete installation of RADIUS on all Maintenance Work Stations.
- Complete replacement of Terminal Server.
- Complete upgrade to CISCO Internetwork Operating System to allow Government Accountability Office-recommended security updates to be installed.
- Complete replacement of Operational LAN Switch.

Program Plans FY 2020 – Performance Output Goals

Performance Monitoring:

- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Sustainment:

- Complete replacement of Maintenance LAN Switch.
- Complete replacement of Workstation/Printer/monitor.
- Complete replacement of Power Distribution Units prior to NAV Canada installs.

Program Plans FY 2021 – Performance Output Goals

Performance Monitoring:

- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Sustainment:

- Complete expansion of Seattle ARTCC (ZSE) ECG to accommodate Canadian radars at Kaines Mountain, Wallenstein, Integrate Calgary, Victoria, and Sea Island.

Program Plans FY 2022 – Performance Output Goals

- None.

2A03, NEXT GENERATION WEATHER RADAR (NEXRAD)

FY 2018 Request \$5.5M

**Next Generation Weather Radar (NEXRAD) – Service Life Extension Program (SLEP)
Phase 1, W02.02-02 / X, Next Generation Weather Radar (NEXRAD) – Service Life
Extension Program (SLEP) Phase 2, W02.02-03**

Program Description

NEXRAD SLEP is a nine year refurbishment program to extend the service life of 12 FAA-owned NEXRAD systems until 2030 when a replacement capability is expected to be deployed. NEXRAD is a long range weather radar that detects, analyzes, and transmits weather information for use by the ATC System Command Center, en route, terminal and flight service facilities. NEXRAD products and services are processed by FAA's Weather and Radar Processor, Integrated Terminal Weather System, and the Corridor Integrated Weather System. This weather information helps determine the location, time of arrival, and severity of weather conditions to determine the best routing for aircraft.

With the National Weather Service (NWS) as the lead agency, there are currently 160 NEXRAD systems used by the Tri-Agency partners consisting of NWS, FAA, and the Department of Defense. The FAA owns and operates 12 of the NEXRAD systems; seven are located in Alaska, four in Hawaii, and one in Puerto Rico. The NWS collects and redistributes NEXRAD weather data from the radars they operate and some of the 12 FAA NEXRAD radars to create forecasts that are used in all phases of flight.

NEXRAD radars were initially deployed from 1992-1997. Some FAA-owned NEXRAD systems began reaching their 20-year end-of-life state in 2015; however, the Tri-Agency partners intend to keep NEXRAD in full operation through 2030.

NEXRAD – SLEP Phase 1 (W02.02-02):

A Final Investment Decision for NEXRAD was achieved on 19 September 2012 and a new cost and schedule baseline established. This program will have four main purposes:

- Extend the life of the FAA's NEXRAD to 2030, and beyond. There are four NEXRAD subsystems that have been identified as needing replacement/refurbishment:
 - Signal Processor (replace)
 - Pedestal (refurbish)
 - Transmitter (refurbish)
 - NEXRAD shelters and facilities (refurbish)
- Provide continued support for product improvements to the legacy NEXRAD program in accordance with the Tri-Agency Memorandum of Agreement. Each year, the FAA pays its pro-rata share of NEXRAD Product Improvement (NPI) Science Evolution costs.
- Install hardware and software technology refresh updates on the 12 FAA-owned NEXRADs. In particular, the Radar Product Generator and Radar Data Acquisition computers and peripherals require technology refresh which began in 2014.
- Optimize and validate FAA-specific algorithms that provide the capability to discern and display in real time, incidences of in-flight icing and hail. A prime objective is to enable the future development of operationally suitable displays to be used by pilots, controllers, Flight Service specialists, and dispatchers as decision making tools for avoiding and/or mitigating airborne threats due to the presence of airborne icing and hail.

NEXRAD – SLEP Phase 2 (W02.02-03):

The program office will support NWS NPI Science Evolution and Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) in 2021 and will initiate development of a business case for a NEXRAD SLEP Phase 2 Investment Analysis Readiness Decision planned for 2023. The program office will coordinate with 2nd level engineering and NWS Maintenance Logistics Center to identify sustainability issues of the NEXRAD System.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The NEXRAD program contributes to the Deliver Benefits through Technology and Infrastructure strategic priority by ensuring sustained operational availability of NEXRAD. NEXRAD measures precipitation intensity, storm motion, and weather echo tops, and provides this data in varied displays directly or indirectly to all core airports and most other air traffic control facilities in the continental United States.

Program Plans FY 2018 – Performance Output Goals

NEXRAD – SLEP Phase 1 (W02.02-02):

- Fund FAA’s pro-rata share of NPI Science Evolution costs.
- Complete 11 Signal Processor replacements (12 of 12, 100%).
- Complete one Transmitter refurbishment (1 of 12, 8%).
- Deliver upgraded Icing algorithm to Radar Operations Center (ROC).

NEXRAD – SLEP Phase 2 (W02.02-03):

- None.

Program Plans FY 2019 – Performance Output Goals

NEXRAD – SLEP Phase 1 (W02.02-02):

- Fund FAA’s pro-rata share of NPI Science Evolution costs.
- Complete three Transmitter refurbishments (4 of 12, 33%).
- Complete one pedestal refurbishment (1 of 12, 8%).
- Deliver upgraded Icing algorithm to ROC.

NEXRAD – SLEP Phase 2 (W02.02-03):

- None.

Program Plans FY 2020 – Performance Output Goals

NEXRAD – SLEP Phase 1 (W02.02-02):

- Fund FAA’s pro-rata share of NPI Science Evolution costs.
- Complete four Transmitter refurbishments (8 of 12, 67%).
- Complete five pedestal refurbishments (6 of 12, 50%).
- Deliver upgraded Icing algorithm to ROC.

NEXRAD – SLEP Phase 2 (W02.02-03):

- None.

Program Plans FY 2021 – Performance Output Goals

NEXRAD – SLEP Phase 1 (W02.02-02):

- Complete four Transmitter refurbishments (12 of 12, 100%).
- Complete six pedestal refurbishments (12 of 12, 100%).

NEXRAD – SLEP Phase 2 (W02.02-03):

- Fund FAA’s pro-rata share of NPI Science Evolution costs.
- In coordination with 2nd level engineering and NWS Maintenance Logistics Center develop sustainability issue report of the NEXRAD System.
- Fund MIT/LL to enhance Icing and Hail detection algorithms.

Program Plans FY 2022 – Performance Output Goals

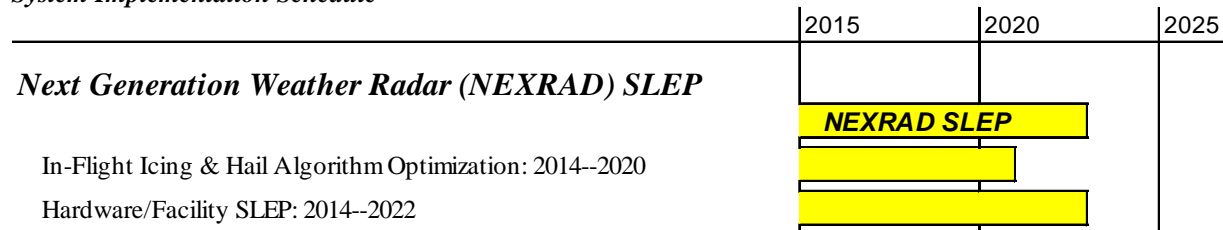
NEXRAD – SLEP Phase 1 (W02.02-02):

- Complete last site replacement/refurbishment. (APB milestone)

NEXRAD – SLEP Phase 2 (W02.02-03):

- Fund FAA’s pro-rata share of NPI Science Evolution costs.
- In coordination with 2nd level engineering and NWS Maintenance Logistics Center develop sustainability issue report of the NEXRAD System.
- Fund MIT/LL to enhance Icing and Hail detection algorithms.

System Implementation Schedule



2A04, AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC) & COMBINED CONTROL FACILITY (CCF) BUILDING IMPROVEMENTS

FY 2018 Request \$100.4M

- A, Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements, F06.01-00
- B, San Juan Facility Remediation, F08.01-01

A, Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements, F06.01-00

Program Description

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 2 CCF facilities.

Major modernization projects include:

- **Control Wing Basement** – This project renovates portions of the control wing basement and replaces old and obsolete mechanical and electrical systems 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** – This project rebuilds or replaces the ARTCC chillers and cooling towers along with associated mechanical systems such as piping, pumps, fans, filters, and controls.
- **Building Automation Controls System Replacement** – This project replaces aging Direct Digital Control Systems that monitor and control the facility’s environmental systems, such as heating, ventilation, air conditioning equipment, chillers, cooling towers, pumps, air handlers, and computer room air conditioners, and monitor water leak detection systems. BACnet, a replacement system for building automation and control networks uses an open communication standard protocol. BACnet was developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers specifically for building automation and control networks. This project will provide standardization of Building Automation Control Systems at all FAA en route facilities.

Beginning in FY 2019, the following projects will be executed to extend the service life of the ARTCCs and CCFs and include:

- **Fire Detection and Annunciation System 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 the 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 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.
- **Control Wing First Floor and Attic Modernization Project** – This project consists of control wing first floor and attic upgrades. The project includes upgrades and restoration of fire-rated walls and floors, replacement or upgrades of access floor systems, code and accessibility upgrades, wall and floor finish upgrades, upgrades to fire suppression systems, replacement of air handling units, replacement of chiller and hot water piping systems, replacement of interior lighting, replacement of the lighting central battery system and dimming control system, and replacement of building electric distribution systems including panel boards and branch circuits. The area for this project is the facility's Air Traffic Control Operations Room, which will remain in operation throughout the project.

The details on how the projects are packaged and implemented will be determined upon completion of a scoping survey. A standard design will be developed for each project, and then site adapted for each ARTCC and CCF.

All of these facilities were originally constructed and commissioned in the 1960s, and were expanded several times through the 1990's. As of FY 2016, there was a \$94.5 million backlog of building systems components that have exceeded their service life and should be replaced. These building systems include: architectural elements, such as walls, roofing and interior finishes; mechanical systems such as heating, ventilation and air conditioning equipment, environmental control systems and plumbing; electrical distribution and lighting, and fire protection systems. This backlog increases the risk of equipment failure that will increase maintenance costs and could cause disruption to the air traffic control mission of these facilities. This program supports air traffic service requirements by sustaining the buildings in a good condition, and modernizing them as necessary to meet new operational needs. This program is included in the ATC Facilities Sustainment Strategic Plan.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The program contributes to the FAA's performance metric of maintaining operational availability of the NAS by ensuring that buildings that house en route air traffic control equipment are sustained and modernized to meet operational requirements. Improvements to ARTCC facility infrastructure will extend the service life of these facilities and minimize potential outages that would cause delays to air traffic. Associated risks from incidents such as roof leaks and pipe ruptures include equipment damage, mold, and interruptions to operations. The chiller plants for air conditioning are currently approaching or are past their economic life expectancy. Replacement of these plants is underway but will not be completed until 2019. A catastrophic failure of a chiller plant could ultimately result in the loss of Air Traffic services at an ARTCC.

Program Plans FY 2018 – Performance Output Goals

- Award construction contracts for Control Wing Basement/Major Mechanical projects at Denver and Kansas City ARTCCs
- Award construction contracts for Building Automation Controls System Replacement projects at Indianapolis, Washington, Salt Lake City, and Seattle ARTCCs.
- Award design contracts for Building Automation Controls Systems Replacement for Los Angeles, and Atlanta, ARTCCs and Guam CCF.
- Award design contracts for Fire Detection and Alarm System Replacement for Los Angeles, Jacksonville, Memphis, Boston, Indianapolis, and Albuquerque ARTCCs.
- Award construction contract for dewatering project at Minneapolis ARTCC to correct a site condition where ground water is infiltrating into the building.
- Award construction contract for M1 Build Out Phase II at Miami ARTCC.
- Complete update of the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award contracts for Facility Condition Future Projects Survey at Indianapolis, New York, Cleveland, and Los Angeles ARTCCs and Guam CCF.
- Award standard design for Central Plant and Power Service Building Modernization Project.

Program Plans FY 2019 – Performance Output Goals

- Award construction contracts for Building Automation Controls System Replacement project at Los Angeles, Atlanta, Minneapolis, and Denver ARTCCs and Guam CCF.
- Award construction contracts for Fire Detection and Alarm System Replacement for Los Angeles, Jacksonville, Memphis, Boston, Indianapolis, and Albuquerque ARTCCs.
- Award design contracts for Fire Detection and Alarm System Replacement Fort Worth, Houston, Kansas City, Anchorage, Minneapolis, Cleveland, New York, and Miami ARTCCs and San Juan CCF.
- Complete update of the national Facility Condition Assessment database for all other ARTCCs and CCFs.
- Award contracts for Facility Condition Future Projects Survey at Boston, Denver, Kansas City, Atlanta, and Washington ARTCCs.

Program Plans FY 2020 – Performance Output Goals

- Award construction contracts for Fire Detection and Alarm System Replacement for Fort Worth, Houston, Kansas City, Anchorage, Minneapolis, Cleveland, New York, and Miami ARTCCs and San Juan CCF.
- Award design contracts for Fire Detection and Alarm System Replacement for Washington, Denver, Atlanta, Oakland, Chicago, Salt Lake City, and Seattle ARTCCs and Guam CCF.
- Award design contract for Central Plant/Power Service Building for Anchorage and Miami ARTCCs.
- Complete update of the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award contracts for Facility Condition Future Projects Survey for Fort Worth, Jacksonville, Minneapolis, and Albuquerque ARTCCs and San Juan CCF.

Program Plans FY 2021 – Performance Output Goals

- Award construction contracts for Fire Detection and Alarm System Replacement for Washington, Denver, Atlanta, Oakland, Chicago, Salt Lake City, and Seattle ARTCCs and Guam CCF.
- Award design contracts for Central Plant/Power Service Building for eight specific ARTCC sites to be determined.
- Complete update of the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award construction contract for Central Plant/Power Service Building for Anchorage and Miami ARTCCs.
- Award standard design for Control Wing First Floor and Attic Modernization Project.

Program Plans FY 2022 – Performance Output Goals

- Award construction contract for Central Plant/Power Service Building for eight specific ARTCC sites to be determined.
- Complete update of the national Facility Condition Assessment database for all ARTCCs and CCFs.

B, San Juan Facility Remediation, F08.01-01

Program Description

The San Juan Combined Control Facility (CCF) (ZSU) was constructed over 50 years ago and is located in a highly active seismic and geologically sensitive area. A recent structural evaluation identified significant seismic deficiencies with several of the on-site buildings. A decision was made to renovate the Administration Building and demolish other obsolete buildings at ZSU. The renovation of the Administration Building will provide space for the consolidation of technical support staff into a structurally sound, code-compliant building, while preserving the historically significant architecture of the original structure which is eligible for inclusion in the National Register.

This program will mitigate structural deficiencies associated with the occurrence of a seismic event and upgrade building systems infrastructure and architectural finishes. The renovation also addresses space requirements for Controller training classrooms and offices for Technical Operations personnel. Once completed, the technical support staff and controller trainings functions will be relocated from temporary buildings and trailers into the new renovated administration building. The obsolete buildings and trailers will be demolished and removed from site.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The program contributes to the FAA's performance metric of sustaining operational availability of the NAS, by ensuring that the building that houses Technical Operations staff is renovated to meet operational and structural requirements. Improvements to the Administration Building will extend the service life of the ZSU CCF. Updates to structural integrity to meet current building standards, including seismic risks, will reduce the overall risk of building related issues that could impact or interrupt operations.

Program Plans FY 2018 – Performance Output Goals

- Award construction contract for renovation of the Administration building and demolition of other buildings.

Program Plans FY 2019 – Performance Output Goals

- Complete construction of the structural seismic upgrade and installation of the roof and Hurricane Impact Insulated Laminated glazing windows. (Prior year funding)

Program Plans FY 2020 – Performance Output Goals

- Complete residual work and address change orders. (Prior year funding)
- Complete Administration Building renovation in third quarter. (Prior year funding)
- Complete personnel relocation in fourth quarter. (Prior year funding)

Program Plans FY 2021-2022 – Performance Output Goals

- None.

2A05, AIR TRAFFIC MANAGEMENT (ATM) – TRAFFIC FLOW MANAGEMENT (TFM)

FY 2018 Request \$4.9M

- A, Traffic Flow Management (TFM) Infrastructure – Field/Remote Site Technology Refresh, A05.01-13
- B, Traffic Flow Management (TFM) Infrastructure – TFM Improvements, A05.01-14
- X, Traffic Flow Management (TFM) Infrastructure – Traffic Flow Management System (TFMS) Modernization Part 2, A05.01-15

A, Traffic Flow Management (TFM) Infrastructure – Field/Remote Site Technology Refresh, A05.01-13

Program Description

The Traffic Flow Management System (TFMS) is the automation backbone for the Air Traffic Control System Command Center (ATCSCC) and the Traffic Management Units (TMUs) at en route centers and TRACONs that assist the ATCSCC in strategic planning and management of air traffic. TFM hosts the software decision support systems that are used in managing and metering air traffic to reduce delays and make maximum use of system capacity. These tools help the ATCSCC and TMUs to dynamically balance growing flight demands with NAS capacity. The system compares the projected traffic with the capacity of destination airports to determine if steps need to be taken to manage the flow and prevent delays. The FAA uses the information from this system to collaborate with aviation customers to develop and implement airspace management programs that reduce delays and ensure smooth and efficient traffic flow through FAA-controlled airspace. TFM benefits all segments of aviation including airlines, general aviation, U.S. Department of Defense, U.S. Department of Homeland Security, and appropriate foreign Air Traffic Control entities.

TFM Infrastructure Field/Remote Site Technology Refresh will replace TFMS equipment at field sites. Procured in 2008-2009, the support of current field equipment ended in 2014 and now requires hardware replacement in-kind for technology refresh. Hardware will be replaced at over 88 TFM-equipped Air Traffic Control facilities around the country including TMUs at En Route Centers, Terminal Radar Facilities, and Air Traffic Control Towers. The program achieved Final Investment Decision on June 18, 2014.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

When the NAS is impacted by severe weather, congestion and/or outages, TFM predicts chokepoints and facilitates the development and execution of mitigation initiatives and collaboration with stakeholders, using common information displays and tools to minimize NAS delays. The TFM Infrastructure – Field/Remote Site Technology Refresh Infrastructure program will support the FAA's performance metric for on-time arrival through the update of automated systems that provide more accurate and timely information for all TFM system users, improve operator and passenger access to flight information, and reduce system delays when the NAS is impacted by severe weather, congestion and/or outages.

Keeping the TFMS fully mission capable is an enabling technology for the NextGen Collaborative Air Traffic Management Technologies Work Package (WP) 4 efforts and in the future, WP5; both will operate on TFMS.

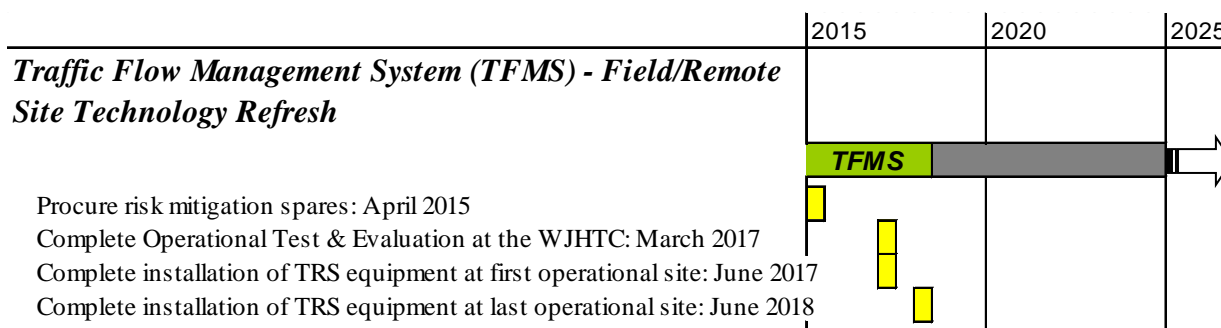
Program Plans FY 2018 – Performance Output Goals

- Complete installation of TFM Infrastructure Field/Remote Site (TRS) equipment at last operational site. (APB milestone)

Program Plans FY 2019-2022 – Performance Output Goals

- None.

System Implementation Schedule



B, Traffic Flow Management (TFM) Infrastructure – TFM Improvements, A05.01-14

Program Description

This program will conduct operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of Traffic Flow Management (TFM) services. The scope of these NAS enhancements is limited to operational changes that do not require significant capital investments or involve complex system interdependencies. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an Air Traffic Organization Standard Operating Procedure and coordinated with applicable stakeholders. Capability areas will be explored, developed, and executed over a multi-year period. Enhancements will be identified in each fiscal year and subsequently executed in the same fiscal year and/or possibly the following fiscal year, based on the nature of the changes and other programmatic factors. All required change management processes, such as the NAS Change Proposal, Safety Management System, and requirements management, will be followed.

Potential capability areas include:

- **Improved NAS State Awareness.** The current human-computer-interface used to communicate NAS status to Traffic Managers is scattered among several displays, decreasing consistent situational awareness and increasing task workload to maintain awareness;
- **TFM Data Integration.** Key demand and capacity information is currently not fully integrated between the FAA's two principal traffic flow management systems. Unlocking and integrating this data will improve overall NAS planning activities and traffic management initiative selection and execution;
- **Enhanced Data Exchange with Users.** Current methods to communicate system state and constraint information with users and the flying public is based on old technology and is not conducive with machine to machine exchange. Enhancements will be pursued to more efficiently create and sustain a common operational picture amongst ATM actors;
- **Better use of existing TFMS surface data.** The objective is to use surface data already contained in Traffic Flow Management System to automatically calculate airport delay information and post that information to the Operational Information System. These delays are tracked manually today; an automated display would give the FAA and NAS Users much needed status information; and
- **Displaying Traffic Management Initiative (TMI) data from National Traffic Management Log directly on the Traffic Situation Display.** This would include Ground Stops, Ground Delay Programs, Collaborative Trajectory Options Program, open/closed Fixes, Mile-in-Trail Restrictions.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

TFM improvements will upgrade decision support tools to help traffic managers implement more efficient TMIs. Improvements to Time-Based Flow Management, Traffic Flow Management, and potentially other systems, will assist traffic managers in more efficiently utilizing airport and airspace resources to increase arrival and departure capacity.

Program Plans FY 2018-2022 – Performance Output Goals

- Complete operational analysis, engineering analysis, and solution development of hardware and software enhancements.
- Deliver hardware and software enhancements in the operational release to address operational problems and system improvements.

X, Traffic Flow Management (TFM) Infrastructure – Traffic Flow Management System (TFMS) Modernization Part 2, A05.01-15

Program Description

The Traffic Flow Management System (TFMS) is the automation backbone for the Air Traffic Control System Command Center (ATCSCC) and the Traffic Management Units (TMUs) at en route centers and TRACONs that assist the ATCSCC in strategic planning and management of air traffic. TFM hosts the software decision support systems that are used in managing and metering air traffic to reduce delays and make maximum use of system capacity. These tools help the ATCSCC and TMUs to dynamically balance growing flight demands with NAS capacity. The system compares the projected traffic with the available capacity at destination airports to determine if steps are needed to manage traffic flow to prevent or minimize delays. The FAA uses the information from this system to collaborate with aviation customers to develop and implement airspace management programs to reduce delays and ensure smooth and efficient traffic flow through FAA-controlled airspace to benefit all segments of NAS users.

TFMS is the nation's primary source for capturing and disseminating flight information across the aviation community. TFMS exchanges real time data with many essential NAS systems and relies on real time communication between the FAA operational facilities, Airline Operations Centers (AOCs) and various government agencies to accomplish its goal of managing traffic flows within the NAS. TFMS serves as the primary platform for NextGen Collaborative Air Traffic Management Technology (CATMT) capabilities and is expected to host new NextGen functionality including elements of the Terminal Flight Data Manager (TFDM).

TFM Modernization (TFM-M) program, started in 2005 and successfully completed in 2010 with the establishment of the current TFMS baseline by modernizing the system architecture, core databases, and processing. To reduce risk and development time, the initial investment did not include modernizing all aspects of the system at once. Instead, TFM-M focused on creating a scalable open architecture and postponed updating some complex legacy functions and main front-end applications to a future incremental effort.

The TFM-M 2 program will modernize those remaining TFMS legacy front-end applications and will increase integration and interoperability by establishing a fully robust, commercially-available and standards-compliant system. These upgrades will improve TFMS reliability, dependability, and availability, and remove the current need for workarounds that increase software complexity, specialized adaptors, and internal high-maintenance interfaces. This software modernization effort will be performed and deployed in the 2023-2026 timeframe.

The program will also provide a replace-in-kind technology refresh of the hardware providing the central data processing capability for the TFMS. It will replace the hardware of the TFM Processing Center (TPC) and the TFM application National Traffic Management Log (NTML) located at the WJHTC, the TFMS Disaster Recovery Center (DRC), and the TFMS prime contractor site. The NTML equipment was last replaced in 2012 and will need to be replaced by 2020. The TFMS equipment purchased in 2013 and operational in 2015 will need to be replaced in 2021 to avoid obsolescence, degradation of system performance, and impact to other programs.

A Concept & Requirements Definition Readiness Decision (CRDRD) for this program is planned for FY 2020; an Investment Analysis Readiness Decision (IARD) in FY 2021; and Final Investment Decision (FID) in FY 2022.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The ability of TFM to remain fully available to the TMU community is a key requirement in being able to deal with delays when the NAS is impacted by severe weather, congestion and/or outages. Removing recognized performance issues is one clear way to increase system availability.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the CRDRD:
 - Preliminary shortfall analysis;
 - As-Is and To-Be functional analyses;
 - Preliminary concept of operations document; and
 - Concept and Requirements Definition plan.

Program Plans FY 2020 – Performance Output Goals

- Achieve CRDRD for TFM-M Part 2.
- Develop the following products in support of the IARD:
 - Draft Shortfall Analysis/Quantification;
 - Draft Preliminary Cost Estimate; and
 - Draft Preliminary Requirements Documents.

Program Plans FY 2021 – Performance Output Goals

- Achieve IARD for TFM-M Part 2.
- Develop the following products in support of the FID:
 - Draft Final Program Requirements;
 - Draft Final Business Case Analysis Report; and
 - Final Cost Estimate.

Program Plans FY 2022 – Performance Output Goals

- Achieve FID for TFM-M Part 2.
- Pending JRC approval:
 - Complete preliminary design.
 - Other output goals will be developed at FID.

2A06, AIR/GROUND COMMUNICATIONS INFRASTRUCTURE

FY 2018 Request \$9.8M

Radio Control Equipment (RCE) – Sustainment, C04.01-01 / Communications Facilities Enhancement – Expansion, C06.01-00

Program Description

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.

Radio Control Equipment (RCE) – Sustainment (C04.01-01):

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. Additional functionality, such as split voice and data is provided, which splits the control data from the voice circuit enabling the voice circuit to be compressed and use less bandwidth. This reduces operating costs for satellite communications because fees are based on the bandwidth used. The new equipment also provides dual control functionality with the option to toggle control of a remote communications facility between two towers allowing the transfer of frequency control to another facility when a tower is closed. RCE is required at service delivery sites such as Air Route Traffic Control Centers (ARTCCs), Terminal Radar Approach Control facilities, Air Traffic Control Towers, Combined Center Radar Approach Control, Radar Approach Controls, and Automated Flight Service Stations. This equipment is also installed at supporting facilities such as Remote Center A/G facilities that serve ARTCCs, Remote Transmitter/Receiver facilities that serve terminal facilities, and Remote Communications Outlet facilities that serve Flight Service Stations.

Communications Facilities Enhancement – Expansion (C06.01-00):

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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The A/G Communications Infrastructure Sustainment programs reduce the number of outages by replacing aging and increasingly unreliable communications equipment with modern equipment. These programs improve and provide required upgrades at A/G Communication sites and facilities to sustain reliable operation.

Program Plans FY 2018 – Performance Output Goals

Radio Control Equipment – Sustainment (C04.01-01):

- Procure 100 control type power supplies.
- Procure 100 of redesigned modules to replace obsolete parts.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of nine CFE sites.

Program Plans FY 2019 – Performance Output Goals

Radio Control Equipment – Sustainment (C04.01-01):

- Procure 100 control type power supplies.
- Procure 100 of redesigned modules to replace obsolete parts.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of nine CFE sites.

Program Plans FY 2020 – Performance Output Goals

Radio Control Equipment – Sustainment (C04.01-01):

- Procure 100 control type power supplies.
- Procure 100 of redesigned modules to replace obsolete parts.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of four CFE sites.

Program Plans FY 2021 – Performance Output Goals

Radio Control Equipment – Sustainment (C04.01-01):

- Procure 100 control type power supplies.
- Procure 100 of redesigned modules to replace obsolete parts.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of four CFE sites.

Program Plans FY 2022 – Performance Output Goals

Radio Control Equipment – Sustainment (C04.01-01):

- Procure 100 control type power supplies.
- Procure 100 of redesigned modules to replace obsolete parts.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of ten CFE sites.

2A07, AIR TRAFFIC CONTROL EN ROUTE RADAR FACILITIES IMPROVEMENTS

FY 2018 Request \$5.4M

Long Range Radar (LRR) Improvements – Infrastructure Upgrades/Sustain, S04.02-03

Program Description

The LRR Infrastructure Upgrades/Sustain program modernizes and upgrades 157 radar facilities that provide aircraft position information to FAA Air Route Traffic Control Centers and to other users (e.g., Department of Defense and Homeland Security). These planned improvements also support the installation and lifecycle modernization of the secondary beacon radars, i.e. Mode Select and Air Traffic Control Beacon Interrogator (ATCBI), for both stand-alone and those co-located with long-range primary radars. The antennas for secondary beacon radars were typically mounted above the long-range primary radar antennas with the processors for both radars also co-located at facilities constructed in the 1950s and 1960s. These facilities have reached the end of their designed service life and will require renovation and upgrades to maintain their current level of service. Some en route secondary radar service outages were due to leaking roofs and antiquated air conditioning systems. These outages can impact air traffic flow and cause delays.

The scope of work of the LRR infrastructure upgrades include:

- Upgrade of existing lightning protection, grounding, bonding, and shielding systems;
- Upgrade of existing power distribution systems;
- Upgrade of radar structural components to support the LRR Service Life Extension Program and ATCBI-6 deployments;
- Major repair and replacement of access roads, grounds, storm water controls, security lighting, and walkways;
- Abatement of hazardous materials such as asbestos-contaminated materials, lead-based paint, and mold;
- Refurbishment of heating, ventilation, and air conditioning (HVAC) systems, cooling fans, duct works, elevators, wiring and lighting systems, and walkways; and
- Repair or replacement of building and antenna tower roofs and structural components, such as foundations, beams, columns, bracings, struts, platforms, walls, and concrete slabs.

Planning is underway to develop a 10-year strategy for investments to upgrade the facilities to a sustainable level. This program is included in the ATC Facilities Sustainment Strategic Plan.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The LRR Infrastructure Upgrades/Sustain program renovates existing FAA-owned surveillance facilities and structures serving the NAS. The NAS requires reliable and continuous operation of surveillance equipment. Repairs, improvements, and modernization of existing infrastructure will enable facilities to meet current operational, environmental, and safety needs, economically extend the service life of facilities, and reduce the chance of outages that cause air traffic delays.

Program Plans FY 2018 – Performance Output Goals

- Complete upgrades of critical infrastructure systems at 12 facilities including critical, essential, and commercial power distribution and HVAC systems (actuals may vary based upon validation and priority for the year).
- Complete sustainment projects at 3 facilities. The scope includes roof replacements, building envelope repairs, safety improvements and plumbing upgrades (actuals may vary based upon validation and priority for the year).

Program Plans FY 2019-2022 – Performance Output Goals

- Complete upgrades of critical infrastructure systems at 12 facilities per year including critical, essential commercial power distribution and HVAC systems (actuals may vary based upon validation and priority for the year).
- Complete sustainment projects at 14 facilities per year. The scope includes roof replacements, building envelope repairs, safety improvements, mold abatements, asbestos abatements, access road repairs, plumbing upgrades, lighting improvements, and fire detection upgrades (actuals may vary based upon validation and priority for the year).

2A08, VOICE SWITCHING CONTROL SYSTEM (VSCS)

FY 2018 Request \$12.8M

Voice Switching and Control System (VSCS) –Technology Refresh – Phase 3, C01.02-04 / X, Voice Switching and Control System (VSCS) – Technology Refresh – Level of Effort, C01.02-05

Program Description

The Voice Switching and Control System (VSCS) allow en route controllers to communicate with pilots, other controllers, other air traffic facilities, and commercial telephone contacts. VSCS Training and Backup Switches (VTABS) are independent voice communication switches for en route training and serve as hot backup voice communications switches for critical VSCS air-to-ground and ground-to-ground communications. VTABS provides air traffic controllers and pilots with a path for voice communications in the event that VSCS is unavailable. VSCS and VTABS must be available at all ARTCCs until the systems are replaced by the NAS Voice System (NVS).

VSCS –Technology Refresh – Phase 3 (C01.02-04):

The VSCS Technology Refresh Phase 3 program will replace and upgrade hardware and software components for the voice switching systems in all 21 en route air traffic control centers; and the testing and training systems located at the William J. Hughes Technical Center and the FAA Academy. These upgrades will 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. To date, this program has replaced the VSCS internal control systems, updated the obsolete language used in some software programs, and completed the retrofit for the local area network transceiver.

VSCS Technology Refresh Phase 3 is dependent upon engineering analysis which will include ground-to-ground node reduction efforts (approximately 10 nodes), Fiber Optic Tie Trunk power supply replacements (approximately 500), Local Area Network Transceiver retrofits (approximately 7,000), and PECO II, Inc. power equipment replacement. A Final Investment Decision for VSCS Technology Refresh Phase 3 was approved in November 2012. A Baseline Management Notice has requested a revision of the final APB Milestone to remove the PLM to C software conversion effort for the air-to-ground switch and replace it with the Power Equipment Replacement effort.

VSCS – Technology Refresh – Level of Effort (C01.02-05):

The VSCS Technology Refresh Level of Effort program will maintain ongoing Diminishing Manufacturing Sources and Material Shortages (DMSMS) analysis, conduct program management activities, and provide engineering support. Depending on continued engineering analyses, potential technology refresh activities under the Level of Effort may include VTABS Subsystem refresh, VSCS Control Subsystem refresh and Position Equipment Test Set refresh. VSCS Technology Refresh Level of Effort will be a stand-alone effort starting FY 2019 and will continue to sustain VSCS/VTABS until fully replaced by NVS.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The VSCS Technology Refresh program supports the Performance Metric to sustain operational availability of the NAS by improving the system reliability of en route voice communications for both current and future operations by replacing and upgrading components of the obsolete, non-supportable elements of VSCS hardware and software. Reports indicate VSCS equipment had an average operational availability of 99.971% from 2007 through 2010 with a downward trend as compared to a safety-critical NAS services availability requirement of 99.999%. VSCS Technology Refresh is required to sustain both the operational availability of the VSCS and VTABS, and the ability of the VSCS Depot to support site requisitions.

Program Plans FY 2018 – Performance Output Goals

VSCS –Technology Refresh – Phase 3 (C01.02-04):

- Complete VSCS PECO II, Inc. Power Equipment Replacement. (APB milestone)

VSCS – Technology Refresh – Level of Effort (C01.02-05):

- None.

Program Plans FY 2019 – Performance Output Goals

VSCS –Technology Refresh – Phase 3 (C01.02-04):

- None.

VSCS – Technology Refresh – Level of Effort (C01.02-05):

- Complete quarterly VSCS / VTABS System Technology Evolution Process database update needed for DMSMS analysis.
- Award contract to recover, replace or upgrade components identified in the DMSMS analysis.

Program Plans FY 2020 – Performance Output Goals

VSCS –Technology Refresh – Phase 3 (C01.02-04):

- None.

VSCS – Technology Refresh – Level of Effort (C01.02-05):

- Complete quarterly VSCS / VTABS System Technology Evolution Process database update needed for DMSMS analysis.
- Recover, replace or upgrade VSCS components as identified in the DMSMS analysis.

Program Plans FY 2021 – Performance Output Goals

VSCS –Technology Refresh – Phase 3 (C01.02-04):

- None.

VSCS – Technology Refresh – Level of Effort (C01.02-05):

- Complete quarterly VSCS / VTABS System Technology Evolution Process database update needed for DMSMS analysis.
- Recover, replace or upgrade VSCS components as identified in the DMSMS analysis.

Program Plans FY 2022 – Performance Output Goals


VSCS –Technology Refresh – Phase 3 (C01.02-04):

- None.

VSCS – Technology Refresh – Level of Effort (C01.02-05):

- Complete quarterly VSCS / VTABS System Technology Evolution Process database update needed for DMSMS analysis.
- Recover, replace or upgrade VSCS components as identified in the DMSMS analysis.

System Implementation Schedule

	2015	2020	2025
Voice Switching and Control System (VSCS) - Technology Refresh			
First site 2002 -- Last site 2027			

2A09, OCEANIC AUTOMATION SYSTEM (OAS)

FY 2018 Request \$23.1M

- A, Advanced Technologies and Oceanic Procedures (ATOP) – Sustainment 2, A10.03-01
- B, Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Improvements, A10.03-03
- C, Advanced Technologies and Oceanic Procedures (ATOP) – ATOP Enhancements (Work Package 1), A10.03-02

A, Advanced Technologies and Oceanic Procedures (ATOP) – Sustainment 2, A10.03-01

Program Description

The ATOP program replaced the original oceanic air traffic control system, updated procedures, and modernized the oceanic automation systems located at the Oakland, New York, and Anchorage Air Route Traffic Control Centers. Full operational capability was achieved at all three centers in 2007. A support system was also installed at the William J. Hughes Technical Center (WJHTC). ATOP fully integrates flight and surveillance data processing, detects conflicts between aircraft, provides data link and surveillance capabilities, and automates the previous manual processes for oceanic air traffic control.

The ATOP Sustainment 2 program will replace the hardware and operating system, and integrate the new technology with the baseline ATOP applications. The ATOP program reduces maintenance and logistics costs and supports incorporation of software changes and new capabilities to support future NextGen, Surveillance and Broadcast Services, and other NAS improvements. The Final Investment Decision (FID) was completed in February 2016.

The ATOP program will support a 10-year operational life through hardware and software changes:

- Hardware replacement of all processors, displays, network switches, printers, and enterprise data storage devices;
- Operating system upgrade from AIX 5.3 to Red Hat Linux;
- Software performance improvements to target projected 2028 traffic loads; and
- System improvement/cost reduction solutions.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

ATOP Sustainment 2 program replaces obsolete and unsupportable equipment and the operating system to reduce future system failures and increase ATOP system performance to meet future requirements and capabilities.

Program Plans FY 2018 – Performance Output Goals

- Complete implementation of the technology refresh configuration at the WJHTC.
- Develop and validate system transition procedures for site deployment.
- Complete software porting from AIX 5.3 to Linux and provide a technology refresh hardware and software release for test purposes.

Program Plans FY 2019 – Performance Output Goals

- Release T27 (Linux Port) for operational use.
- Complete implementation of the technology refresh configuration (Linux Port and hardware) at the first ATOP site.

Program Plans FY 2020 – Performance Output Goals

- Complete the implementation of the technology refresh (Linux Port and hardware) at the last two ATOP sites.
- Complete development of ATOP T28 improved performance software and release for operational use.
- All three ATOP sites operational on T28 improved performance software release.

Program Plans FY 2021-2022 – Performance Output Goals

- None.

**B, Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Improvements,
A10.03-03**

Program Description

This program will support operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of oceanic domain services. Full operational capability for ATOP was achieved at all three centers in 2007. The scope of these NAS enhancements is limited to operational changes that require an expedited solution but do not require significant capital investments, nor involve significant systems complexity or interdependencies. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an Air Traffic Organization Standard Operating Procedure and will use the ATOP NAS Change Proposal process to identify and prioritize the requirements.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

This program will improve the flexibility, reliability, and efficiency of oceanic air traffic control by providing enhancements to more frequently accommodate user preferred flight trajectories and requests for altitude changes, increasing the likelihood of on-time arrivals.

Program Plans FY 2018-2022 – Performance Output Goals

- Complete operational and engineering analysis, solution development, and solution implementation activities for prioritized ATOP system enhancements.

C, Advanced Technologies and Oceanic Procedures (ATOP) – ATOP Enhancements (Work Package 1), A10.03-02

Program Description

The ATOP program replaced the original oceanic air traffic control system, updated procedures and modernized the oceanic automation systems located at the Oakland, New York, and Anchorage Air Route Traffic Control Centers (ARTCCs). Full operational capability was achieved at all three centers in 2007. A support system was also installed at the William J. Hughes Technical Center. ATOP fully integrates flight and surveillance data processing, detects conflicts between aircraft, provides data link and surveillance capabilities, and automates previously manual processes for oceanic air traffic control.

The ATOP Enhancements program is addressing the operational shortfalls of the current oceanic system as the FAA moves forward with NextGen and other NAS upgrades. The program continues the evolution of the capabilities and services from requirements developed by the Air Traffic Procedures Directorate, AJV-8. The program has six planned enhancements to address the following shortfall categories shown below:

- User interface and data processing limitations impacting controller coordination;
- Inability to access required external weather data and publish flight and system data;
- Lack of automation support for coordination with international air navigation service providers;
- Failure to realize benefits from integrating new products, services and data provided via NextGen;
- Lack of conflict probe in surveillance airspace; and
- Lack of support for automatic user request processing.

The six enhancements are:

- Enhanced Controller Coordination;
- NextGen: Data Exchange via System Wide Information Management (SWIM) (Interface Rehost and Publish Services);
- Expanded Oceanic International Interfaces;
- NextGen: Data Exchange via SWIM (New Services);
- NextGen: Enhanced Conflict Probe for ATOP Surveillance Airspace; and
- NextGen: Approval of User Requests in Oceanic Airspace (Auto Re-Probe).

Investment Analysis Readiness Decision (IARD) was completed in February 2017. Final Investment Decision (FID) is planned for 2nd quarter FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 5 – Limit the impact of aircraft CO2 emissions on the global climate by achieving carbon neutral growth by 2020 compared to 2005, and net reductions of the climate impact from all aviation emissions over the longer term (by 2050). (FAA Business Planning Metric)*

Relationship to Performance Metric

The ATOP Enhancements program, through improved communication, coordination and surveillance, will enable controllers to provide more direct routings that will reduce fuel burn and carbon dioxide emissions.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the FID:
 - Final Program Requirements documentation;
 - Enterprise Architecture Artifacts;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID and initiate development of enhancements.

Program Plans FY 2019-2022 – Performance Output Goals

- Output goals will be developed at FID.

2A10, NEXT GENERATION VERY HIGH FREQUENCY AIR/GROUND COMMUNICATIONS SYSTEM (NEXCOM)

FY 2018 Request \$53.0M

Next-Generation VHF and UHF A/G Communications (NEXCOM) – Segment 2 – Phase 1 of 2, C21.02-01 / Next-Generation VHF and UHF A/G Communications (NEXCOM) – Segment 2 – Phase 2 of 2, C21.02-02

Program Description

The NEXCOM program replaces and modernizes the aging and obsolete NAS air-to-ground (A/G) analog radios that allow direct voice communication with pilots. Replacing the radios is part of a larger program to address the limitations on increasing the allocation of radio frequency spectrum dedicated solely for controller communications. Additional frequencies are needed to ensure that the air traffic system's available spectrum is able to accommodate future growth in U.S. air traffic communication requirements. New Very High Frequency (VHF) radios can handle both the existing 25 kHz bandwidth voice mode protocol for channel separation, or they can operate in the more efficient 8.33 kHz bandwidth voice mode currently used in Europe. The 8.33 kHz voice-only mode divides the current bandwidth for one channel into three channels. This increase in the number of channels partitions the existing spectrum so one of the three channels can be used for a stand-alone data communications system (i.e., Datacomm program).

These radios will support Voice over Internet Protocol (VoIP) and meet the requirements of the NextGen NAS Voice Systems (NVS) program. In addition, replacement of obsolete radios improves A/G radio equipment maintainability and reliability, and enhances A/G information security and communications control. As part of the JRC approvals, Emergency Transceivers and Hand Held Radios are included in the current program baseline.

Segment 1a of the NEXCOM program finished replacing all 25,000 en route radios with Multimode Digital Radios in FY 2013.

The NEXCOM Segment 2 program began replacing radios at terminal and flight services in FY 2009, under an existing contract, with planned completion scheduled in FY 2026. Ultimately 35,000 radios will be deployed into the NAS under the NEXCOM Segment 2 program. 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 3rd quarter, FY 2017.

NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

The NEXCOM procurement for Segment 2, Phase 1 has a combined contract to deliver VHF radios for civil aviation and Ultra High Frequency (UHF) radios for military aviation. A total of 15,000 radios will be replaced in Phase 1 from FY 2009 through FY 2018.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

NEXCOM Segment 2, Phase 2 completes terminal and flight services facility radio modernization that began under Phase 1. A total of 20,000 radios will be replaced during Phase 2 from FY 2019 through FY 2026. In addition, the

program is currently reviewing and finalizing the requirements and Screening Information Request package for the upcoming procurement of Emergency Transceivers. The program expects contract award in FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

NEXCOM will reduce the number of unplanned outages by replacing existing communications equipment with modern A/G equipment. An added performance benefit will be 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, Phase 1.

Program Plans FY 2018 – Performance Output Goals

NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

- Deploy 3,000 new Terminal Air Traffic Control Radios.
- Procure 2,300 Radios.
- Achieve IOC at 450 sites. (APB milestone)
- Deploy VHF/UHF Emergency Transceivers at key site for testing.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

- Award Emergency Transceiver contract.
- Procure Emergency Transceiver for operational Test & Evaluation.

Program Plans FY 2019 – Performance Output Goals

NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

- None.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

- Deploy 3,000 new Terminal Air Traffic Control Radios.
- Procure 3,300 Radios.
- Procure 120 Emergency Transceivers.

Program Plans FY 2020 – Performance Output Goals

NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

- None.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

- Deploy 3,000 new Terminal Air Traffic Control Radios.
- Procure 3,300 Radios.
- Procure 250 Emergency Transceivers.

Program Plans FY 2021 – Performance Output Goals

NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

- None.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

- Deploy 3,000 new Terminal Air Traffic Control Radios.
- Procure 3,000 Radios.
- Procure 250 Emergency Transceivers.
- Procure 650 Emergency (Handheld) VHF Transceivers.

Program Plans FY 2022 – Performance Output Goals

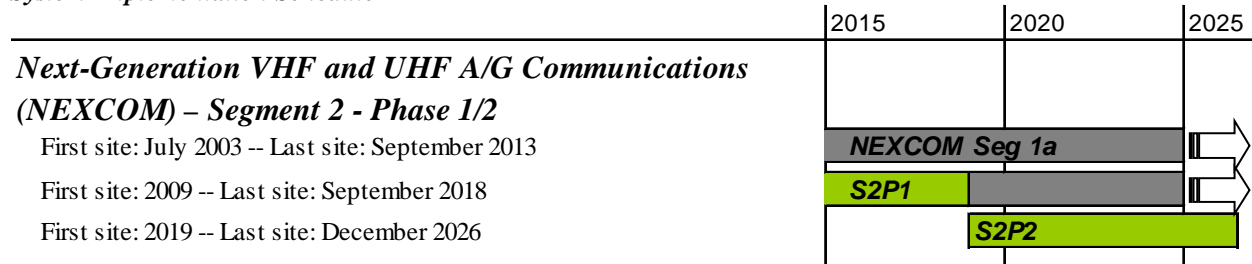
NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

- None.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

- Deploy 3,000 new Terminal Air Traffic Control Radios.
- Procure 2,100 Radios.
- Procure 250 Emergency Transceivers.
- Procure 950 Emergency (Handheld) VHF Transceivers.

System Implementation Schedule



2A11, NEXTGEN – SYSTEM-WIDE INFORMATION MANAGEMENT (SWIM)

FY 2018 Request \$50.1M

- A, System Wide Information Management (SWIM) – Segment 2B, G05C.01-08
- B, System Wide Information Management (SWIM) – Common Support Services-Weather (CSS-Wx) Work Package 1, G05C.01-06 / X, System Wide Information Management (SWIM) – Common Support Services-Weather (CSS-Wx) Work Package 2, G05C.01-09
- X, System Wide Information Management (SWIM) – Segment 2C – NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure and 3rd Party Provider, G05C.01-10

A, System Wide Information Management (SWIM) – Segment 2B, G05C.01-08

Program Description

In 2007, the FAA established the SWIM program to implement a set of Information Technology (IT) capabilities in the NAS to provide users with relevant and commonly understandable information. The principles behind the SWIM concept include the following:

- The separation of information provision and consumption in such a way that the number and nature of the consumers can evolve through time;
- Loose system coupling, in which each component has little or no knowledge of the definitions of other separate components;
- Using publicly available open standards; and
- Using Service Oriented Architecture (SOA) implemented as a suite of interoperable services.

SWIM maximizes the use of current infrastructure while allowing the sharing of information between diverse systems enabling NextGen delivery of the right information to the right places at the right time. This is achieved by providing the IT enterprise infrastructure necessary for NAS systems to share and reuse information and increase interoperability.

SWIM's enterprise infrastructure enables systems to publish information of interest to NAS users, request and receive information from other NAS services, and support NAS security requirements. SWIM provides Governance to NAS programs to ensure services are SWIM compliant and meet all FAA SOA standards. By providing this Governance and the supporting enterprise infrastructure SWIM reduces the cost and risk for NextGen programs to develop and deploy services.

Plans for Segment 2B include the following:

- Identity and Access Management (IAM) Phase 2: A SOA core service that provides security controls for access to SWIM. Deploys strong authentication and authorization using Private Key Infrastructure certificates to ensure the right level of access and security in the NAS, available through Atlanta (ATL) Network Enterprise Management Center (NEMC) and Salt Lake City (SLC) NEMC;
- Enterprise Service Monitoring (ESM) Phase 2 and Phase 3: A SOA core service that provides enterprise monitoring of SWIM services and SWIM related systems. Provides situational awareness of Operations and Maintenance status of NAS infrastructure and the SOA services, including service outages. Service will be available through ATL NEMC and SLC NEMC;
- SWIM Terminal Data Distribution System (STD DS) Phase 2: An enhanced service that provides access to terminal-related data. Implements track and flight plan data, real-time status/alerts from tower and airport systems, and other system enhancements in standard formats utilizing the SWIM infrastructure (NAS Enterprise Messaging Service). System will be deployed at 38 TRACONS; and
- NAS Common Reference (NCR): A new service that consists of a geospatial query engine and data aggregation utility that provides common situational awareness for traffic flow management. Provides agile filtering of spatially consistent data supporting 4D trajectory querying capability, providing a layered view of NAS data as correlated useful information. Service will be available through ATL NEMC and SLC NEMC.

The Segment 2B Final Investment Decision occurred in October 2015.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

SWIM reduces the number and types of unique interfaces, reduces redundancy of information, facilitates information-sharing, improves predictability and operational decision-making, and reduces the 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. In addition, SWIM provides the foundation for greatly enhanced information exchange and sharing outside the FAA.

Program Plans FY 2018 – Performance Output Goals

- Complete SOA suitability assessments for NAS programs entering the FAA investment analysis processes.
- Complete Final Flight Information Exchange Model Compliant Schema Development for STD DS Flight Data. (APB milestone)
- Complete NCR Critical Design Review (CDR). (APB milestone)
- Complete Initial Operational Capability (IOC) for Strong Authentication using digital certificates for internal connections between NAS systems (IAM Phase 2) (APB milestone)
- Complete ESM Phase 2 IOC. (APB milestone)

Program Plans FY 2019 – Performance Output Goals

- Complete SOA suitability assessments for NAS programs entering the FAA investment analysis processes.
- Complete STD DS Phase 2 Release 4 IOC. (APB milestone)
- Complete ESM Phase 3 Development Testing (which enables ESM to accept status messages from a Non-Communication, Information & Network Programs SWIM producer). (APB milestone)
- Complete NCR Operational Testing at WJHTC. (APB milestone)

Program Plans FY 2020 – Performance Output Goals

- Complete SOA suitability assessments for NAS programs entering the FAA investment analysis processes.
- Complete ESM Phase 3 IOC. (APB milestone)
- Complete STDDS Phase 2 Release 5 IOC. (APB milestone)
- Complete IOC for Attribute Based Access Control (Authorization) Capability (IAM Phase 2). (APB milestone)
- Complete NCR IOC. (APB milestone)

Program Plans FY 2021 – Performance Output Goals

- Complete SOA suitability assessments for NAS programs entering the FAA investment analysis processes.
- Complete STDDS Phase 2 Release 6 IOC. (APB milestone)

Program Plans FY 2022 – Performance Output Goals

- None.

System Implementation Schedule



B, System Wide Information Management (SWIM) – Common Support Services-Weather (CSS-Wx) Work Package 1, G05C.01-06 / X, System Wide Information Management (SWIM) – Common Support Services-Weather (CSS-Wx) Work Package 2, G05C.01-09

Program Description

Common Support Services-Weather (CSS-Wx) program will 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 System Wide Information Management (SWIM) (G05C.01-08), a data management and sharing system the FAA is implementing for NextGen. Consumers of CSS-Wx information will be air traffic controllers, traffic managers, commercial aviation, general aviation, and other aviation enterprises. The program will consolidate several legacy weather dissemination systems such as the Weather Message Switching Center Replacement (WMSCR), Automated Weather Observing System (AWOS) Data Acquisition System (ADAS), Automated Lightning Detection and Reporting System (ALDARS), and World Area Forecast System (WAFS) Internet File Service (WIFS). CSS-Wx will be the FAA's single provider of aviation weather data for integration into NextGen enhanced Decision Support Tools (DSTs). The CSS-Wx system is scheduled to achieve Initial Operational Capability (IOC) in FY 2019.

The CSS-Wx System will:

- Provide weather information via Web Coverage Service for gridded data, Web Feature Service for non-gridded data, and Web Map Service for images;
- Filter weather information by location and time with the ability to provide the user with weather data for a specific geographic area;
- Provide weather information in common, standardized formats using Weather Information Exchange Model (WXXM) for non-gridded data and using Network Common Data Form for gridded data; and
- Store, archive, and retrieve weather information.

The CSS-Wx system will deliver improved weather products for input into collaborative decision-making applications using information provided by the NextGen Weather Processor (NWP) (G04W.03-02), the National Oceanic and Atmospheric Administration's NextGen Web Services, and other weather sources available to FAA and NAS users.

Common Support Services-Weather (CSS-Wx) Work Package 1 (G05C.01-06):

The CSS-Wx WP1 is in the AMS Solution Implementation phase. Final Investment Decision (FID) for CSS-Wx WP1 occurred concurrently with the FID for NWP WP1 in March 2015. CSS-Wx will be deployed at 60 operational sites:

two (2) centrally located facilities (Atlanta and Salt Lake City); 33 TRACONs, 21 ARTCCs, three (3) Combined Control Facilities, and one (1) at the ATCSCC.

Common Support Services-Weather (CSS-Wx) Work Package 2 (G05C.01-09):

CSS-Wx WP2 will subsume additional legacy weather systems such as WMSCR, AWOS ADAS, ALDARS, and WAFS WIFS. CSS-Wx WP2 will also provide additional Web services, filtering, and complex queries capabilities.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

CSS-Wx is an enterprise service that provides access to weather observations and predictions to enable collaborative and dynamic NAS decision making. It will enable integration of information from weather sources into NextGen DSTs. CSS-Wx will enable Airline Operations Centers and Traffic Flow Management to better develop weather mitigation plans and re-plans by selecting flight paths that maximize use of available capacity in weather impacted environments. CSS-Wx will provide NWP mosaics to en route and terminal controllers enabling more precise and timely information to respond to pilot requests for deviations around hazardous weather. CSS-Wx helps maximize use of airport capacity by providing more precise information on weather location and movement, which allows runways to remain in use longer and reopen more quickly after an adverse weather event.

Program Plans FY 2018 – Performance Output Goals

Common Support Services-Weather (CSS-Wx) Work Package 1 (G05C.01-06):

- Complete CSS-Wx WP1 Factory Acceptance Testing (FAT). (APB Milestone)

Common Support Services-Weather (CSS-Wx) Work Package 2 (G05C.01-09):

- None.

Program Plans FY 2019 – Performance Output Goals

Common Support Services-Weather (CSS-Wx) Work Package 1 (G05C.01-06):

- Complete CSS-Wx WP1 Operational Testing (OT). (APB Milestone)
- Achieve CSS-Wx WP1 Key Site Initial Operational Capability (IOC). (APB Milestone)
- Achieve CSS-Wx WP1 In-Service Decision. (APB Milestone)

Common Support Services-Weather (CSS-Wx) Work Package 2 (G05C.01-09):

- None.

Program Plans FY 2020 – Performance Output Goals

Common Support Services-Weather (CSS-Wx) Work Package 1 (G05C.01-06):

- Achieve CSS-Wx WP1 First Site Operational Readiness Date (ORD). (APB Milestone)
- Achieve CSS-Wx WP1 ORD at 13 sites (13 of 60, 22%).

Common Support Services-Weather (CSS-Wx) Work Package 2 (G05C.01-09):

- None.

Program Plans FY 2021 – Performance Output Goals

Common Support Services-Weather (CSS-Wx) Work Package 1 (G05C.01-06):

- Achieve CSS-Wx WP1 ORD at 36 sites (49 of 60, 82%).

Common Support Services-Weather (CSS-Wx) Work Package 2 (G05C.01-09):

- None.

Program Plans FY 2022 – Performance Output Goals

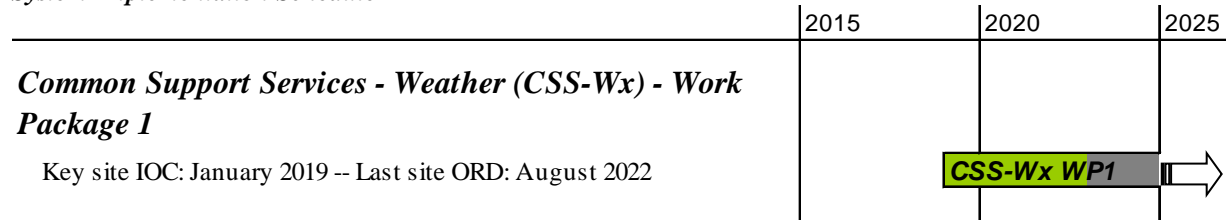
Common Support Services-Weather (CSS-Wx) Work Package 1 (G05C.01-06):

- Achieve CSS-Wx WP1 ORD at 11 sites (60 of 60, 100%). (Prior year funding)

Common Support Services-Weather (CSS-Wx) Work Package 2 (G05C.01-09):

- Achieve CSS-Wx WP2 software release to key sites.

System Implementation Schedule



X, System Wide Information Management (SWIM) Segment 2C – NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure and 3rd Party Provider, G05C.01-10

Program Description

In 2007, the FAA established the SWIM program to implement a set of Information Technology (IT) capabilities in the NAS to provide users with relevant and commonly understandable information. The principles behind the SWIM concept include the following:

- The separation of information provision and consumption in such a way that the number and nature of the consumers can evolve through time;
- Loose system coupling, in which each component has little or no knowledge of the definitions of other separate components;
- Using publicly available open standards; and
- Using Service Oriented Architecture (SOA) implemented as a suite of interoperable services.

SWIM maximizes the use of current infrastructure while allowing the sharing of information between diverse systems enabling NextGen delivery of the right information to the right places at the right time. This is achieved by providing the IT enterprise infrastructure necessary for NAS systems to share and reuse information and increase interoperability.

SWIM's enterprise infrastructure enables systems to publish information of interest to NAS users, request and receive information from other NAS services, and support NAS security requirements. SWIM provides governance to NAS programs to ensure services are SWIM compliant and meet all FAA SOA standards. By providing this Governance and the supporting enterprise infrastructure SWIM reduces the cost and risk for NextGen programs to develop and deploy services.

Plans for SWIM Segment 2C include:

- Technology refresh of existing NAS Enterprise Messaging Service (NEMS) infrastructure such as NEMS nodes, Local Load Balancer, Global Load Balancer, and Solace boxes;
- Completing additional NEMS Infrastructure upgrades at eight sites to expand capacity due to planned NAS programs bandwidth requirements such as for Common Support Services-Weather. The upgrades will include Solace boxes, additional NetApp storage for Basic 2 guaranteed messaging system level capability, Java Message Service accelerator; and
- Adding 3rd Party Provider Services to support 500+ Tier 2 external NEMS consumers by forwarding all FAA approved SWIM content to a commercial cloud solution provider.

An Investment Analysis Readiness Decision (IARD) is currently planned for 2nd quarter of FY 2018. A Final Investment Decision (FID) is planned for 4th quarter of FY2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

SWIM reduces the number and types of unique interfaces, reduces redundancy of information, facilitates information-sharing, improves predictability and operational decision-making, and reduces the 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. In addition, SWIM provides the foundation for greatly enhanced information exchange and sharing outside the FAA.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Pending FID approval:
 - Complete Technology Refresh of eight Internal Data Exchange (DEX) Messaging Nodes (DMNs) at the following sites: Salt Lake City ARTCC (ZLC), Mike Monroney Aeronautical Center (OEX), Atlanta ARTCC (ZTL), Atlantic City International Airport (ACY), FAA Telecommunication Infrastructure (FTI) National Test Bed (FNTB), Fort Worth ARTCC (ZFW), Washington ARTCC (ZDC), and Seattle ARTCC (ZSE).
 - Complete Technology Refresh of Internal DMNs and Internal DEX Access Nodes (DANs) at SWIM Prototype Facility.
 - Complete Technology Refresh of the NAS Enterprise Security Gateway DANs at the Salt Lake City and Oklahoma City facilities.

Program Plans FY 2020 – Performance Output Goals

- Milestones will be provided after SWIM Segment 2C FID.

Program Plans FY 2021 – Performance Output Goals

- Milestones will be provided after SWIM Segment 2C FID.

Program Plans FY 2022 – Performance Output Goals

- Milestones will be provided after SWIM Segment 2C FID.

2A12, NEXTGEN – AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B) NAS WIDE IMPLEMENTATION

FY 2018 Request \$139.2M

- A, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01
- B, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Sustain/Relocate (Gulf of Mexico Platform), G02S.05-01
- X, Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services (FY21-Out), G02S.03-06

A, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01

Program Description

Automatic Dependent Surveillance-Broadcast (ADS-B) is an advanced surveillance technology that provides highly accurate and comprehensive surveillance information. ADS-B is an enabling technology for NextGen. This system promises to significantly reduce delays and enhance safety by using aircraft broadcasted position based on the aircraft's navigation system calculation using the Global Navigation Satellite System (GNSS) or other navigation inputs, instead of position information from traditional radar.

Aircraft position (longitude, latitude, altitude, and time) is determined using the GNSS, and/or an internal inertial navigational reference system, or other navigation aids. The aircraft's ADS-B equipment processes this position information, along with other flight parameters (e.g., identification, velocity, pilot selected altitude, and other data) to be broadcast approximately once a second to ADS-B receivers. This information is used to display the aircraft's position on en route and terminal automation systems such as Standard Terminal Automation Replacement System, Microprocessor En Route Automated Radar Tracking System, En Route Automation Modernization, and Advanced Technologies and Oceanic Procedures.

In addition to the ground-based ADS-B receivers, nearby aircraft within range of the broadcast and equipped with ADS-B In avionics may also receive and process the surveillance information of nearby ADS-B equipped aircraft; this information will be available to the pilot on the aircraft's display. ADS-B equipment may also be installed on airport ground support or emergency vehicles to allow controllers and pilots to locate and identify them on runways or taxiways.

The program ensures continuation of the FAA subscription for ADS-B Baseline Services delivered by the prime contractor utilizing contractor owned and operated ADS-B infrastructure already in place in the NAS. Subscription fees support the operation of the system, necessary upgrades, and eventual modernization. Annual Subscription fees to the prime contractor provide services to existing service volumes. The program also provides Wide-area Multilateration (WAM) surveillance service capability providing aircraft location information to the automation systems. These services allow controllers to provide separation services at airports in Colorado and North Carolina.

The acquisition of ADS-B equipment has been structured as a multi-year, performance-based service contract for the vendor to install and maintain ground-based ADS-B equipment to provide surveillance information to FAA automation systems. This program continues implementation of baseline ADS-B applications and enables: Ground-based Interval Management-Spacing; Traffic Situation Awareness with Alerts; Airport Surface Traffic Situation Awareness; Enhanced Visual Approach to support merging and spacing with Cockpit Display of Traffic Information Assisted Visual Separation; Weather; and NAS Situation Awareness.

Eight airports in the NAS will receive Airport Surface Surveillance Capability (ASSC), which is a surface multilateration system that receives inputs from cooperative and non-cooperative sensors. ASSC consists of a multilateration subsystem, multi-processor subsystem, data distribution subsystem, tower display subsystem and a maintenance subsystem. Using fused target data, ASSC will enhance situational awareness for tower controllers by providing the position of all aircraft and ground vehicles on the airport movement area, and aircraft flying on approach to the airport. In addition, the data can be distributed by the System Wide Information Management Terminal Data Distribution System, which allows surface situational awareness information to be made available to external consumers in the aviation community. The surface surveillance data is intended to be shared with multiple stakeholders via the External Surface Data Release capability to improve efficiency.

The ADS-B system is an essential element of NextGen and supports implementation of the Operational Improvements that make air travel more efficient and safe. See also ADS-B Sustain Lease Services (FY21-Out) portion of the program under G02S.03-06.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

ADS-B is a technology that will allow implementation of new air traffic control procedures based on more accurate aircraft position information that will allow more efficient use of airspace capacity, fewer 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 during inclement weather conditions. These efficiency benefits translate to savings in both aircraft direct operating costs and passenger value of time. The Business Case Analysis Report dated May 15, 2012 shows \$3.2B in capacity and efficiency benefits.

Program Plans FY 2018 – Performance Output Goals

- Achieve IOC of Terminal ATC Separation Services at 31 sites (136 cumulative).
- Achieve ASSC at IOC one site (3 cumulative).
- Achieve FID for next ADS-B investment segment.
- Pay subscription fees:
 - Provide WAM surveillance services supporting air traffic operations for selected airports.
 - Provide service to more than 300 service volumes within specified requirements.

Program Plans FY 2019 – Performance Output Goals

- Achieve IOC of Terminal ATC Separation Services at 18 sites (154 cumulative).
- Achieve ASSC IOC at four sites (7 cumulative).
- Pay subscription fees:
 - Provide WAM surveillance services supporting air traffic operations for selected airports.
 - Provide service to more than 300 service volumes within specified requirements.

Program Plans FY 2020 – Performance Output Goals

- Achieve IOC of Terminal ATC Separation Services at 1 site (155 cumulative). (APB milestone)
- Achieve IOC at last site for ASSC system (8 cumulative). (APB milestone)
- Pay subscription fees:
 - Provide WAM surveillance services supporting air traffic operations for selected airports.
 - Provide service to more than 300 service volumes within specified requirements.

Program Plans FY 2021-2022 – Performance Output Goals

- None – funding beyond FY 2020 is under G02S.03-06.

B, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Sustain/Relocate (Gulf of Mexico Platform), G02S.05-01

Program Description

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. In addition to the ADS-B surveillance facilities, voice communications and weather services are maintained to support ATC Instrument Flight Rule requirements. Aircraft utilizing these services include high altitude commercial aircraft transiting the GOM and low-altitude helicopters providing transportation to the multiple energy platforms operating throughout the GOM.

This program is supported by a Memorandum of Agreement (MOA) between the FAA and multiple energy and transportation companies with interests in the GOM. The MOA defines the roles, responsibilities, and contributions of each party. The energy and transportation companies provide space for ADS-B, weather, and voice communication

equipment; engineering design services; installation support; limited preventative maintenance; telecommunications services; and transportation to the oil platforms at no cost to the FAA. The FAA installs and maintains ADS-B, weather, and voice communications. Maintenance for ADS-B and weather equipment are paid through a leased service as monthly subscription charges. These monthly charges are covered under the ADS-B NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01.

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 meeting FAA criteria. Additional facilities may be installed using existing inventory to ensure service reliability. This program provides the needed funds to relocate equipment in the event FAA loses access to a current platform space.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The implementation of ADS-B technology enables the use of new ATC procedures based on more accurate aircraft position information that will allow more efficient use of airspace capacity, fewer delays, and more optimal routing for aircraft. Other efficiency benefits include reduced weather deviations and fewer cancellations resulting from increased access to many oil platforms during inclement weather conditions. These efficiency benefits translate to savings in both aircraft direct operating costs and passenger value of time.

The objective of the ADS-B Sustain/Relocate GOM program is to provide Air Traffic Services to the high-altitude and low-altitude aviation communities, sustaining availability of ADS-B services for the U.S. portion of the GOM by relocating this equipment to other locations.

Program Plans FY 2018 – Performance Output Goals

- Identify platforms that will be removed from service and assess replacement candidate sites.
- Conduct site surveys, installation, and commissioning activities for surveillance, weather, and equipment services.

Program Plans FY 2019 – Performance Output Goals

- Identify platforms that will be removed from service and assess replacement candidate sites.
- Conduct site surveys, installation, and commissioning activities for surveillance, weather, and equipment services
- Complete installation of one ADS-B surveillance facility, one Remote Communications Air/Ground Very High Frequency communications facility and two Automated Weather Observing System (AWOS) weather facilities (based upon lifespan availability of energy platforms).

Program Plans FY 2020 – Performance Output Goals

- Identify platforms that will be removed from service and assess replacement candidate sites.
- Conduct site surveys, installation, and commissioning activities for surveillance, weather, and equipment services.
- Complete installation of one ADS-B surveillance facility and one AWOS weather facility (based upon lifespan availability of energy platforms).

Program Plans FY 2021-2022 – Performance Output Goals

- None.

X, Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services (FY21-Out), G02S.03-06

Program Description

Automatic Dependent Surveillance-Broadcast (ADS-B) is an advanced surveillance technology that provides highly accurate and comprehensive surveillance information. ADS-B is an enabling technology for NextGen. This system promises to significantly reduce delays and enhance safety by using aircraft broadcasted position based on the aircraft's navigation system calculation using the Global Navigation Satellite System (GNSS) or other navigation inputs, instead of position information from traditional radar.

Aircraft position (longitude, latitude, altitude, and time) is determined using the GNSS, and/or an internal inertial navigational reference system, or other navigation aids. The aircraft's ADS-B equipment processes this position information along with other flight parameters (e.g., identification, velocity, pilot selected altitude, and other data) to be broadcast approximately once a second to ADS-B receivers. The information is used to display the aircraft's position on en route and terminal automation systems such as, Standard Terminal Automation Replacement System, Microprocessor En Route Automated Radar Tracking System, En Route Automation Modernization, and Advanced Technologies and Oceanic Procedures.

In addition to the ground-based ADS-B receivers, nearby aircraft within range of the broadcast and equipped with ADS-B In avionics may also receive and process the surveillance information of nearby ADS-B equipped aircraft; this information will be available to the pilot on the aircraft's display. ADS-B equipment may also be installed on airport ground support or emergency vehicles to allow controllers and pilots to locate and identify them on runways or taxiways.

This program will continue to provide leased ADS-B services for FY 2021 and beyond. The program plans to introduce new scope to Baseline Services & Applications by implementing a surveillance backup strategy, new mitigations for spectrum congestion, and re-competing service contracts. In 2018, a Final Investment Decision (FID) is planned to request funding for the FY 2020 – FY 2025 timeframe. The program may continue to pay subscription fees for Alaska surveillance services, CONUS Surface services (including ADS-B service at Airport Surface Surveillance Capability sites), and CONUS Terminal and En Route surveillance services. The program will also provide program management to support ongoing security updates; dedicated support for Gulf of Mexico platform owners to provide mitigation against jamming & spoofing; and other typical program management activities including risk, business case development, and communications.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

ADS-B is a technology that will allow implementation of new air traffic control procedures based on more accurate aircraft position information that will allow more efficient use of airspace capacity, fewer 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 during inclement weather conditions. These efficiency benefits translate to savings in both aircraft direct operating costs and passenger value of time. The Business Case Analysis Report dated May 15, 2012 shows \$3.2B in capacity and efficiency benefits.

Program Plans FY 2018-2020 – Performance Output Goals

- None.

Program Plans FY 2021-2022 – Performance Output Goals

- Ensure continuation of leased ADS-B services.
- Additional output goals will be determined at FY 2018 FID.

2A13, WIND SHEAR DETECTION SERVICE (WSDS)

FY 2018 Request \$1.0M

- Wind Shear Detection Services – Work Package 1, W05.03-01
- X, Juneau Airport Wind System (JAWS) – Technology Refresh, W10.01-02

Wind Shear Detection Services – Work Package 1, W05.03-01

Program Description

Wind Shear Detection Services (WSDS) Work Package 1 is a portfolio program consisting of several legacy wind shear detection systems deployed in the NAS. This program will address obsolescence of the legacy Weather Systems Processor (WSP), Low Level Windshear Alert System (LLWAS) and Wind Measuring Equipment (WME). The WSDS program will ensure continuation of the existing service levels provided by the legacy systems by upgrading the components necessary to resolve obsolescence and supportability issues of the 34 WSP, 60 WME, and 50 LLWAS systems deployed in the NAS.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

WSDS WP1 contributes to the reduction of commercial air carrier fatalities per 100 million persons by preventing aircraft accidents in the terminal environment during take-off and landing. WSDS will accomplish this by providing hazardous wind shear alerts and warnings to Air Traffic Controllers to be passed on to pilots to avoid potential wind shear encounters.

Program Plans FY 2018 – Performance Output Goals

- Install WSP site upgrade at 17 sites (34 of 34, 100%).
- Last WSP site upgrade complete. (APB milestone)
- Install WME site upgrade at 30 sites (60 of 60, 100%).
- Install LLWAS site upgrade at 25 sites (50 of 50, 100%).
- Last WME/LLWAS site upgrade complete. (APB milestone)

Program Plans FY 2019-2022 – Performance Output Goals

- None.

X, Juneau Airport Wind System (JAWS) – Technology Refresh, W10.01-02

Program Description

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 system components is necessary because of the weather conditions 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 consulting support. The Final Investment Decision (FID) is planned in FY 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

JAWS Technology Refresh contributes to maintaining operational availability of 99.7 by replacing obsolete unsupportable equipment which could fail.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the Investment Analysis Readiness Decision (IARD):
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Achieve IARD.

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID.

Program Plans FY 2021-2022 – Performance Output Goals

- Additional output goals will be defined at FID.

2A14, NEXTGEN – COLLABORATIVE AIR TRAFFIC MANAGEMENT TECHNOLOGIES PORTFOLIO

FY 2018 Request \$9.0M

Collaborative Air Traffic Management Technologies (CATMT) – Work Package 4, G05A.05-03 / X, Collaborative Air Traffic Management Technologies (CATMT) – Work Package 5, G05A.05-04

Program Description

The Collaborative Air Traffic Management Technologies program provides enhancements to the Traffic Flow Management (TFM) System (TFMS). The TFMS supports the FAA's Traffic Management personnel in providing efficiency-critical NAS services. Throughout each day, Traffic Managers use the TFMS to maintain near real-time

situational awareness and predict areas which may experience congestion due to capacity reductions or unusual demand increase. The 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 at all major Air Traffic Control (ATC) facilities (80 sites), and flight operators. TFMS remote sites are also located at other FAA and Government offices (39).

TFMS becomes especially important when external factors such as adverse weather reduce NAS capacity and require proactive planning, coordination, and adjustments to mitigate impacts, e.g., missed connections, canceled flights, increased fuel consumption, etc. The ATCSCC uses the TFMS to model and implement NAS-wide Traffic Management Initiatives (TMI) to make the most efficient use of available capacity to avoid gridlock and minimize delays. When delays are necessary, TFMS assigns departure times equitably and gives flight operators flexibility through submission of trajectory options and departure slot substitutions.

Some TFMS products are also used by other FAA offices, Government agencies, and flight operators who participate in Collaborative Decision Making; see <http://cdm.fly.faa.gov>. The TFMS is also the FAA's primary provider of flight information to the public; see <http://www.fly.faa.gov>. TFMS has 30 different applications authorized users may interact with.

The TFMS receives data on planned and active flights from various sources, forecasts demand for monitored NAS elements, and provides information and alerts to FAA users and other NAS stakeholders. Many industry vendors subscribe to non-sensitive TFMS data feeds. The TFMS has data interfaces with more than 30 FAA systems and external entities.

The TFMS is based on a multi-tiered, centralized Service Oriented Architecture running custom application software on commercial hardware and software infrastructure components. The TFM Production Center, at the William J. Hughes Technical Center (WJHTC) in New Jersey, performs the core data processing and distribution of flight data. There is also a backup Disaster Recovery Center in northern Virginia.

CATMT Work Package 4 (G05A.05-03):

CATMT Work Package 4 (WP4) is a new segment that was approved by the FAA Joint Resources Council (JRC) on June 21, 2017 providing NextGen Midterm TFM/CATM capabilities between FY 2017 and FY 2022. CATMT WP4 was approved to deploy the following capabilities:

- Improved Demand Predictions (IDP) – a set of several enhancements aimed at improving the TFMS predictions of demand for NAS resources.
- Integrated Departure Route Planning (IDRP) – a tool that provides strategic/tactical forecast of departure route and fix status due to convective weather and traffic volume for specific terminals. Provides traffic managers with a semi-automated resolution algorithm to “solve” departure constraints. IDRP will be adapted for six metroplex areas: New York (N90); Chicago (C90); Dallas (D10); Philadelphia (PHL); Potomac – DC Metro (PCT)); and Southern California (SCT).
- TFMS Ingestion of Weather Data – 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.

CATMT Work Package 5 (G05A.05-04):

CATMT Work Package 5 (WP5), a future segment, when approved by the FAA JRC will provide NextGen Midterm TFM/CATM capabilities between FY 2021 and FY 2025. This option will be evaluated once WP4 enters full execution phase beyond FY 2017. Investment analysis work to support WP5 will be performed under Strategic Flow Management Engineering Enhancement (G05A.01-02).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

The CATMT program will support the NAS on-time arrival rate performance metric through the use of automated systems that provide more accurate and timely information for all TFM system users, improve operator and passenger access to flight information, and reduce system delays. CATMT will provide more accurate forecasting of system capacity and user demand; improve modeling, evaluation and optimization of traffic management initiatives; improve information dissemination, coordination and execution of traffic flow strategies with NAS users; minimize and equitably distribute delays across airports and users; collect and process additional performance data to define metrics and identify trends; and provide greater ease of use to the traffic management users.

Program Plans FY 2018 – Performance Output Goals

CATMT WP4 (G05A.05-03):

- Complete contract transition from TFM-Modernization to TFM2.
- Complete System Design Review for the IDP Capability.

CATMT WP5 (G05A.05-04):

- None.

Program Plans FY 2019 – Performance Output Goals

CATMT WP4 (G05A.05-03):

- Complete Detailed Design Review for the IDP capability.
- Begin system engineering for the IDRP/CSS-Wx capability.

CATMT WP5 (G05A.05-04):

- None.

Program Plans FY 2020 – Performance Output Goals

CATMT WP4 (G05A.05-03):

- Complete development for the IDP capability.
- Complete System Test and Deployment of the IDP capability.
- Complete System Design Review and Detailed Design Review of the IDRP/CSS-Wx capability.

CATMT WP5 (G05A.05-04):

- None.

Program Plans FY 2021 – Performance Output Goals

CATMT WP4 (G05A.05-03):

- Complete development for the IDRP/CSS-Wx capability.
- Complete System Test for the IDRP/CSS-Wx capability.

CATMT WP5 (G05A.05-04):

- Output goals will be determined at FID.

Program Plans FY 2022 – Performance Output Goals

CATMT WP4 (G05A.05-03):

- Complete joint deployment of IDRP/CSS-Wx capability. (Prior year funding)
- Complete site adaptation for six IDRP metroplex areas (6 of 6, 100%). (Prior year funding)

CATMT WP5 (G05A.05-04):

- Output goals will be determined at FID.

System Implementation Schedule

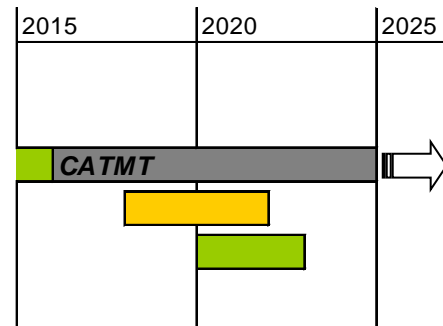
Collaborative Air Traffic Management Technologies (CATMT) – Work Package 4 and 5

First Operational Capability (OC): June 2008 -- Last OC: TBD

WP4 Software Development 2018 -- 2021

WP4 Software Deployment: 2020 -- 2022

WP5 - Pending final investment decision



2A15, NEXTGEN – TIME BASED FLOW MANAGEMENT (TBFM) PORTFOLIO

FY 2018 Request \$40.5M

- A, Time Based Flow Management (TBFM) Work Package 3, G02A.01-06 / X, Time Based Flow Management (TBFM) Technology Refresh, G02A.01-07
- X, Time Based Flow Management (TBFM) Work Package 4, G02A.01-08

A, Time Based Flow Management (TBFM) Work Package 3, G02A.01-06 / X, Time Based Flow Management (TBFM) Technology Refresh, G02A.01-07

Program Description

The Time Based Flow Management (TBFM) system uses time-based metering to better utilize NAS capacity by improving traffic flow management of aircraft approaching and departing congested airspace and airports. TBFM has been deployed and is operational at the 20 Air Route Traffic Control Centers and adapted for most major airports served by those centers. TBFM is a vital part of the NAS and enhances air traffic operations by reducing delays and increasing efficiency of airline operations. Enhancements to the TBFM system will directly support NextGen Performance Based Navigation (PBN) concepts.

TBFM Work Package 3 (G02A.01-06):

TBFM Work Package 3 is a follow-on phase of TBFM Work Package 2 that will implement additional NextGen concepts, such as optimized descent during time-based metering and Terminal Sequencing and Spacing (TSAS) to provide efficient sequencing and runway assignment. The TSAS capability will extend the aircraft's trajectory plan into the terminal airspace up to the runway to enable better predictability and accuracy for support of advanced PBN procedures such as Required Navigation Performance. Also in WP3 is the expansion of the Integrated Departure/Arrival Capability (IDAC) to additional locations. The design, development and deployment of these concepts and enhancements will occur during the 2015-2022 timeframe and support the following current NextGen Operational Improvements:

- **Improved Management of Arrivals/Surface/Departure Flow Operations (104117)** – Enables access to surface information to improve departure time predictions and supports a more integrated arrival/departure operation and more efficient flows. Integrates and automates the departure capability with the TBFM system.
- **Time-Based Metering in the Terminal Environment (104128)** – Supports a time-based sequencing and spacing capability in the terminal environment by providing TBFM developed runway and sequence assignment information to terminal automation systems for display to controllers.

Final Investment Decision (FID) for Work Package 3 was achieved in April FY 2015.

TBFM Technology Refresh (G02A.01-07):

TBFM Technology Refresh will replace the existing hardware that was deployed in 2012 and 2013 with new hardware in the FY 2021-2022 time frame. The current hardware will begin to reach its end of service and maintenance by

2017. The program office is currently working towards Investment Analysis Readiness Decision (IARD) in FY 2019 and FID in FY 2020 to replace this hardware. The TBFM Technology Refresh investment complements the TBFM Work Package 4, G02A.01-08.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

TBFM will expand the use of time-based metering solutions to additional locations and phases of flight to support the performance metric to maintain average daily airport capacity. TBFM will improve flight efficiency by allowing controllers to sequence and space arriving aircraft to optimize the use of airport capacity thereby avoiding last minute maneuvering of aircraft as they approach the airport. Time-based metering through TBFM has provided an average 3-5% increase in throughput at the airports where it is installed.

Program Plans FY 2018 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Deploy first IDAC site. (APB milestone)
- Complete deployment of IDAC to 1 site (1 of 5, 20%)
- Complete Keysite for TSAS.

TBFM Technology Refresh (G02A.01-07):

- None.

Program Plans FY 2019 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Complete Integration and Test of TSAS at WJHTC. (APB Milestone)
- Deploy first TSAS site. (APB milestone)
- Complete deployment of TSAS to 1 site (1 of 9, 11%).
- Complete deployment of IDAC to 4 sites (5 of 5, 100%).
- Deploy last (5th) IDAC site. (APB milestone)

TBFM Technology Refresh (G02A.01-07):

- Develop the following products in support of IARD:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Achieve IARD for TBFM Technology Refresh.

Program Plans FY 2020 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Complete integration and testing of 4th TSAS Site.
- Achieve TSAS In-Service Decision. (APB milestone)

TBFM Technology Refresh (G02A.01-07):

- Develop the following products in support of the FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for TBFM Technology Refresh.

Program Plans FY 2021 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Deploy 5th TSAS site. (APB milestone)
- Complete deployment of TSAS to 7 sites (8 of 9, 89%).

TBFM Technology Refresh (G02A.01-07):

- Pending FID approval:
 - Complete Site Surveys (number of sites to be determined).
 - Complete Engineering Analysis needed for hardware selection.

Program Plans FY 2022 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Complete deployment of TSAS to 1 site (9 of 9, 100%).
- Deploy last (9th) TSAS site. (APB milestone)

TBFM Technology Refresh (G02A.01-07):

- Pending FID approval:
 - Complete hardware installations at sites (number of sites to be determined).

X, Time Based Flow Management (TBFM) Work Package 4, G02A.01-08

Program Description

The Time Based Flow Management (TBFM) system uses time-based metering to better utilize NAS capacity by improving traffic flow management of aircraft approaching and departing congested airspace and airports. TBFM has been deployed and is operational at the 20 Air Route Traffic Control Centers and adapted for most major airports served by those centers. TBFM is a vital part of the NAS and enhances air traffic operations, by reducing delays and increasing efficiency of airline operations. Enhancements to the TBFM system will directly support NextGen Performance Based Navigation (PBN) concepts.

TBFM Work Package 4 (WP4) will build upon core TBFM capabilities already in place to increase benefits of time-based metering across the NAS and enable expansion of PBN operations in the NAS. TBFM Work Package 4 candidate capabilities include:

- **Path Stretch:** An automation-based advisory to controllers to meet time-based metering schedule in cruise that will enable aircraft to absorb assigned delay laterally when speed control alone is insufficient. This will reduce the use of vectoring to maintain delivery accuracy to the meter point and allow continuation of an Optimized Profile Descent (OPD). This will enhance flight efficiency, reduce emissions and noise, and increase system predictability.
- **Terminal Sequencing & Spacing (TSAS) Dashboard:** Monitors TSAS and en route time-based metering schedule conformance to assist Traffic Managers in anticipating necessary schedule adjustments. This will optimize the use of TSAS and in turn, further optimize arrival throughput.
- **System-Wide What-If Capability:** Automation decision support tool for terminal and en route Traffic Managers to inform tactical management decision-making and coordination for arrival operations when schedule adjustments are needed. This will optimize time-based metering operations by allowing Traffic Managers to model several scenarios when schedule adjustments are necessary; assess the impact on overall system performance; and implement the most optimal solution that allows aircraft to increasingly fly PBN procedures.
- **Fleet Prioritization:** Dynamically incorporate and where feasible, grant user preferences for airspace when assigning time-based metering slots and associated delay. This will improve collaborative decision making and user efficiency.
- **Improved TBFM-Traffic Flow Management System (TFMS) Data Integration:** Increase data sharing between TBFM and TFMS systems to enhance demand capacity prediction and the integration of time-based metering. This will enable coordination of proposed Traffic Management Initiatives (TMI) before implementation to minimize unintended and potentially disruptive TMI interactions; improving collaborative decision making, user efficiency, and system predictability.

- **TSAS Expansion:** Deploy TSAS to additional sites beyond those that will receive TSAS via TBFM WP3. Geographical expansion of TSAS will improve flight efficiency and system predictability in the NAS and increase the utilization of PBN procedures.
- **Integrated Departure/Arrival Capability (IDAC) Expansion:** Deploy IDAC to additional sites, beyond the sites that will receive IDAC via TBFM WP2 and WP3. Geographical expansion of IDAC will reduce departure release coordination time/effort, improve flight efficiency, and enhance system predictability.
- **Weather Source Migration:** Using the System Wide Information Management system, obtain weather data from the FAA's Common Support Service-Weather system. This will decrease FAA's operating costs and minimize future costs associated with incorporating new weather products into TBFM.

Investment Analysis Readiness Decision (IARD) for TBFM WP4 is planned in FY 2019. Final Investment Decision (FID) for TBFM WP4 is planned in FY 2020. In parallel with the Investment Analysis process, a contract re-compete will complement the path moving forward for TBFM WP4.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

TBFM will expand the use of time-based metering solutions to additional locations and phases of flight to support the performance metric to maintain average daily airport capacity. TBFM will improve flight efficiency by allowing controllers to sequence and space arriving aircraft to optimize the use of airport capacity thereby avoiding last minute maneuvering of aircraft as they approach the airport. Time-based metering through TBFM has provided an average 3-5% increase in throughput at the airports where it is installed.

Program Plans FY 2018 – Performance Output Goals

- Complete concept engineering/technical analysis of candidate capabilities.
- Deliver Concept documentation for each WP4 candidate capability.
- Conduct market survey for new prime TBFM contract.

Program Plans FY 2019 – Performance Output Goals

- Complete the required AMS documentation for IARD:
 - Shortfall Analysis/Quantification;
 - Solution Concept of Operations;
 - Functional Analysis;
 - Enterprise Architecture Products; and
 - Preliminary Program Requirements.
- Achieve IARD for TBFM WP4.
- Complete market analysis for new TBFM contract.
 - Release the Screening Information Request (SIR) for new contract.

Program Plans FY 2020 – Performance Output Goals

- Complete development of the following documentation required for FID:
 - Final Program Requirements document;
 - Business Case;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for TBFM WP 4.
- Pending FID approval:
 - Complete evaluation of prime contractor proposals received in response to new prime TBFM SIR.
 - Award TBFM WP4 contract.

Program Plans FY 2021 – Performance Output Goals

- Pending FID approval:
 - Complete Engineering Analysis for IDAC hardware.
 - Complete System Requirements Review.

Program Plans FY 2022 – Performance Output Goals

- Pending FID approval:
 - Complete System Design Review.
 - Complete site surveys for IDAC expansion (number of sites to be determined).

2A16, NEXTGEN – NEXT GENERATION WEATHER PROCESSOR (NWP)

FY 2018 Request \$35.5M

NextGen Weather Processor (NWP), Work Package 1, G04W.03-02 / X, NextGen Weather Processor (NWP), Work Package 2, G04W.03-03

Program Description

The NextGen Weather Processor (NWP) program will establish a common weather processing platform that will replace the legacy FAA weather processor systems and host new capabilities. Using data feeds from both the FAA and National Oceanic and Atmospheric Administration (NOAA) radars, other weather sensors, and NOAA forecast models, NWP will use sophisticated algorithms to create high-quality, aviation-specific current and predicted weather information. NWP will create high value weather products that will be accessed through the Common Support Services-Weather (CSS-Wx) system. NWP will perform weather translation to enable the use of this weather information by automated decision-support tools. NWP will also provide improved aviation safety related windshear products.

The NWP program will:

- Replace and enhance the current processing and display functionality of the following Systems:
 - Corridor Integrated Weather System - Provides 0-to-2 hour aviation weather predictions and information to the Traffic Flow Management System and associated users of heavily traveled air corridors.
 - Weather and Radar Processor - Provides weather information to en route air traffic controllers, supervisors, traffic management coordinators, and Center Weather Service Unit meteorologists.
 - Integrated Terminal Weather System - Provides weather information to terminal air traffic supervisors and controllers.
- Generate aviation weather products with expanded coverage areas and faster update rates;
- Generate 0-to-8 hour aviation weather products;
- Generate safety critical wind shear alerts and real-time weather radar information; and
- Perform translation of convective weather into weather constraint areas.

Next Generation Weather Processor (NWP), Work Package 1 (G04W.03-02):

The Joint Resources Council (JRC) approval for Final Investment Decision (FID) for NWP WP1 was approved in March 2015 concurrently with the approval of FID for CSS-Wx WP1. NWP will be deployed at 36 operational facilities; these include two centrally located facilities at Atlanta and Salt Lake City, and at 34 TRACONS. In addition, NWP Aviation Weather Displays will be deployed at 117 designated facilities.

Next Generation Weather Processor (NWP), Work Package 2 (G04W.03-03):

NWP WP2 will enhance weather algorithms and generate additional advanced products such as new radar mosaic, predictive products, weather avoidance fields, and terminal products.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

NWP produces improved weather mosaics and predictions and formats them for integration into decision support tools. It supports on-time arrival rates by making better use of weather information for operational decision-making to support the optimal selection of aircraft routing and precise spacing for arriving and departing aircraft. The increased accuracy of predictions and improved observations allows automation systems to create and use individual trajectory-based profiles which optimize the usage of available airspace.

Most delays in the NAS are attributed to weather conditions. Based on Operations Network, the official source of NAS air traffic operations and delay data, 68 percent of air traffic delays over 15 minutes for 2003-2012 were due to weather. The NWP capabilities will decrease avoidable aircraft delays, diversions, and cancellations.

Program Plans FY 2018 – Performance Output Goals

Next Generation Weather Processor (NWP), Work Package 1 (G04W.03-02):

- Conduct NWP WP1 Test Capability Accreditation Procedures by Prime Contractor.

Next Generation Weather Processor (NWP), Work Package 2 (G04W.03-03):

- None.

Program Plans FY 2019 – Performance Output Goals

Next Generation Weather Processor (NWP), Work Package 1 (G04W.03-02):

- Complete NWP WP1 Factory Acceptance Test (FAT). (APB milestone)

Next Generation Weather Processor (NWP), Work Package 2 (G04W.03-03):

- None.

Program Plans FY 2020 – Performance Output Goals

Next Generation Weather Processor (NWP), Work Package 1 (G04W.03-02):

- Complete NWP WP1 Operational Testing (OT). (APB milestone)
- Achieve NWP WP1 Key Site Initial Operational Capability (IOC). (APB milestone)

Next Generation Weather Processor (NWP), Work Package 2 (G04W.03-03):

- None.

Program Plans FY 2021 – Performance Output Goals

Next Generation Weather Processor (NWP), Work Package 1 (G04W.03-02):

- Achieve NWP WP1 In-Service Decision. (APB milestone)
- Complete NWP WP1 first site Operational Readiness Date (ORD). (APB milestone)
- Achieve NWP WP1 ORD at 5 sites (5 of 36, 14%).

Next Generation Weather Processor (NWP), Work Package 2 (G04W.03-03):

- None.

Program Plans FY 2022 – Performance Output Goals

Next Generation Weather Processor (NWP), Work Package 1 (G04W.03-02):

- Achieve NWP WP1 ORD at 31 sites (36 of 36, 100%). (Prior year funding)

Next Generation Weather Processor (NWP), Work Package 2 (G04W.03-03):

- Complete NWP WP2 Preliminary Design Review (PDR).
- Complete NWP WP2 Critical Design Review (CDR).

System Implementation Schedule



2A17, AIRBORNE COLLISION AVOIDANCE SYSTEM X (ACAS X)

FY 2018 Request \$7.7M

Airborne Collision Avoidance System X (ACAS X) – Segment 1, M54.01-01

Program Description

The Airborne Collision Avoidance System X (ACAS X) is being developed to meet future collision avoidance requirements. The ACAS X program will provide guidance and technical expertise to the RTCA to develop the functional architecture, functional interfaces and requirements for the next generation of collision avoidance capability. ACAS X will replace the existing Traffic Alert and Collision Avoidance Systems II (TCAS II) which is required in US airspace for all commercial aircraft with 30 or more seats and on all cargo aircraft greater than 33,000 pounds. ACAS X will reduce the number of false alerts, or “nuisance” Resolution Advisories in US airspace and improve future operations.

The ACAS X program will perform simulations, develop prototypes, and create advanced performance specifications that will result in the development of Minimum Operational Performance Standard (MOPS), Technical Standard Order and Advisory Circular documentation. Manufacturers will produce the ACAS X equipment in accordance with these documents. The program will also provide sustainment of TCAS II field equipment, encounter models, toolsets and certification support for manufacturer equipment. ACAS X will also address shortfalls that were identified in the TCAS II system. The system architecture will be designed to facilitate rapid updates to threat detection and resolution logic using an automated process. This capability will be very useful for future adaptations to NextGen operations and for unmanned aircraft systems encounter profiles and patterns. ACAS X will have the flexibility to accommodate a variety of different sensor types and new generations of sensors; i.e. receiving data from Automatic Dependent Surveillance-Broadcast (ADS-B) Airborne Position Messages.

The initial ACAS X systems will have two variants:

- ACAS Xa: A variant of ACAS X which 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: A variant of ACAS X intended for use with NextGen operations where other variants of ACAS X would generate unacceptably high rates of Resolution Advisories if used. An example of such an operation would be Closely-spaced Parallel Operations. This variant will be used in conjunction with ACAS Xa.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Preliminary results of ACAS X system performance and safety analysis shows that ACAS X could produce 54% fewer alerts and be over 50% safer than current TCAS II v7.1 logic. ACAS X will reduce the number of false alerts of potential midair collisions and provide the accuracy needed to maintain the high level of aviation safety that is critical in terminal air traffic areas.

Program Plans FY 2018 – Performance Output Goals

- Complete System Safety Hazard Analysis. (APB milestone)
- RTCA publish MOPS. (APB milestone)

Program Plans FY 2019 – Performance Output Goals

- Complete operational evaluation of ACAS X (Limited Implementation Program with Commercial Airlines on Host Aircraft). (APB milestone)
- Update and publish Standards and Recommended Practices (SARPS). (APB milestone)

Program Plans FY 2020 – Performance Output Goals

- Publish Technical Standard Order and Advisory Circular. (APB milestone)

Program Plans FY 2021 – Performance Output Goals

- Publish ACAS X Operational Assessment / Validation Report. (APB milestone).

Program Plans FY 2022 – Performance Output Goals

- None.

2A18, NEXTGEN – DATA COMMUNICATION IN SUPPORT OF NEXTGEN

FY 2018 Request \$154.1M

Data Communications – Segment 1 Phase 1, G01C.01-05 / Data Communications – Segment 1 Phase 2 Initial En Route Services, G01C.01-06 / Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services, G01C.01-07 / X, Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future, G01C.01-11

Program Description

The Data Communications (Data Comm) program will provide data communications services between the pilots and air traffic controllers. Data Comm will provide a link between ground automation and flight deck avionics for safety-of-flight ATC clearances, instructions, traffic flow management, flight crew requests and reports. Data Comm is critical to the success of NextGen operational improvements by providing communication infrastructure enhancements. Data Comm will:

- Reduce the impact of ground delay programs, airport reconfigurations, convective weather, congestion, and other causes;
- Reduce communication errors;
- Improve controller and pilot efficiency through automated information exchange;
- Enable NextGen services (e.g., enhanced re-routes, trajectory operations); and
- Increase controller productivity leading to increased capacity.

These improvements to the NAS are planned to be delivered by Data Comm in multiple segments. Segment 1 will deliver in two phases, the initial set of data communications services integrated with automation support tools to provide NAS benefits and lay the foundation for a data-driven NAS. Segment 1 Phase 1 (S1P1) will deploy the Controller-Pilot Data Link Communications (CPDLC) Departure Clearance (DCL) in the Tower domain. Segment 1 Phase 2 (S1P2) will deliver CPDLC data communications services to the En Route domain. The Data Comm En Route services will contribute to a reduction in flight delays, more efficient routes for aircraft resulting in increased operational efficiency, enhanced safety all while reducing operational costs for airspace users.

Data Communications – Segment 1 Phase 1 (G01C.01-05):

In S1P1, the Data Comm program will deliver DCL to 62 airports to include revisions with full route clearances transmitted directly to the aircraft on the airport surface. The CPDLC DCL service will expedite the delivery of departure clearances to aircraft, streamline clearance delivery operations and enable quicker recovery from adverse

weather events. CPDLC DCL will improve efficiency, reduce ground delays, and result in more strategic management of NAS resources.

The major elements of S1P1 implementation are:

- Tower Data Link Services (TDLS) software and hardware enhancements to enable CPDLC DCL services in the Towers;
- En Route Automation Modernization (ERAM) software and hardware enhancements that provide log-on capability, protocol gateway functionality, and direct interface to flight data. In S1P1, all of the ERAM enhancements focus on infrastructure services for the Tower controllers;
- Data Communications Network Service (DCNS) which will provide the air/ground communications network services infrastructure; and
- Avionics Equipage Initiative which will provide incentives for airlines to equip aircraft with Future Air Navigation Systems (FANS) 1/A avionics.

Data Comm S1P1 has achieved a number of milestones:

- ERAM Initial Test Release: April 2014
- Operational Test: March 2015
- First-Site Initial Operational Capability (IOC): August 2015
- Operational Readiness Decision: September 2015
- In-Service Decision (ISD): December 2015

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

S1P2 will leverage the S1P1 infrastructure to deliver initial services to the En Route domain. Initial services will include transfer of communication/initial check-in, airborne reroutes, altimeter settings and altitudes, limited controller initiated reroutes, limited direct-to-fix messages, and limited crossing restrictions.

As Data Comm becomes fully operational, the majority of pilot-controller exchanges will be handled by Data Comm for appropriately equipped users.

The major elements of the S1P2 Initial En Route Services implementation are:

- ERAM software enhancements for En Route CPDLC applications;
- DCNS expanded coverage and capacity; and
- TDLS software enhancements to provide additional services to Tower controllers.

Data Comm S1P2 Initial En Route Services has achieved the following milestones:

- ERAM Data Comm Contract Definitization: March 2015
- Completed Contractor Detailed Design: May 2016
- Order DCNS Network Service Volume for Keysite: April 2017

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

This program will continue to provide the Very High Frequency (VHF) Data Link (VDL) Mode 2 air ground network service that provides connectivity between the controllers and the cockpit. 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.

The DCIS Network Services costs were baselined through FY 2021 during the S1P2 Initial En Route Services FID in October 2014.

Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future (G01C.01-11):

This program will continue to provide the Very High Frequency (VHF) Data Link (VDL) Mode 2 air ground network service that provides connectivity between the controllers and the cockpit. 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.

The DCIS Network Services Future costs were baselined in August 2016.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Data Communications will revolutionize ATC communication between the ground and the cockpit, increasing the capacity, flexibility, and productivity of the NAS. Data Communications provides services which will increase throughput, reduce flight times, and enable other efficiency gains in both the Terminal and En Route environments. It will reduce the air traffic control communications workload; reduce message delays to air traffic; and increase controller flexibility and efficiency. Data Communications will allow complex routing communications that optimize use of available NAS resources such as airspace and airports. This improvement will occur for routine operations and be critical during system disruptions such as those caused by severe weather. Data Communications is a key transformational program under NextGen that will enable advanced capabilities, such as Trajectory Based Operations, Tailored Arrivals, Advanced Interval Management, Enhanced Surface Movement, and Dynamic RNP. Data Communication will also reduce operational errors, enhancing the safety and efficiency of the NAS.

Program Plans FY 2018 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- Conduct Post Implementation Review.

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

- Complete developmental testing and evaluation. (APB Milestone)
- Deliver ERAM software to test and evaluation site.

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

- Provide and maintain air-ground VDL-2 network services.

Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future (G01C.01-11):

- None.

Program Plans FY 2019 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- Complete avionics equipage initiative.

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

- Complete Operational Evaluation.
- Achieve first site IOC for Initial En Route Services. (APB Milestone)

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

- Provide and maintain air-ground VDL-2 network services.

Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future (G01C.01-11):

- None.

Program Plans FY 2020 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- None.

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

- Achieve ISD for Initial En Route Services. (APB Milestone)

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

- Provide and maintain air-ground VDL-2 network services.

Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future (G01C.01-11):

- None.

Program Plans FY 2021 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- None.

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

- Achieve last-site IOC. (APB milestone)

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

- Provide and maintain air-ground VDL-2 network services.

Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future (G01C.01-11):

- None.

Program Plans FY 2022 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- None.

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

- None.

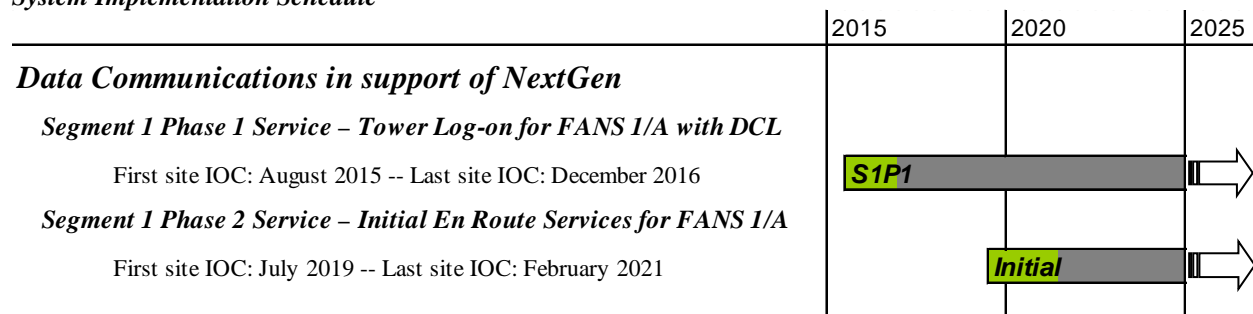
Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

- None.

Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future (G01C.01-11):

- Provide and maintain air-ground VDL-2 network services.

System Implementation Schedule



2A19, OFFSHORE AUTOMATION

FY 2018 Request \$11.0M

Offshore Automation, A38.01-01

Program Description

The Offshore Automation program will perform service analysis and concept requirements definition for the FAA's existing offshore automation systems. This program will identify operational shortfalls associated with the current operations/systems; identify potential NextGen capabilities that should be expanded to these operations/systems; and create the required artifacts for investment decisions to replace the existing offshore systems. Replacing these one-off systems with NextGen common systems will improve NAS interoperability and reduce cost by standardizing the training, maintenance and development efforts across the platform. In addition, this program would greatly enhance the ability of personnel to transition to and from these previously unique facilities.

There are four sites in the NAS that have unique automation platforms not found at CONUS (Terminal, domestic En Route) or Oceanic sites. These are known as the offshore sites and consist of Anchorage Air Route Traffic Control Center (ARTCC), Honolulu Control Facility, Guam Combined Control Facility (CCF), and the San Juan CCF. These facilities all use the same Radar Data Processor and Microprocessor En Route Automated Radar Tracking System

(Micro-EARTS); the Flight Data Processor (FDP) varies by facility. No other ARTCCs use these unique systems; maintaining the different FDPs adds extra training, repair, and replacement costs.

The Anchorage ARTCC uses FDP-2000; a server-based FDP. Prior to spring 2016, FDP-2000 had end of life (EOL) hardware which could no longer be repaired upon failure, expired maintenance vendor contracts, and did not have Second Level Engineering (SLE) national support. Hardware sustainment actions in 2016 and 2017 will identify and deploy replacements for the EOL hardware and SLE national support is now in place. The SLE support employees that have the knowledge to troubleshoot, repair and recover from outages are eligible for retirement; backfilling these positions with individuals having the required skills will be challenging due to the age of the system, lack of complete documentation, and unavailable training for maintaining the hardware.

The Offshore Flight Data Processing System (OFDPS) at Honolulu is a Host-based FDP originally running software on IBM mainframe equipment which has reached end-of-life. A new replacement IBM mainframe has been acquired but is the last mainframe in the IBM inventory able to support the requirements of OFDPS. Once this new mainframe reaches EOL, a replacement system for the entire OFDPS will be required. The connectivity equipment, Series 1 Replacement, is only at Honolulu and is scheduled for replacement in 2017 largely for Internet Protocol connectivity. In addition, the En Route Automation Modernization (ERAM) program has replaced all of the Host-based systems at CONUS ARTCCs, and the OFDPS program now has to cover the entire cost of maintaining and supporting the Host-based FDP system at Honolulu.

The Guam facility also utilizes the OFDPS system located in Hawaii but is defined by separate airspace within the OFDPS. All physical equipment for Guam is located in Hawaii, except for the Flight Data Input/Output (FDIO). This ties Guam to the Hawaii maintenance schedule meaning that service to Guam is also down when Hawaii takes the OFDPS down for maintenance during their low-traffic time. Because of the time difference between Guam and Hawaii, Guam often loses this service during busy periods; both inconvenient and a safety sensitive situation. Due to shared hardware, the same EOL and sustainment issues affecting the OFDPS system in Hawaii also affect Guam.

There is limited functionality between the San Juan Micro-EARTS and the ERAM system at Miami. Data sharing is only minimally supported between the two systems and in some cases requires that duplicate entries be made in both the Micro-EARTS and the ERAM FDIO equipment. The San Juan facility receives flight data processing functionality via a modified FDIO feed from the ERAM system at Miami ARTCC. This makes San Juan dependent upon Miami Center to make any airspace or sector changes which can result in delays. Due to this dependency and foreign airspace between Miami and San Juan, flight information for incoming flights often does not reach San Juan controllers before the aircraft enters San Juan airspace; complicating air traffic control.

These diverse automation systems drive unique training, maintenance, and support infrastructures, and have EOL sustainability needs which may have efficiency and safety implications due to loss of coverage (i.e. Guam and San Juan) and will require additional upgrades to meet NextGen required capabilities. Additional training will be critical for Air Traffic controllers, Technical Operations, Air Traffic Organization Program Management Office and Second Level Engineering Maintainers.

Alternatives are being evaluated to address the automation systems at these four offshore locations. The Investment Analysis Readiness Decision was approved in March 2017, Initial Investment Decision is planned in the 4th quarter of FY 2017 and Final Investment Decision (FID) is planned in FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The Offshore Automation program will replace the unique legacy systems with modern NAS automation, increasing standardization across the NAS. This investment will also resolve the ongoing maintenance and supportability

limitations at the offshore sites and address potential future shortfalls for system maintenance and enhancements stemming from attrition of system software knowledgeable support staff.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the FID:
 - Final Program Requirements documentation;
 - Enterprise Architecture Artifacts;
 - Business Case documentation;
 - Implementation Strategy and Planning Document;
 - Post Implementation Review Strategy Document;
 - Test and Evaluation Master Plan;
 - Program Management Plan;
 - Final Safety Risk Management and Information System Security Documents; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for Offshore Automation.

Program Plans FY 2019-2022 – Performance Output Goals

- Output goals will be developed at FID.

2A20, NEXTGEN - ADVANCED SURVEILLANCE ENHANCED PROCEDURAL SEPARATION (ASEPS)

FY 2018 Request \$4.4M

**Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation –
Reduced Oceanic Separation Advanced Surveillance Enhanced Procedural Separation
(ASEPS), G02S.04-01**

Program Description

The Reduced Oceanic Separation (ROS) ASEPS program will increase the use of current separation standards and potentially reduce separation in Oceanic Flight Information Regions. Oceanic airspace is different from the rest of the NAS due to current limitations in surveillance capabilities. Enhancing surveillance can provide significant improvements to air navigation services by reducing separation minima for optimum routing or new air routes for increased oceanic airspace capacity. The performance of required communications, navigation, and surveillance equipment must be capable of providing the overall accuracy necessary for reducing separation standards. The ROS ASEPS program will reexamine current limitations to reducing oceanic separation standards by evaluating improved surveillance capabilities; the two alternatives are Space-Based Automatic Dependent Surveillance – Broadcast (ADS-B) or enhancing Automatic Dependent Surveillance – Contract (ADS-C) by way of a faster update rate than available today. This will also benefit a number of planned NextGen Operational Improvements (OIs) including: OI 102108 – Oceanic In-Trail Climb and Descent and OI 104102 – Flexible Entry Times for Oceanic Tracks.

To address previous limitations in the oceanic ATC system, FAA developed and implemented the Advanced Technologies and Oceanic Procedures (ATOP) program. ATOP provides controllers with automated aircraft track generation, conflict prediction and reporting, weather data processing, automation of airspace sectorization capabilities, recognition of separation minima based on aircraft equipage, and aircraft position data. The surveillance information displayed on ATOP is generated today by ADS-C, which is part of an avionics package called the Future Air Navigation System available onboard aircraft today. In the future, this information could be generated and/or enhanced by one of the ROS ASEPS alternatives.

An Investment Analysis Readiness Decision was completed in January 2014, followed by three JRC Strategy Decisions in October 2014, July 2015, and June 2016, to review the progress of the investment. The ROS ASEPS program will continue maturing the analyses, and return to the JRC in 4th quarter FY 2017 for an Initial Investment Decision, followed by a Final Investment Decision (FID) in 4th quarter FY 2018. Per the direction of the JRC in July 2015, the ROS ASEPS program is currently working to enhance the ADS-B System to receive and test Space-Based

ADS-B data at the FAA William J. Hughes Technical Center. Additionally, in advance of the FID, the program will develop an ASEPS ATOP prototype system to be used in simulations to validate ASEPS requirements.

The following activities will be conducted to mature the investment:

- Collision Risks and Safety efforts with the International Civil Aviation Organization
- Separation assurance and safety assessments
- FAA Safety Management efforts for changes to the NAS
- Engage in testing
- Develop requirements

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 5 – Reduce risks in flight by limiting the rate of the most serious losses of standard separation to 20 or fewer for every thousand (.02) losses of standard separation within the National Airspace System.*

Relationship to Performance Metric

This program supports the strategic priority of making aviation safer and smarter by improving air traffic services in U.S. controlled oceanic airspace. By increasing the use of current separation standards and pursuing reductions to separation standards, this investment will increase the precision of information used for aircraft separation resulting in safer and more efficient operations.

Program Plans FY 2018 – Performance Output Goals

- Complete ICAO & FAA safety assessments.
- Develop the following final products in support of the FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for ROS ASEPS.

Program Plans FY 2019-2022 – Performance Output Goals

- None.

2A21, EN ROUTE IMPROVEMENTS

FY 2018 Request \$3.0M

En Route Improvements, A01.16-01

Program Description

The En Route Improvements supports operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of en route services. The scope of these NAS enhancements is limited to operational changes that don't require significant capital investments; don't require a formal investment decision; nor involve significant systems complexity, interdependencies, or NAS operational changes. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an Air Traffic Organization domain service enhancement Standard Operating Procedure and coordinated with applicable stakeholders. This program also supports a category of requirements that address necessary and unplanned changes resulting from operational changes in the field, unanticipated changes from external organizations (e.g. International Civil Aviation Organization, third party data providers, neighboring Air Navigation Service Providers), or potential cost-savings initiatives. Candidate enhancement areas include: Improved Computer-Human Interface features; Improved accuracy of flight data presentation and use; Enhanced interface processing with adjacent

systems/facilities; Improved weather data management; and the addition of system hardware platforms and components.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The En Route Improvements program will improve the presentation, access, and use of En Route Automation Modernization and other systems data by air traffic controllers and managers, resulting in more efficient, safer, and cost-effective delivery of en route services. It will conduct operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of en route domain services.

Program Plans FY 2018-2022 – Performance Output Goals

- Complete operational analysis, engineering analysis, and solution development of hardware and software enhancements.
- Deliver hardware and software enhancements in the operational release to address operational problems and system improvements

2A22, COMMERCIAL SPACE INTEGRATION

FY 2018 Request \$4.5M

- Commercial Space Integration Into The NAS, M55.01-01
- X, Space Integration Enhancements 1, G01M.03-01

Commercial Space Integration Into The NAS, M55.01-01

Program Description

In accordance with the Commercial Space Launch Act and the President's National Space Policy, the FAA's Office of Commercial Space Transportation (AST) serves as the single government interface to the commercial space transportation industry. In this role, AST ensures protection of the public, property, and the national security and foreign policy interests of the United States during commercial launches and reentries, and it encourages, facilitates, and promotes United States commercial space transportation. AST grants licenses and permits to commercial space operators, authorizing them to conduct launches and/or reentries, or to operate spaceports across the U.S. Since the end of the Space Shuttle Program, the need for resupply missions to the International Space Station, along with a growing interest in space tourism, has encouraged private industry to invest in and pursue their own space programs. As space transportation technologies continue to advance, the number of launch and reentry operations are expected to increase across the NAS. AST works closely with Air Traffic Organization (ATO) to facilitate the development of agreements with commercial space operators required by Part 400 regulations, and to support the planning, real time monitoring, and real-time response processes necessary to safely manage the affected airspace when both aviation and launch or reentry vehicles must share the same airspace. AST personnel that support these missions are stationed at the Air Traffic Control System Command Center (ATCSCC) where they interface regularly with traffic managers and procedures specialists at Air Route Traffic Control Centers and other air traffic facilities.

The Commercial Space Transportation Integration into the NAS program focuses specifically on the development of a new Space Data Integrator (SDI) that will automate the FAA's current manual process, as well as enable existing NAS automation and decision support tools during launch and reentry operations. The initial phase of this program will provide a data integration capability to process real-time vehicle and aircraft hazard area data and then provide the information to the Traffic Flow Management System (TFMS) at the ATCSCC and other affected facilities.

The number of licensed and permitted commercial space operations and their complexity has increased significantly over the past few years, and for each commercial space operation, AST and ATO must work together to safely block off large areas of airspace, while minimizing the effect on the capacity and efficiency of the NAS. Existing air traffic tools were not designed to support launch and reentry operations so the FAA uses telephone and/or internet connections to receive real-time information on vehicle position and health status. In order to support launch and reentry operations, a small team of AST and ATO personnel manually transfer data across tools, telephones, and networks verbally and on paper, enter the data by hand, and complete multiple checks to minimize the potential for human error. Being resource intensive, the team can address only one mission at a time, putting stress on FAA's ability to keep pace with the increasing tempo of commercial space operations.

The development of the SDI will provide real-time commercial space data to FAA decision support tools in the strategic, tactical, and automation environment and is essential to the FAA's ability to safely minimize the effects of these operations on NAS capacity and efficiency. In support of the FAA Administrator's Strategic Initiative for the NAS, an SDI prototype was successfully developed in collaboration with NextGen, ATO System Operations Support and ATO Mission Support to demonstrate this concept at the ATCSCC. The prototype will continue to be utilized in the development of requirements and benefits as this capability is expanded into the En Route and Terminal environments for future investments. The Commercial Space Integration into the NAS program will introduce processes and procedures that will allow the FAA to reduce the amount of airspace required to be closed in advance of a mission, effectively respond to off-nominal scenarios in a timelier manner during a mission, and quickly release airspace back to the system as the mission progresses.

The program is planning for Initial Investment Decision (IID) in 2nd quarter FY 2018 and a Final Investment Decision (FID) in 1st quarter FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter.*
- *FAA Performance Metric 3 – No fatalities, serious injuries, or significant property damage to the uninvolved public during licensed or permitted space launch and reentry activities.*

Relationship to Performance Metric

Through its licensing and permitting processes, AST is committed to ensuring that no fatalities, serious injuries, or significant property damage to the public occurs during licensed or permitted space launch and reentry activities. This program will develop a SDI that automates ingest and dissemination of real-time mission data, allowing for a more dynamic use of the NAS. Using precise and real-time information will improve initial planning in determining hazard areas and closures, which will reduce the amount of airspace being closed for long periods of time while still maintaining the required level of safety for all NAS users. This program will facilitate the transition from the current use of large, static hazard areas, to smaller, dynamic hazard areas in the future by automating resource intensive, layered approaches and reducing the potential for human error during launch and reentry operations. Benefits of this capability will also include consistent processes that will result in more timely and accurate information being available to NAS users to support timely and effective responses to off-nominal scenarios and timely release of airspace when it is no longer needed. This makes aviation safer and smarter while enabling the integration of more commercial space operations into the NAS.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the IID:
 - Initial Program Requirements;
 - Enterprise Architecture Products;
 - Business Case Analysis Report; and
 - Initial Implementation Strategy and Planning Document.
- Achieve IID for Commercial Space Integration into the NAS: SDI.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for Commercial Space Integration into the NAS: SDI.

Program Plans FY 2020-2022 – Performance Output Goals

- Output goals will be determined at FID, to include deployment of the SDI capability and follow-on enhancements.

X, Space Integration Enhancements 1, G01M.03-01

Program Description

The objective of this program is to maximize availability of airspace for space launch and reentry operations while minimizing the effect of these operations on other NAS stakeholders. This program will develop and subsequently implement Air Traffic Management (ATM) changes, mainly Decision Support Tools (DSTs), to enable the integration of space launch and reentry operations into the NAS. The program will use an incremental approach to addressing each of the shortfalls identified in the preliminary Shortfalls Analysis Report, “2015 Integrating Launch and Reentry Operations into the NAS.” Integrating space launch and reentry operations into the NAS is a multi-faceted goal affecting FAA air traffic operations, services, and systems.

The FAA does not have the capabilities in place to efficiently meet the anticipated growth in space launch and reentry operations created by commercialization and is currently using non-integrated systems that require data to be communicated by voice or other non-operational systems. Time consuming and labor intensive processes are employed to transfer data between operational systems that are not designed for the task. Intentional duplication of effort is consciously utilized as a safety measure, as a checks and balance system, to reduce the potential for human error in manual data entry and transcription. These processes do not allow for efficient planning of launch and reentry operations. Airspace management strategies for balancing the needs of all airspace users during launch and reentry operations are not optimized limiting NAS efficiency, effectiveness, and capacity. As a result, abundant safety considerations inhibit launch and reentry vehicle integration with the NAS through the use of large areas of airspace restrictions for long periods of time. A lack of timely information flow drives the activation of restricted areas before and beyond the times that are needed. When off-nominal events require the reanalysis of Aircraft Hazard Areas (AHAs) these same limitations, along with other shortcomings in communication and surveillance, impede response times. There is a limited ability to archive, analyze, and disseminate data and information gathered post launch and reentry which inhibits continual evaluation and improvement of FAA’s approach to integrate launch and reentry operations. Agency policies to help balance the needs of launch and reentry operators and other NAS users do not exist. Without a system to quickly share accurate, assimilated data across the FAA and among stakeholders, the agency will continue to struggle to keep pace with the growing space transportation industry.

For the long term, this program will define and mature a set of capabilities to facilitate the integration of space launch and reentry operations into the NAS. The need for these capabilities will be prioritized and bundled into a set of phased acquisitions to provide Air Traffic Services (ATS) with the required upgrades. The program will leverage work already completed to support decisions for modified policies, procedures, acquisitions, or other activities to support ATS. Using system engineering techniques such as analysis, simulation and modeling, and human-in-the-loop simulations, the program will identify, assess, and validate the impact of new technology and operational procedures on the NAS infrastructure. Changes to NAS systems will be determined and specific artifacts/products will be developed to support the investment decision process for the acquisition and implementation of these changes.

For the near term, this program supports the integration of commercial space into the NAS by focusing on Space Data Integrator (SDI) improvements include the automation of the current manual process used for launch/reentry operations in the En Route and Terminal environments, as well as the integration of an improved AHA generator capability developed by NextGen to expedite calculations. The improved AHA generator “Hazard Risk Assessment and Management (HRAM)” is capable of calculating refined AHAs in seconds, rather than minutes, as well as

performing additional capabilities. The continued development of the SDI tool will provide real-time commercial space data to the Joint Space Operations Group and affected air traffic managers in the tactical and automation environment and is essential to the FAA's ability to safely minimize the effects of these operations on NAS capacity and efficiency.

Based on the broad scope and complexities of the program as documented in the preliminary Shortfalls Analysis Report, the potential operational solutions will be prioritized and packaged into multiple work packages. The Investment Analysis Readiness Decision (IARD) is planned for FY 2020; the Initial Investment Decision (IID) is planned for FY 2021; and the Final Investment Decision (FID) is planned for FY 2022.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter.*
- *FAA Performance Metric 3 – No fatalities, serious injuries, or significant property damage to the uninvolved public during licensed or permitted space launch and reentry activities.*

Relationship to Performance Metric

The anticipated growth in space launch and reentry operations created by commercialization is projected to exceed the capability of the FAA's current system. New ATC policies and automation capabilities will assist controllers in maintaining safe aircraft/spacecraft separation while optimizing the use of available system capacity. The results from this program will promote the safe and efficient use of airspace and airports during space launch and reentry activities and reduce the probability for fatalities, serious injuries or significant property damage to the uninvolved public.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete preliminary shortfall analysis and enterprise architecture changes for the enhancement of the Space Data Integrator.
- Complete development of the Operational concept, requirements validation report, shortfall and impact assessment of additional technologies for integrating commercial space into the NAS.

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the IARD for Space Integration Enhancements:
 - Functional analysis;
 - Preliminary Program Requirements (pPR);
 - Quantified shortfall;
 - Alternative analysis; and
 - Investment Analysis Plan.
- Achieve IARD for Space Integration Enhancements.

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of IID for Space Integration Enhancements:
 - Updated pPR;
 - Draft Business Case;
 - Initial Affordability Analysis; and
 - Initial Implementation Strategy and Planning.
- Achieve IID for Space Integration Enhancements.

Program Plans FY 2022 – Performance Output Goals

- Develop the following products in support of the FID for Space Integration Enhancements:
 - Shortfall analysis report;
 - Final Program Requirements;
 - Independent Government Cost Estimate;
 - Detailed Program Planning documentation; and
 - Source selection documentation.
- Achieve FID for Space Integration Enhancements.

B: Terminal Programs

2B01, TERMINAL DOPPLER WEATHER RADAR (TDWR) – PROVIDE
FY 2018 Request \$3.8M

**Terminal Doppler Weather Radar (TDWR) – Service Life Extension Program (SLEP) –
Phase 2, W03.03-02**

Program Description

The Terminal Doppler Weather Radar (TDWR) is used by ATC to increase the safety of the NAS. TDWRs provide vital information and warnings regarding hazardous windshear conditions, precipitation, gust fronts, and microbursts to air traffic controllers managing arriving and departing flights in the terminal area. There are 45 TDWR systems commissioned, protecting 46 high-capacity airports, throughout the United States and Puerto Rico that are prone to wind shear events. Two additional systems at the FAA’s Mike Monroney Aeronautical Center in Oklahoma City provide engineering support and training. There have been no wind shear accidents at any TDWR-protected airport since its TDWR was commissioned. TDWR weather data is transmitted to FAA automation systems and to 34 National Weather Service forecast offices. The current system has been in service since 1994 and is facing serious obsolescence issues and must be updated.

TDWR SLEP Phase 2 is a sustainment effort to extend the service life of the system. It will replace TDWR components that have deteriorated due to aging, have become obsolete or unsupportable, and were not addressed in Phase 1. This service life extension program will enable these systems to continue to provide safety and traffic management services throughout the NAS.

The following will be addressed in the SLEP Phase 2:

- Replace the Direct Digital Controller (DDC);
- Replenish the Wind Shear Ribbon Display to FAA Depot;
- Replace the Antenna Servo Controller;
- Replace the Transmitter Microwave Assemblies; and
- Refurbish facility grounding.

Final Investment Decision was approved by the Joint Resources Council December 16, 2015.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The TDWR SLEP will support the Performance Metric to sustain adjusted operational availability by ensuring legacy TDWRs are kept fully operational. The TDWR's required inherent availability (excluding any logistics or administrative delays) is 99.7%. Since October 2012, considering both scheduled and unscheduled outages, TDWR service availability has only been about 97.1%. With only a small amount of the availability shortfall due to logistics and administrative delays, a significant improvement in the TDWR's operational reliability is required.

Program Plans FY 2018 – Performance Output Goals

- Complete the Ground System Refurbishment at 16 sites (31 of 47, 66%).
- Complete DDC First Article Testing. (APB milestone)

Program Plans FY 2019 – Performance Output Goals

- Complete installation of the DDC at 15 sites (16 of 47, 34%).
- Complete Grounding System Refurbishment at 16 sites (47 of 47, 100%).
- Complete Grounding System Refurbishment (APB milestone)
- Complete the First Article Testing for the Wind Shear Ribbon Display. (APB milestone)
- Complete the First Article Testing for the Antenna Servo Controller. (APB milestones)

Program Plans FY 2020 – Performance Output Goals

- Complete replenishment of Wind Shear Ribbon Displays at Depot. (APB Milestone).
- Complete installation of the DDC at 16 sites (32 of 47, 68%).
- Complete installation of the Antenna Servo Controller at 15 sites (16 of 47, 34%).
- Complete the First Article Testing for the Transmitter Microwave Assembly. (APB milestone)

Program Plans FY 2021 – Performance Output Goals

- Complete the DDC installations at 15 sites (47 of 47, 100%). (Prior year funding)
- Complete installation of DDC replacement modification kits. (APB milestone) (Prior year funding)
- Complete installation of the Antenna Servo Controller at 16 sites (32 of 47, 68%). (Prior year funding)
- Complete installation of the Transmitter Microwave Assembly at 27 sites (28 of 47, 60%). (Prior year funding)

Program Plans FY 2022 – Performance Output Goals

- Complete installation of the Antenna Servo Controller at 15 sites (47 of 47, 100%). (Prior year funding)
- Complete installation of the Transmitter Microwave Assembly at 19 sites (47 of 47, 100%). (Prior year funding)

2B02, STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM (STARS) SUSTAIN

FY 2018 Request \$86.7M

- A, Standard Terminal Automation Replacement System (STARS) – Technology Refresh (TAMR Phase 1), A04.01-01
- B, Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Planning/Engineering, A04.01-03 / X, Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Implementation, A04.01-05

A, Standard Terminal Automation Replacement System (STARS) – Technology Refresh (TAMR Phase 1), A04.01-01

Program Description

The STARS program is a joint Department of Defense and Department of Transportation FAA program to modernize terminal air traffic control automation systems. The STARS is a digital processing and display system that replaces aging air traffic control equipment at FAA Terminal Radar Approach Control (TRACON) facilities and Air 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 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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The STARS program has overall system availability (software/hardware) of 99.9993% at all operational sites (Source: Web NAS Performance Analysis System). This program will modernize the STARS equipment to allow it to continue to operate at this high level of availability. STARS uses Commercial-Off-The-Shelf 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.

Program Plans FY 2018 – Performance Output Goals

- Procure hardware for upgrades from G1 to G4 configuration at 11 operational sites.
- Implement mandatory software security and safety enhancements, new functionality and upgrades needed for enhanced performance and capacity in support of NextGen initiatives.
- Complete Initial Operating Capability (IOC) at 10 sites (32 of 48 sites, 67%).
- Complete IOC at 26th site. (APB milestone)

Program Plans FY 2019 – Performance Output Goals

- Complete IOC at 9 sites (41 of 48 sites, 85%).
- Complete IOC at 39th site. (APB milestone)

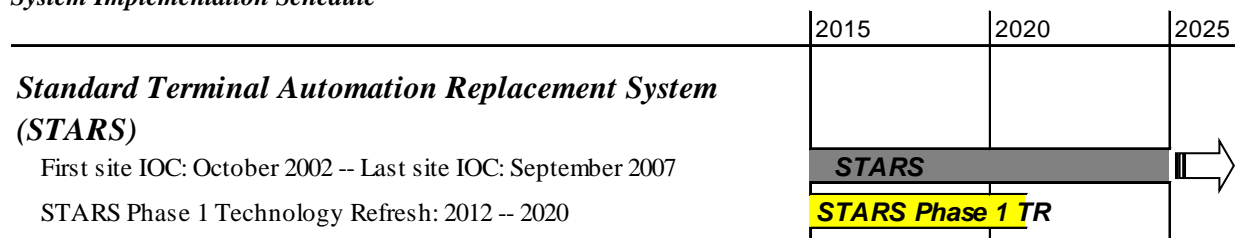
Program Plans FY 2020 – Performance Output Goals

- Complete IOC at 6 sites (48 of 48, 100%). (Prior year funds)
- Complete IOC at last site. (APB milestone) (Prior year funds)

Program Plans FY 2021-2022 – Performance Output Goals

- None.

System Implementation Schedule



B, Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Planning/Engineering, A04.01-03 / X, Standard Terminal Automation Replacement System (STARS) – Sustainment 2 Implementation, A04.01-05

Program Description

The STARS program is a joint Department of Defense and Department of Transportation FAA program designed 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 Air 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.

STARS – Sustainment 2 Planning/Engineering (A04.01-03):

This program 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, the end of vendor support in FY 2021, and to qualify the X3000 Processor/Digital Recording Device replacement. Due to the urgency, this program will also replace 5 STARS G1/G2 Local Integrated Tower Equipment (LITE) systems with new STARS G4 remote tower equipment.

The program will seek JRC approval for a STARS Sustainment 2 Planning/Engineering FID in FY 2017.

STARS – Sustainment 2 Implementation (A04.01-05):

This program will engineer and deploy additional key elements of STARS that have reached their EOL and are no longer compatible with current commercial offerings. The Sustainment 2 Implementation will also include the G5 next generation platform replacement of the Main Display Monitor.

The program plans to seek JRC approval for a STARS Sustainment 2 Implementation IARD in FY 2018 and FID in FY 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The STARS program has overall system availability (software/hardware) of 99.9993% at all operational sites (Source: Web NAS Performance Analysis System). This program will modernize the STARS equipment to allow it to continue to operate at this high level of availability while preparing the systems for the STARS technology refreshes that will trail in the following years. STARS uses Commercial-Off-The-Shelf components that have a life expectancy of 10 to 15 years. Current STARS equipment has been in the NAS since 2011 and is in need of equipment upgrades.

Program Plans FY 2018 – Performance Output Goals

STARS – Sustainment 2 Planning/Engineering (A04.01-03):

- Complete identification of "Gaps" between standards on existing Prime contract and the FY 2018 FAA standards for FAA-G-2100 and FAA-STD-019.
- Complete engineering plans for transition of STARS Operating System from Solaris to Linux.
- Finalize requirements for X3000 Processor/Digital Recording Device replacement for continuous data recording.
- Finalize requirements for new STARS pointing device.
- Purchase hardware for all 5 sites (Technology Refresh of G1/G2 LITE systems).

STARS – Sustainment 2 Implementation (A04.01-05):

- None.

Program Plans FY 2019 – Performance Output Goals

STARS – Sustainment 2 Planning/Engineering (A04.01-03):

- Complete STARS design that is compliant with FAA-G-2100 and FAA-STD-019.
- Complete consolidation of STARS documents required for FAA Second Level Engineering.
- Deploy STARS to sites 1 and 2 (Technology Refresh of G1/G2 LITE systems).

STARS – Sustainment 2 Implementation (A04.01-05):

- None.

Program Plans FY 2020 – Performance Output Goals

STARS – Sustainment 2 Planning/Engineering (A04.01-03):

- Deploy STARS to sites 3, 4, and 5 (Technology Refresh of G1/G2 LITE systems).

STARS – Sustainment 2 Implementation (A04.01-05):

- None.

Program Plans FY 2021 – Performance Output Goals

STARS – Sustainment 2 Planning/Engineering (A04.01-03):

- None.

STARS – Sustainment 2 Implementation (A04.01-05):

- Output goals will be established at FID.

Program Plans FY 2022 – Performance Output Goals

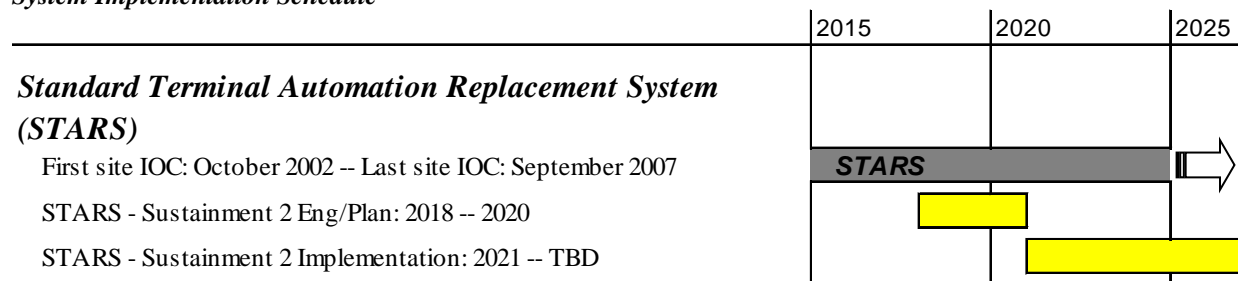
STARS – Sustainment 2 Planning/Engineering (A04.01-03):

- None.

STARS – Sustainment 2 Implementation (A04.01-05):

- Output goals will be established at FID.

System Implementation Schedule



2B03, TERMINAL AUTOMATION MODERNIZATION/ REPLACEMENT PROGRAM (TAMR PHASE 3)

FY 2018 Request \$66.1M

Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2, A04.07-02

Program Description

The TAMR program employs 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, TAMR Phase 1, replaced the automated radar processing and display systems at 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 (ARTS) IIE systems at TRACONs and their associated 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 STARS Remote Towers 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 surveillance systems.

TAMR Phase 3 Segment 2 supports Automatic Dependent Surveillance-Broadcast (ADS-B) requirements and continues FAA's original plan for terminal convergence into a single automation platform. Once completed, convergence of terminal automation onto a standard platform will eliminate the need to sustain the Common Automated Radar Terminal System (CARTS) and its associated software development activities. The Final Investment Decision (FID) for Segment 1 was approved in December 2011 and the FID for Segment 2 was approved in September 2012.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The upgrade to current technology will support ADS-B implementation and data management requirements associated with improving air traffic control management which can increase and improve the use of airspace capacity. The new equipment will provide the ability to increase the number of aircraft being simultaneously tracked from 256 to 1350 unique aircraft, and the number of surveillance sensors that can be connected from 1 to 12. These improvements will increase efficiency in using available NAS capacity.

Program Plans FY 2018 – Performance Output Goals

- Procure 4 ELITE operational systems.
- Procure 6 remote tower systems.
- Deliver 12 additional systems (11 operational and 1 support).
- Complete IOC at 65th ARTS IIE site. (APB milestone)
- Achieve IOC at 23 sites (90 of 97, 93%).

Program Plans FY 2019 – Performance Output Goal

- Deliver 4 additional operational systems.
- Achieve IOC at 7 sites (97 of 97, 100%).
- Complete IOC at last site, 91st (ARTS IIE). (APB Milestone)
- Complete ORD at last site (ARTS IIE). (APB Milestone)
- Complete ORD at last site (ARTS IE). (APB Milestone)

Program Plans FY 2020-2022 – Performance Output Goal

- None.

System Implementation Schedule



2B04, TERMINAL AUTOMATION PROGRAM

FY 2018 Request \$8.5M

- A, Flight Data Input/Output (FDIO) – Sustainment, A01.11-01
- B, Standard Terminal Automation Replacement System (STARS) Enhancements 2, A04.08-01
- C, Terminal Improvements, A04.09-02

A, Flight Data Input/Output (FDIO) – Sustainment, A01.11-01

Program Description

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. FDIO also provides Flight Data Service to Honolulu Control Facility and San Juan Combined Control Facility. The FDIO system interfaces to several En Route automation systems including: En Route Automation Modernization (ERAM), Flight Data Processor 2000, and Offshore Flight Data Processing system where it provides flight data information to NAS Terminal facilities. In addition, FDIO provides flight data information to other mission critical terminal automated systems. This information assists controllers in tracking aircraft, providing departure clearances, and anticipating the arrival of the aircraft in the sector under their control. The FDIO system also receives data from the Terminal Radar Approach Control Facility, Air Traffic Control Tower and Radar Approach Control controllers and relays this data back to the En Route Automation systems.

The FDIO Sustainment program replaces the end-of-life/obsolete FDIO equipment with fully compatible (form/fit/function) commercial off the shelf (COTS) and modified COTS equipment. Individual components are procured and replaced as they reach their end of life. The program is based on a five-year replacement cycle for the various components in order to maintain system operational availability. In addition to replacing components it's necessary to provide a common Internet Protocol infrastructure to support future ERAM, NextGen architectures, and the Tower Flight Data Manager system.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

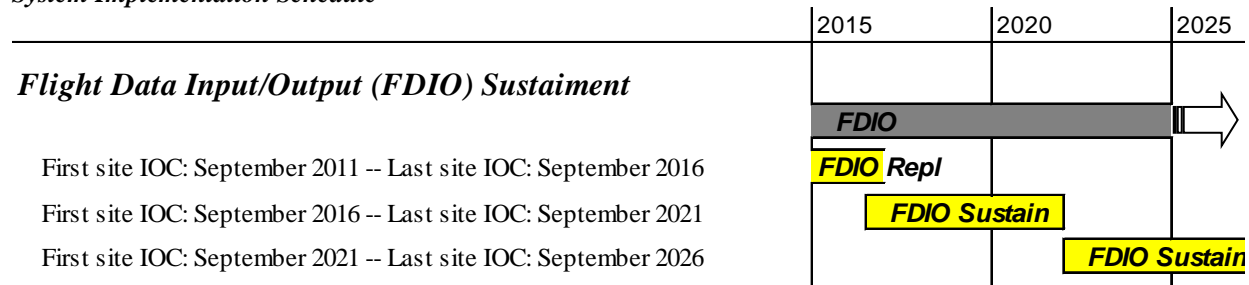
Relationship to Performance Metric

The FDIO program replaces end-of-life, obsolete FDIO equipment with modern and modified COTS equipment, thereby reducing potential outages and delays. The five-year replacement cycle that FDIO employs ensures sustained system operational availability at the core airports reportable facilities.

Program Plans FY 2018-2022 – Performance Output Goals

- Procure and install replacement FDIO system components including the terminal server, keyboard, monitor, Keyboard Video Mouse switch, Digi Card replacement, and printer at FAA and Department of Defense ATC facilities.

System Implementation Schedule



B, Standard Terminal Automation Replacement System (STARS) – Enhancements 2, A04.08-01

Program Description

Building upon previous investments, STARS Enhancement 2 is the next useful segment for the Standard Terminal Automation Replacement System platform by consolidating terminal automation onto a single platform. As envisioned by NextGen, it 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. TRACON automation capabilities must evolve to support mid-term concepts for NextGen.

STARS Enhancement 2 is the first of multiple segments 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.

The Surface/Tower/Terminal Systems Engineering, G06A.02-01, program will develop the investment documentation and initial requirements documents in support of the Investment Analysis Readiness Decision (IARD) for STARS Enhancement 2 as well as documents for the Initial Investment Decision (IID) and Final Investment Decision (FID). This program supports the investment activities by providing system engineering analysis and design. The IID is planned for FY 2017 and FID for FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The STARS Enhancement 2 program supports greater capacity by developing and implementing automation-based changes that will enable more efficient control and safer movement of air traffic within the Terminal domain and smoother transitions for traffic entering and departing Terminal airspace. It will provide TRACON personnel with the automation tools and support to more efficiently perform inter- and intra-facility coordination and improve air traffic control and management within the TRACON domain.

Continued safe and efficient operations in the NAS require a balanced and synchronized evolution of the NAS as a whole. Capacity of the air traffic control system over any given route is inherently limited by the most restrictive

component of that route. The FAA's recent strategic enhancements have emphasized the En Route and Airport Surface domains within the NAS. As traffic flow and management in these areas is improved, it is anticipated that bottlenecks will increasingly occur in the Terminal Area due to unaddressed operational deficiencies. To gain the full benefits of FAA and local jurisdiction investments in the NAS, Terminal area shortfalls must also be addressed.

By addressing operational shortfalls in the Terminal domain, the FAA will be able to leverage the increased use of Performance Based Navigation procedures and aircraft capabilities, support Trajectory Based Operations, and provide support for other NextGen concepts.

Program Plans FY 2018 – Performance Output Goals

- Provide system engineering analysis to develop inputs for the initial program requirements and draft final program requirement documents. System engineering analysis for candidate capabilities will include such activities as prototyping, Human-in-the-Loop assessments, algorithm analyses, and performance analyses.
- Complete definition of requirements for initial set of STARS enhancements.

Program Plans FY 2019-2022 – Performance Output Goals

- Milestones will be developed at FID.

C, Terminal Improvements, A04.09-02

Program Description

The Terminal Improvements program will support operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of terminal services. The scope of these NAS improvements is limited to operational changes that don't require significant capital investments; don't require a formal investment decision; nor involve significant systems complexity, interdependencies, or NAS operational changes. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an Air Traffic Organization Standard Operating Procedure and coordinated with applicable stakeholders. Capability areas will be explored, developed, and executed over a multi-year period. Improvements will be identified in each fiscal year and subsequently executed in the same fiscal year and/or possibly the following fiscal year, based on the nature of the changes and other programmatic factors. All required change management processes, such as the NAS Change Proposal, Safety Management System, and requirements management, will be followed.

This program also supports a category of requirements that address necessary and unplanned changes resulting from operational changes in the field, unanticipated changes from external organizations (e.g. International Civil Aviation Organization, third party data providers, neighboring Air Navigation Service Providers), or potential cost-savings initiatives. Candidate enhancement areas include: Additional system hardware platforms and components; Improvements to existing communications mechanisms; Surveillance integration and display enhancements; and Functional and computer-human interface enhancements

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The Terminal Improvements program will improve the presentation, access, and use of Standard Terminal Automation Replacement System and other systems data by air traffic controllers and managers, resulting in more efficient, safer, and cost-effective delivery of terminal services. It will conduct operational analysis, engineering analysis, solution development, and solution implementation activities designed to improve the delivery of terminal domain services.

Program Plans FY 2018-2022 – Performance Output Goals

- Complete operational analysis, engineering analysis, and solution development of hardware and software enhancements.
- Deliver hardware and software enhancements in the operational release to address operational problems and system improvements.

2B05, TERMINAL AIR TRAFFIC CONTROL FACILITIES - REPLACE

FY 2018 Request \$31.1M

**Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON)
Replacement, F01.02-00**

Program Description

The Air Traffic Control Tower/ Terminal Radar Approach Control (ATCT/TRACON) Replacement program replaces towers and TRACONs that no longer meet operational and sustainability requirements. The FAA provides air traffic control services from more than 500 ATCT and TRACON facilities and as needed, will replace buildings that no longer meet current and future operational requirements. The average age of Control towers is now 33 years, with some as old as 65. As the volume and complexity of terminal air traffic control operations increase, so does the need to have additional positions in the ATCT/TRACON facilities. Older control towers, those built more than 20 years ago, often do not have the physical space necessary to meet current operational requirements. In addition, some terminal facilities must be upgraded to conform to current building codes and design standards. This program will address these requirements and is included in the ATC Facilities Sustainment Strategic Plan.

Tower and TRACON replacements are large capital investments; given constrained resources, the FAA is focusing on risk-based analyses to ensure those facilities in greatest need are replaced first. Each year, the FAA will analyze facilities within its tower and TRACON inventory to determine if they should be replaced. As facilities are identified for replacement, they will be added to the list of towers and TRACONs to be replaced in future years.

Projects are funded in five segments and are scheduled based on priority. The five segments are: Advance Requirements and Other Direct Costs; Land Acquisition/Design; Construction; Electronic Systems – Purchase Equipment and Installation; and Disposition. Depending upon size, a typical project spans a period of 5 to 10 years from inception to completion. While each segment is fully funded in the year requested, it may take more than one year to complete the work for any given segment of a project.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The ATCT/TRACON Replacement program contributes to the FAA strategic priority of delivering benefits through technology and infrastructure by replacing ATCTs and TRACONs to meet current and future operational requirements. Some replacements are required to accommodate growth in air traffic; others are needed to provide added space for new equipment. In some cases the tower must be replaced to ensure that controllers have an unobstructed view of the runways and taxiways or a new ATCT must be constructed due to airport expansion. This program will ensure that these facilities are ready to meet both current and forecast levels of demand for air traffic control services and support the sustainment of operational availability of the NAS.

Program Plans FY 2018 – Performance Output Goals

- Award a design contract for two sites: Baltimore, MD (BWI) and Charleston, SC (CHS).
- Complete equipment procurement and installation at one site: Charlotte, NC (CLT).

Program Plans FY 2019 – Performance Output Goals

- Award a design contract for three sites.
- Complete disposition of one site.

Program Plans FY 2020 – Performance Output Goals

- Award a design contract for two sites.

Program Plans FY 2021 – Performance Output Goals

- Award construction contracts for two sites.

Program Plans FY 2022 – Performance Output Goals

- Award construction contracts for two sites.
- Complete equipment procurement and installation at two sites.

**2B06, ATCT/TERMINAL RADAR APPROACH CONTROL (TRACON) FACILITIES - IMPROVE
FY 2018 Request \$56.8M**

- A, Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization, F01.01-00
- B, Facility Realignment Implementation, F02.10-02 / X, Facility Realignment Planning, F02.10-01 /
- X, Strategic Initiatives Analysis and Validation, M08.48.01

**A, Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON)
Modernization, F01.01-00**

Program Description

The Air Traffic Control Tower/ Terminal Radar Approach Control (ATCT/TRACON) Modernization program upgrades towers and TRACONs to meet operational and safety requirements. The FAA must continually upgrade and improve terminal facilities and equipment to provide an acceptable level of service and to meet current and future operational requirements. Improvements include replacing facility components that are deteriorating:

- Waterproofing – Replace or renovate building envelop components (e.g., siding, roof, windows, major sealants, parapets);
- Heating, Ventilation, and Air Conditioning (HVAC) and electrical/mechanical upgrades – Replace or repair HVAC (e.g., replace handling units, condensing units, controls, pumps, boilers, chillers, and roof top units);
- Electrical and mechanical upgrades – (e.g., replacement or repair of electrical power cable, branch circuits and distribution wiring, light fixtures, outlets, etc.);
- Elevators – Replacement or major refurbishment of elevators;
- Plumbing – Replacement or repair of facility plumbing system and components;
- Specialties in operations areas – Major replacement or repair of tower cab or TRACON consoles, major renovation of interior spaces, reconfiguration of operational areas;
- Exterior (civil components) – Establishment of new access roads and parking lots, major replacement of access roads and parking lots, refurbishment of facility grounds, replacement of curbs, walkways, steps, railings, etc.; and
- Interior finishes – Replacement or repair of interior finishes in administrative areas (as part of major renovation or restoration projects).

ATCT/TRACON facilities will also be modernized to address operational and safety issues, including upgrading visibility of the entire airport surface, improving accessibility, removing hazardous materials and upgrading structures to meet seismic standards that didn't exist when they were constructed. Facility improvements must be completed with minimal impact on existing operations. An initial evaluation by the U.S. Army Corps of Engineers found that a number of FAA ATCT/TRACON facilities do not meet current seismic code criteria. This program has initiated

building improvements to comply with the standards established by the Interagency Committee on Seismic Safety in Construction and with “DOT Policy for Seismic Safety of New and Existing DOT Owned or Leased Buildings.” This program is included in the ATC Facilities Sustainment Strategic Plan.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The ATCT/TRACON Modernization program upgrades and improves facilities to support the NAS. This program enables facilities to meet current operational, environmental, seismic, and safety needs more economically than replacing or relocating the entire facility with minimal disruption to operations. Improvements to facility infrastructure, such as electrical distribution systems, heating and air-conditioning, and structural problems, will extend the service life of facilities and reduce potential outages that could impact air traffic operations. The FAA uses Facility Condition Index (FCI) values, based on independent facility assessments or extrapolations, to determine the physical condition of facilities to prioritize facility sustainment, modernization, and replacement efforts. In FY 2014, FCI values ranged from 81 percent to 100 percent for FAA-maintained towers and TRACONs.

Program Plans FY 2018-2022 – Performance Output Goals

- Complete 18 planning activities annually, i.e., quick looks lifecycle and condition assessments, to determine requirements.
- Complete an average of 50 modernization projects per year from previously initiated projects.

B, Facility Realignment Implementation, F02.10-02 / X, Facility Realignment Planning, F02.10-01

Program Description

The Facility Realignment Planning and Facility Realignment Implementation programs conduct congressionally-mandated facility realignment planning and analysis, and manage the implementation of facility realignment recommendations which have been submitted to Congress by the Administrator as a part of the National Facilities Realignment and Consolidation reports.

Facility Realignment Planning (F02.10-01):

This program conducts facility realignment analysis by gathering requirements, collecting inputs from stakeholders, documenting findings, conducting cost-benefit analyses, and developing facility realignment recommendations for the Administrator’s review and approval. The program collaborates with the Air Traffic Organization (ATO), other FAA organizations, and leadership for collective bargaining units to draft facility realignment recommendations for inclusion in National Facilities Realignment and Consolidation reports. The reports are published in the Federal Register for public comment, and with the comments received, submitted to Congress for consideration.

Facility Realignment Implementation (F02.10-02):

This program will manage and execute the implementation of facilities and service realignment recommendations by conducting transition planning and coordinating with the ATO and other FAA organizations to initiate and complete facility modifications, install necessary equipment, support realignment-related training, and prepare the workforce for the transition of services.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

Facility realignments are expected to deliver cost savings, cost avoidance, and operational efficiencies upon implementation, and continue to accrue benefits over time. The cost benefit estimates are developed as a part of facility realignment analysis, validated by finance, and reviewed by the Administrator. The estimates are submitted to Congress by the Administrator as a part of the National Facilities Realignment and Consolidation reports. The magnitude of cost saving and cost avoidance will depend on the number of recommendations approved by the Administrator, submitted to Congress, and approved for implementation.

Program Plans FY 2018 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- None.

Facility Realignment Implementation (F02.10-02):

- Develop and execute the transition of facilities and services approved for realignment by the Administrator.

Program Plans FY 2019 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- None.

Facility Realignment Implementation (F02.10-02):

- Develop and execute the transition of facilities and services approved for realignment by the Administrator.

Program Plans FY 2020 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- Develop and present preliminary findings of FY 2020 analysis to ATO and FAA leadership.
- Prepare report containing the FY 2020 recommendations of the Administrator on realignment and consolidation of facilities and services with public comments as appropriate.

Facility Realignment Implementation (F02.10-02):

- Develop and execute the transition of facilities and services approved for realignment by the Administrator.

Program Plans FY 2021 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- Develop and present preliminary findings of FY 2021 analysis to ATO and FAA leadership.
- Prepare report containing the FY 2021 recommendations of the Administrator on realignment and consolidation of facilities and services with public comments as appropriate.

Facility Realignment Implementation (F02.10-02):

- Develop and execute the transition of facilities and services approved for realignment by the Administrator.

Program Plans FY 2022 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- Develop and present preliminary findings of FY 2022 analysis to ATO and FAA leadership.
- Prepare report containing the FY 2022 recommendations of the Administrator on realignment and consolidation of facilities and services with public comments as appropriate.

Facility Realignment Implementation (F02.10-02):

- Develop and execute the transition of facilities and services approved for realignment by the Administrator.

X, Strategic Initiatives Analysis and Validation, M08.48.01

Program Description

The Strategic Initiatives Analysis and Validation program will develop concepts and plans for future capital investment activities to accomplish FAA's four Strategic Priorities through 2022 as listed below:

- Make Aviation Safer and Smarter
- Deliver Benefits through Technology and Infrastructure
- Enhance Global Leadership
- Empower and Innovate with the FAA's people

The programs included in the Capital Investment Plan contribute to the accomplishment of these priorities. The Strategic Initiatives and Validation program will review and analyze FAA's portfolio of capital programs to identify performance gaps in achieving the Strategic Priorities within the targeted timeframe. This will be accomplished through ongoing review of the programs contributing to the capabilities required to achieve each of the four Strategic Priorities. The information developed from this work will include identification of program gaps, impact assessments, budget estimates to correct the gaps, and prioritized recommendations for consideration by decision makers.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

Strategic Initiatives Analysis and Validation supports cost efficiency initiatives by determining the most cost effective capital investment strategies and solutions to support the agency's Strategic Priorities. Thorough evaluation and validation of requirements, development activities, schedule and budget estimates will reduce unforeseen changes in costs and plans after program approval.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete annual report on accomplishments of prior year initiatives.
- Develop recommendations for program initiatives to support achievement of Strategic Priorities.

Program Plans FY 2020-2022 – Performance Output Goals

- None.

2B07, TERMINAL VOICE SWITCH REPLACEMENT (TVSR)

FY 2018 Request \$6.0M

Terminal Voice Switch Replacement (TVSR) II, C05.02-00

Program Description

Terminal voice switching systems direct and control voice communications. This allows the air traffic controllers to select from the various communications paths available to connect to desired locations. The controller can communicate with another controller position at his or her own facility, another ATC facility, or via radio with a properly equipped aircraft.

The TVSR program replaces and sustains aging, obsolete voice switches in ATC Towers and Terminal Radar Approach Controls to ensure controllers have reliable voice communications in the terminal environment. The program consists of several multiyear equipment contracts for voice switches including Small Tower Voice Switches, Enhanced Terminal Voice Switches, Rapid Deployment Voice Switches, Voice Switch By Pass, and Interim Voice Switch Replacement (IVSR). This program also establishes contract vehicles with the flexibility for FAA to procure voice switch equipment for new or modernized terminal facilities.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The TVSR program supports the performance metric to sustain operational availability of the NAS by sustaining and replacing legacy systems with modern digital equipment to improve system reliability of terminal voice communications thereby reducing outages and preventing delays.

Program Plans FY 2018 – Performance Output Goals

- Deliver approximately 5 IVSR's to various FAA facilities.
- From replaced systems, recover and refurbish components for spare parts.

Program Plans FY 2019 – Performance Output Goals

- Deliver approximately 7 IVSR's to various FAA facilities.
- From replaced systems, recover and refurbish components for spare parts.

Program Plans FY 2020 – Performance Output Goals

- Deliver approximately 7 IVSR's to various FAA facilities.
- From replaced systems, recover and refurbish components for spare parts.


Program Plans FY 2021 – Performance Output Goals

- Deliver approximately 6 IVSR's to various FAA facilities.

Program Plans FY 2022 – Performance Output Goals

- Deliver approximately 6 IVSR's to various FAA facilities.

System Implementation Schedule

	2015	2020	2025
<i>Small-Tower Voice Switches (STVS), Enhanced Terminal Voice Switches (ETVS), Rapid Deployment Voice Switches (RDVS), Voice Switch ByPass (VSBP), and Interim Voice Switch Replacement (IVSR).</i>			
First site IOC: 1994 (2006) -- Last site ORD: TBD			

2B08, NAS FACILITIES OSHA AND ENVIRONMENTAL STANDARDS COMPLIANCE

FY 2018 Request \$46.7M

Environmental and Occupational Safety and Health (EOSH), F13.03-00

Program Description

The Air Traffic Organization (ATO) Environmental and Occupational Safety and Health (EOSH) program is responsible for developing and implementing risk management initiatives that safeguard FAA personnel from occupational hazards and minimize the impact of NAS activities on the environment. EOSH program risk management efforts are founded upon and promote compliance with regulations, internal/external standards, and collective bargaining agreements. EOSH program efforts:

- protect employees and the environment;
- prevent damage and loss of FAA resources;
- preserve the NAS mission by limiting interruptions; and
- promote a culture of safety and environmental responsibility.

This program is included in the ATC Facilities Sustainment Strategic Plan.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 4 – Empower and Innovate with the FAA’s People.*
- *FAA Performance Metric 1 – The FAA is rated in the top 25 percent of places to work in the federal government by employees. (FAA Business Planning Metric)*

Relationship to Performance Metric

The EOSH program supports the Performance Metric by improving the safety of the FAA’s workplaces and protection of the surrounding environments. EOSH program risk management initiatives promote a safer and more healthful work place, enhance employee morale and contribute to placing the FAA in the top 25 percent of best places to work in the Federal government.

Program Plans FY 2018 – Performance Output Goals

- Fall Protection: Upgrade 88 fall protection systems (1021 of 2500, 41%).
- Fire Life Safety (FLS): Upgrade five Air Traffic Control Tower (ATCT) FLS systems (358 of 369, 97%).
- FLS: Complete certificate of occupancy (COO) for 40 FAA control facilities (40 of 570, 7%).
- Electrical Safety: Complete assessment of 100 NAS facilities (377 of 1451, 26%).
- Electrical Safety: Complete 5-year technology refresh at 35 facilities.

Program Plans FY 2019 – Performance Output Goals

- Fall Protection: Upgrade 214 fall protection systems (1235 of 2500, 49%).
- FLS: Upgrade 11 ATCT FLS systems (369 of 369, 100%).
- FLS: Complete COO for 40 FAA control facilities (80 of 570, 14%).
- Electrical Safety: Complete assessment of 100 NAS facilities (477 of 1451, 33%).
- Electrical Safety: Complete 5-year technology refresh at 25 facilities.

Program Plans FY 2020 – Performance Output Goals

- Fall Protection: Upgrade 203 fall protection systems (1438 of 2500, 57%).
- FLS: Complete COO for 40 FAA control facilities (120 of 570, 21%).
- Electrical Safety: Complete assessment of 100 NAS facilities (577 of 1451, 45%).
- Electrical Safety: Complete 5-year technology refresh of 48 facilities.

Program Plans FY 2021 – Performance Output Goals

- Fall Protection: Upgrade 200 fall protection systems (1638 of 2500, 65%).
- FLS: Complete COO for 40 FAA control facilities (160 of 570, 28%).
- Electrical Safety: Complete assessment of 100 NAS facilities (677 of 1451, 55%).
- Electrical Safety: Complete 5-year technology refresh of 15 NAS facilities.

Program Plans FY 2022 – Performance Output Goals

- Fall Protection: Upgrade 201 fall protection systems (1839 of 2500, 73%).
- FLS: Complete COO for 40 FAA control facilities (200 of 570, 35%).
- Electrical Safety: Complete assessment of 100 NAS facilities (777 of 1451, 65%).
- Electrical Safety: Complete 5-year technology refresh of 100 NAS facilities.

2B09, AIRPORT SURVEILLANCE RADAR (ASR-9) SERVICE LIFE EXTENSION PROGRAM (SLEP)

FY 2018 Request \$11.4M

A, Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP), Phase 2, S03.01-09

B, Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP), Phase 3, S03.01-12

**A, Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP),
Phase 2, S03.01-09**

Program Description

The ASR-9 SLEP Phase 2 program will implement modifications to the ASR-9 system to sustain primary radar surveillance in terminal airspace. Without the needed modifications, the ASR-9 system will experience decreasing reliability, lower availability, and increasing supportability risk 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 until replacement begins in 2026. The ASR-9 uses hardware and software architectures that are becoming obsolete. The SLEP will procure Digital Remote Surveillance Communication Interface Processor Replacement (DRSR) systems, Transmitter Backplanes, Radar Data Access Point and replenishment of depot inventory of critical components.

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 the data can be displayed on the controller's screen. The ASR-9 also provides data to the Airport Movement Area Safety System and to the Airport Surface Detection Equipment – model 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 / Automatic Dependent Surveillance Broadcast backup strategy. Based upon this strategy, all 135 ASR-9 systems will remain in service through at least 2026.

The SLEP Phase 2 Final Investment Decision was approved on June 27, 2012 to address obsolescence and supply/support issues of system Lowest Replaceable Units and components within the ASR-9 system.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Currently ASR-9 systems are functioning at an operational availability of 99.38 percent, which does not meet the FAA Performance Metric. Also, the current operational availability of 99.38 percent is below the ASR-9 specifications of 99.9 percent. The ASR-9 service life extension program reduces the risk of unscheduled outages, ensures continuation of service and will improve operational availability.

Program Plans FY 2018 – Performance Output Goals

- Complete installation of 42 DRSR units at ASR-9 sites for a total of 127 out of 154 DRSR units; 82%.

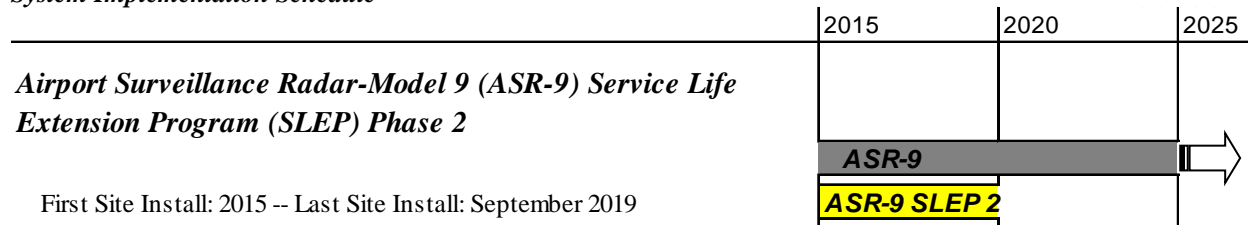
Program Plans FY 2019 – Performance Output Goals

- Complete installation of 27 DRSR units at ASR-9 sites for a total of 154 of 154 DRSR units; 100%. (Prior year funding)
- Installation at last site completed, September 2019. (Acquisition Program Baseline Milestone) (Prior year funding)

Program Plans FY 2020-2022 – Performance Output Goals

- None.

System Implementation Schedule



B, Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program (SLEP) – Phase 3, S03.01-12

Program Description

The ASR-9 SLEP Phase 3 program replaces or upgrades obsolete ASR-9 hardware and software to ensure the continued operation of the radar system. This is an ongoing program that is accomplished in phases to address obsolescence and supportability issues. The Phase 3 program will extend the service life of all 135 ASR-9 systems; 121 operational sites, seven (7) Department of Defense (DoD) sites, and seven (7) support systems.

The ASR-9 system is a non-cooperative (primary) surveillance radar that provides aircraft position and weather information to automation systems for air traffic controllers in terminal airspace. The ASR-9 system supports aircraft separation standards, air traffic operational efficiency, and improves safety at congested airports. During instrument meteorological conditions, the radar provides air traffic controllers with aircraft position and weather information to support aircraft operations. The ASR-9 also provides data under Memorandum of Agreements with the DoD and Homeland Security, through the Defense Radar Program, and to the Department of Treasury and National Weather Service through separate agreements. The DoD uses ASR-9 surveillance data to monitor and detect non-transponder equipped intruders in terminal airspace.

The system was procured in the mid-1980s, fielded between 1989 and 1994, and has significantly exceeded the expected 20-year lifecycle. Future ASR-9 SLEPs are dependent upon ongoing supportability assessments to ensure ASR-9s remain operational through their designated lifecycle.

A Final Investment Decision (FID) for ASR-9 SLEP Phase 3 is scheduled to occur in FY 2018. Implementation is planned to begin in 2019 and continue through 2024.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

ASR-9 systems are currently operating at an availability level of 99.38 percent. This is below the FAA Performance Metric and the ASR-9 operational availability specification of 99.999 percent. With SLEP modifications, the operational availability for the ASR-9 systems will improve.

Program Plans FY 2018 – Performance Output Goals

- Pending FID approval:
 - Conduct Development Test for the ASR-9 Analog to Digital Converter;
 - Conduct Proof of Concept evaluation for the ASR-9 Modulator Pulse Assembly Monitoring and Control Board;
 - Conduct Development Test for the ASR-9 Data Communications Equipment Modernization; and
 - Conduct the Engineering Study for the ASR-9 Maintenance Display Unit.

Program Plans FY 2019-2022 – Performance Output Goals

- Output goals will be established at FID.

2B10, TERMINAL DIGITAL RADAR (ASR-11) TECHNOLOGY REFRESH

FY 2018 Request \$3.2M

Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 2, S03.02-05 / X, Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 3, S03.02-07

Program Description

The ASR-11 Technology Refresh program replaces and upgrades obsolete ASR-11 Commercial-Off-The-Shelf hardware and software to ensure the continued reliable and cost effective operation of the radar system in the NAS. This is an ongoing program to address obsolescence and maintenance issues and is being accomplished in sequential 5-year segments.

ASR-11 Technology Refresh Segment 2 (S03.02-05):

The ASR-11 Technology Refresh Segment 2 program is structured to address the following shortfalls identified in the Segment 2 Shortfall Analysis Report:

- Site Control Data Interface (SCDI) /Operator Maintenance Terminal obsolescence
- Uninterruptible Power Supply capacitor at end of life expectancy

The objective of the Segment 2 program is to ensure continued reliable and cost effective operation of the radar system in the NAS. The Segment 2 Investment Analysis Readiness Decision (IARD) was approved in November 2012 and the Final Investment Decision (FID) was achieved in December 2013.

ASR-11 Technology Refresh Segment 3 (S03.02-07):

The Segment 3 program will address parts obsolescence, operational performance deficiencies, and other areas requiring technology refresh to ensure continued reliable and cost effective operation of all ASR-11 configurations, including the mobile ASR-11, in the NAS. The ASR-11 Technology Refresh Segment 3 IARD is planned for September 2019 and the FID is planned for September 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

ASR-11 systems are currently functioning at an operational availability of 99.5 percent, which is below the FAA performance metric of 99.7 percent. The ASR-11 Technology Refreshment program replaces obsolete hardware within the system to facilitate maintenance and maintain operational availability if a repair or part replacement is needed.

Program Plans FY 2018 – Performance Output Goals

ASR-11 Technology Refresh Segment 2 (S03.02-05):

- Certify for operational use for SCDI replacement, 25% complete.

ASR-11 Technology Refresh Segment 3 (S03.02-07):

- None.

Program Plans FY 2019 – Performance Output Goals

ASR-11 Technology Refresh Segment 2 (S03.02-05):

- Certify for operational use for SCDI replacement, 75% complete. (Prior year funds)

ASR-11 Technology Refresh Segment 3 (S03.02-07):

- Complete Final Shortfall Analysis Report.
- Achieve IARD.

Program Plans FY 2020 – Performance Output Goals

ASR-11 Technology Refresh Segment 2 (S03.02-05):

- Certify last site for operational use for SCDI replacement, 100% complete. (APB milestone) (Prior year funds)

ASR-11 Technology Refresh Segment 3 (S03.02-07):

- Complete final Business Case Analysis Report.
- Complete final Implementation Strategy and Planning Document.
- Achieve FID.

Program Plans FY 2021-2022 – Performance Output Goals

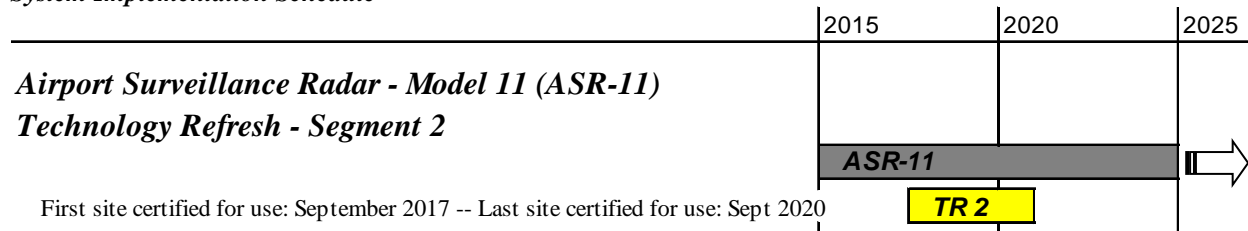
ASR-11 Technology Refresh Segment 2 (S03.02-05):

- None.

ASR-11 Technology Refresh Segment 3 (S03.02-07):

- Output goals will be determined at FID.

System Implementation Schedule



2B11, RUNWAY STATUS LIGHTS (RWSL)

FY 2018 Request \$2.8M

Runway Status Lights (RWSL) – Implementation – Phase 1, S11.01-02 / X, Runway Status Lights (RWSL) – Sustainment, S11.01-04

Program Description

The RWSL system integrates runway lighting equipment with approach and surface surveillance systems to provide a visual signal to pilots and vehicle operators indicating when it is unsafe to enter/cross or begin takeoff on the runway. The system is fully automated based on inputs from surface and terminal surveillance systems. Airport surveillance sensor inputs are processed through light control logic that commands in-pavement lights to illuminate red when there is traffic on or approaching the runway. Runway Entrance Lights provides this signal to aircraft planning to cross or enter a runway from an intersecting taxiway. Takeoff Hold Lights provide a signal to aircraft in position for takeoff.

Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):

The RWSL program received a Final Investment Decision (FID) in 2010 from the JRC for 23 operational and three support sites. In July 2013, the FAA re-scoped the program to 17 airports. In August and December 2016, JRC authorized adding all three prototype systems back into the baseline. Boston, Dallas Fort Worth and San Diego airports were added to the production baseline. Runway Status Lights systems are operational at Orlando International Airport, Washington Dulles International, Phoenix—Sky Harbor, George Bush International, Minneapolis St. Paul International, Seattle-Tacoma International, Charlotte Douglas International, Las Vegas McCarran International, Ft. Lauderdale/Hollywood Airport, Los Angeles International Airport, LaGuardia Airport and Detroit Metro Wayne County Airport. The FAA plans to have all RWSL systems operational by FY 2018.

Runway Status Lights (RWSL) – Sustainment (S11.01-04):

The RWSL Sustainment program will assess the need to replace and upgrade obsolete Commercial Off-the-Shelf 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 2019, and is intended to remain operational until replacement begins in 2026. The program is on track for an Investment Analysis Readiness Decision (IARD) by March 2018 and the FID by March 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 4 – Reduce Category A & B (most serious) runway incursions to a rate of no more than: 0.375 per million operations.*

Relationship to Performance Metric

Runway incursions pose a significant safety issue. The installation of RWSL will contribute toward reducing the rate of runway incursions by indicating to pilots and vehicle operators the existence, or imminent risk, of a conflict if they cross the hold line for a runway. RWSL also warn pilots or vehicles to stop at the hold line if an aircraft on the runway begins its takeoff. The FY 2014 RWSL projected benefits include a reduction in cumulative A&B runway incursions at the 20 RWSL airports by ~17% (from 9.68 in baseline to 8.02 with RWSL); and a reduction in cumulative runway incursions caused by pilot deviations by ~22% (from 41.03 in baseline to 32.17 with RWSL).

Program Plans FY 2018 – Performance Output Goals

Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):

- Achieve Initial Operating Capability at 2 operational sites (19 of 20, 95%).

Runway Status Lights (RWSL) – Sustainment (S11.01-04):

- Achieve IARD for RWSL Sustainment. (RWSL Phase 1 resources)

Program Plans FY 2019 – Performance Output Goals

Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):

- Achieve Initial Operating Capability at 1 operational sites (20 of 20, 100%). (Prior year funds)

Runway Status Lights (RWSL) – Sustainment (S11.01-04):

- Complete development of the following products in support of the FID:
 - Final Program Requirements documentation;
 - Enterprise Architecture Artifacts;
 - Business Case documentation;
 - Finalized Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for RWSL Sustainment.

Program Plans FY 2020-2022 – Performance Output Goals

Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):

- None.

Runway Status Lights (RWSL) – Sustainment (S11.01-04):

- Milestones will be developed at FID.

System Implementation Schedule



2B12, NEXTGEN – NATIONAL AIRSPACE SYSTEM VOICE SYSTEM (NVS)

FY 2018 Request \$68.8M

NAS Voice System (NVS) – Demonstration & Qualification, G03C.01-01 / X, NAS Voice System (NVS) – Deployment, G03C.01-02

Program Description

The NVS program will replace legacy voice switches at en route and terminal ATC facilities. The new switches will be a critical component of the ATC infrastructure, providing voice connectivity for efficient communications by linking incoming and outgoing communication lines to controller workstations. Using a panel at their workspace, controllers will be able to select the lines needed to communicate with pilots, other controllers, ground personnel and other facilities.

The current voice system technology deployed in the NAS will not support the future NextGen concept of operations for capabilities such as networked facilities and offloading selected sector control to other facilities during non-peak operations. These capabilities require that communication lines connected to a controller's workstation panel be automatically configured to add or remove lines as the geographical boundaries of the sector change. The NVS program will have the capacity to support both current and future ATC operations.

NVS will replace the service currently provided by 11 different voice switch configurations, including terminal voice switches, and the en route Voice Switching and Control System, by designing a replacement system that can be scaled to facility size using standardized components that reduce the need for maintenance and the cost of replacement parts.

The NVS program will be implemented in two segments; Demonstration and Qualification, and Deployment. This approach will minimize risk and ensure the new switches will comply with agency requirements.

NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

The Demonstration and Qualification segment provided funding to award the NVS contract in August 2012 to procure prototypes and conduct demonstrations of the basic functionality and NextGen capabilities. Demonstrations were successful and the program received a Final Investment Decision (FID) for NAS qualification from the Joint Resources Council (JRC) in September 2014. The NAS Qualification phase consists of the development and testing of a production-ready system capable of being deployed in the NAS operational environment, including a three article test systems and three Key Site systems. The program will return to the JRC in FY 2019 to request FID for deployment funding at operational facilities beyond the key sites.

NAS Voice System (NVS) – Deployment (G03C.01-02):

The Deployment segment consists of NVS deployments at operational facilities beyond key sites. The NVS deployment schedule will be finalized for the FY 2019 JRC FID for deployment.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The NVS program supports the average daily airport capacity metric by providing an architecture that can handle future growth and load-sharing within a flexible network. NVS will support the NextGen concept of operations for networked facilities and off-loading selected sector control to other facilities during non-peak operations. These capabilities will improve operational efficiency by better balancing workload in response to demand changes.

Program Plans FY 2018 – Performance Output Goals

NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

- Complete Functional and Physical Configuration Audits of test article systems. (APB milestone)
- Deliver first, second, and third article test systems to the William J. Hughes Technical Center (WJHTC) and Mike Monroney Aeronautical Center (MMAC).
- Deliver key site systems and initiate key site testing.

NAS Voice System (NVS) – Deployment (G03C.01-02):

- None.

Program Plans FY 2019 – Performance Output Goals

NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

- Complete Contractor Acceptance and Inspection of equipment at key sites. (APB milestone)
- Complete Operational Test and Evaluation of test systems at WJHTC and MMAC. (APB milestone)
- Complete Initial Operational Capability (IOC) at first key site. (APB milestone)

NAS Voice System (NVS) – Deployment (G03C.01-02):

- Conduct post qualification updates and corresponding training revisions in accordance with the FY 2019 FID.

Program Plans FY 2020 – Performance Output Goals

NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

- Complete In-Service Decision at first key site. (APB milestone)

NAS Voice System (NVS) – Deployment (G03C.01-02):

- Order, deliver and install NVSs in accordance with the FY 2019 FID.

Program Plans FY 2021 – Performance Output Goals

NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

- None.

NAS Voice System (NVS) – Deployment (G03C.01-02):

- Order, deliver and install NVSs in accordance with the FY 2019 FID.

Program Plans FY 2022 – Performance Output Goals

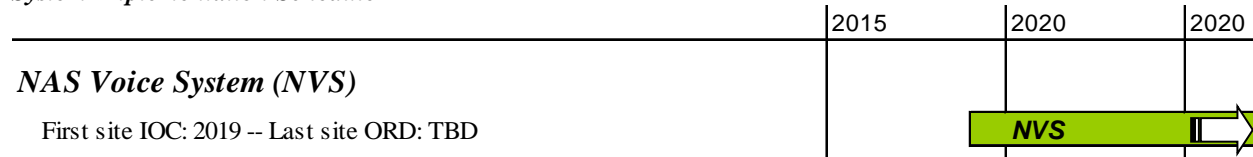
NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

- None.

NAS Voice System (NVS) – Deployment (G03C.01-02):

- Order, deliver and install NVSs in accordance with the FY 2019 FID.

System Implementation Schedule



2B13, INTEGRATED DISPLAY SYSTEM (IDS)

FY 2018 Request \$5.0M

Enterprise Information Display System (E-IDS), A03.05-03

Program Description

The Enterprise Information Display System (E-IDS) will provide an enterprise-level platform that replaces multiple types of Information Display Systems (IDS) in the En Route, Terminal, Traffic Flow and Offshore domains with standard functionality and common hardware/software. IDSs are separate from primary displays, and their purpose is to provide Air Traffic Controllers, Front Line Managers, and Traffic Management Coordinators with supplemental but operationally essential information for controlling aircraft.

IDSs were introduced in the terminal domain in the 1990's and rely on obsolete technology and interfaces with facility-centric, inefficient data organization, and manual update methods. Access to information through trusted sources varies from facility to facility depending upon the type of IDS model and whether the facility has a direct interface to source data. The Terminal environment includes three distinct systems, each with a different hardware/software configuration: IDS-4, Automated Surface Observing System Controller Equipment-IDS and NAS Information Display System. En Route includes a system called En Route Information Display System that provides non-tactical information to FAA personnel in Air Route Traffic Control Centers (ARTCC). Traffic Flow domain is present in both Terminal and En Route environments consisting of large monitors that display real-time, high-level traffic and Traffic Flow Management information. The Alaska ARTCC has developed its own IDS, the ATC Automated Information Display.

In some cases, vendor-supplied information may be the only source available. These limitations make it cumbersome for users to search, retrieve, and display information. It adds additional workload to both controllers who use the systems and data managers who maintain the systems. Multiple types of information retrieval and display systems create inefficient maintenance activities necessary to sustain all system variations. Each system is separate and facility-bound; there is no centralized data backup, data migration, or data recovery capability.

E-IDS will eliminate differences in the information displayed by obtaining it from trusted sources through the System Wide Information Management program. This information will include: (a) real-time weather, Notice to Airmen (NOTAM) and Pilot Reports (PIREP), (b) 56-day static digital information (e.g. charts, approach plates, etc.), and (c) administrative information. E-IDS will be an integrated system that uses a common enterprise-based server to collect, store, update, and provide information from authoritative sources to thousands of client displays in the field.

Current IDSs are unable to fully utilize NextGen capabilities. E-IDS with its enterprise-level platform will leverage NextGen capabilities providing secure, timely, and accurate information to all service providers. E-IDS will add new system displays at Oceanic controller positions in ARTCCs, Alaska Automated Flight Service Stations, and for Tech Ops personnel. Incorporating new technology will improve the safety of the NAS and efficiency of flight-specific ATC operations by providing faster access to specific information.

The E-IDS system will:

- Combine duplicate management activities under an overarching program
- Provide capabilities needed to meet NextGen era technologies that cannot be met by today's IDS'
- Provide efficient data access and data management that is not possible with aging IDS systems

The alternative analysis for E-IDS includes the following:

- Alternative 1 - New FAA-owned Commercial-Off-The-Shelf (COTS) Information Technology (IT) infrastructure that host modified commercially available software (CAS) integrated with repurposed software applications from legacy systems
- Alternative 2 - New FAA-owned COTS IT infrastructure and new modified CAS
- Alternative 3 - Cloud computing services with remote thin client displays connected to high reliability networks at central facilities

The following information will be displayed on E-IDS:

- Dynamic Information
 - NOTAM
 - Special Activity Airspace - Schedule and Status
 - PIREPS
 - Weather and Wind
 - Runway Visual Range
 - Traffic Management Initiatives (Ground/Departure Stops, Snow Removal, Miles in Trail, etc.)
- Static Information
 - Charts
 - Approach Plates
 - Orders (e.g., FAA 7110.65)
 - Standard Operating Procedures
 - Letters of Agreement

JRC approval of the Initial Investment Decision (IID) is planned for 2nd quarter FY 2018, and approval of Final Investment Decision (FID) is planned for 2nd quarter FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The E-IDS will provide Air Traffic Controllers, Front Line Managers, and Traffic Management Coordinators with the full range of information including aeronautical, weather, and administrative information affecting all phases of flight to assist in efficiently managing airspace. This will improve the use of airspace capacity by reducing voice coordination between operators to resolve differences in reported information.

Program Plans FY 2018 – Performance Output Goals

- Complete the following products in support of the IID:
 - Initial Program Requirements Document
 - NAS Enterprise Architecture products
 - Implementation Strategy and Planning Document
 - Safety Risk Management Document
 - Business Case Analysis Report, including Risk-Adjusted Life Cycle Cost Estimates and Benefits
 - Enterprise Infrastructure Services Assessment
 - Integrated Logistics Support Plan
 - Earned Value Management Assessment
 - Final Investment Analysis Plan
- Achieve JRC Approval for IID.

Program Plans FY 2019 – Performance Output Goals

- Complete the following products in support of the FID:
 - Final Program Requirements Document
 - Enterprise Architecture Products
 - Business Case Analysis Report, including Risk-Adjusted Life Cycle Cost Estimates and Benefits
 - Final Implementation Strategy and Planning Document
 - Acquisition Program Baseline (Execution Plan)
- Complete all necessary documentation for Screening Information Request (SIR)
- Issue SIR
- Complete assessment of vendor proposals.
- Finalize vendor negotiations and obtain final proposal.
- Achieve JRC approval for FID.
- Pending JRC approval:
 - Award Contract for System Development
 - Complete System Requirements Review

Program Plans FY 2020 – Performance Output Goals

- Pending JRC FID approval:
 - Complete Preliminary Software Specifications and System Architecture Design
 - Complete Preliminary Design Review

Program Plans FY 2021 – Performance Output Goals

- Pending JRC FID approval:
 - Complete Software Specifications and System Architecture Design
 - Complete Critical Design Review
 - Purchase and install E-IDS equipment for contractor laboratory
 - Purchase and install E-IDS equipment at the William J. Hughes Tech Center laboratory
 - Purchase E-IDS equipment for initial site deployments
 - Complete system prototyping
 - Complete development and testing of initial Build

Program Plans FY 2022 – Performance Output Goals

- Pending JRC FID approval:
 - Install E-IDS equipment for Key Site deployments
 - Complete Key Site testing
 - Achieve Key Site Initial Operational Capability (IOC)
 - Obtain In Service Decision (ISD)
 - Other output goals will be developed at FID.

2B14, REMOTE MONITORING AND LOGGING SYSTEM (RMLS)

FY 2018 Request \$7.4M

- A, Remote Monitoring and Logging System (RMLS) – Technology Refresh, M07.04-02
- B, Automated Maintenance Management System (AMMS), M07.05-01

A, Remote Monitoring and Logging System (RMLS) – Technology Refresh, M07.04-02

Program Description

The RMLS Technology Refresh program will extend the service life of RMLS hardware and software located at the National Operations Control Center (NOCC), Atlantic Operations Control Center (AOCC), Mid-States Operations Control Center (MOCC), Pacific Operations Control Center (POCC), Southern California TRACON (SCT), the William J. Hughes Technical Center (WJHTC), ARTCCs, and the Combined Control Facility (CCF) in Hawaii. Technology refresh began in FY 2015 and is scheduled to be completed in FY 2022. RMLS Technology Refresh replaces the commercial-off-the-shelf components of the RMLS.

The RMLS is used for generating, quantifying, analyzing, measuring, and reporting maintenance information. It also reports error levels, maintenance responsiveness, and utilization levels of NAS components, systems, and services. The RMLS maintenance information is used by the FAA to:

- Analyze trends and improve performance;
- Make investment decisions and support budget requests for replacement, relocation, or modification of existing equipment;
- Detect supportability problems;
- Evaluate the efficiency and effectiveness of the overall maintenance program; and
- Provide reports to Congress and FAA management.

RMLS improves the effectiveness of Technical Operations Services (Tech Ops) maintenance processes and practices. The RMLS oversees the entire event management life cycle, from generation of the initial event through assignment, updates, and event closure. The National Logging Network (NLN) subsystem performs maintenance monitoring and logging functions; the National Remote Maintenance Monitoring (RMM) Network (NRN) subnetwork performs monitoring and control of NAS devices function. RMLS is responsible for routing status messages to field operators, as well as routing commands to NAS devices.

RMLS Technology Refresh will upgrade core components to meet the agency's growing need for data storage and bandwidth throughput, and will provide security updates for full network separation between the non-NAS (Mission Support) and NAS (Operations).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The RMLS Technology Refresh supports the FAA operational availability performance metric by upgrading the systems used for generating, quantifying, analyzing, measuring, and reporting maintenance information to determine operational availability. RMLS maintains NAS availability by providing warnings of deteriorating system performance and allowing maintenance staff to respond quickly to outages and other performance issues.

Program Plans FY 2018 – Performance Output Goals

- Complete Operational Test & Evaluation for NLN. (APB milestone)
- Complete deployment of the following at NAS Enterprise Security Gateway in Atlanta and Salt Lake City:
 - 12 presentation servers
 - 4 proxy servers
- Complete deployment of the following at POCC, MOCC, AOCC, NOCC:
 - 8 Database (DB) servers
 - 4 Storage array
 - 8 DB switches
 - 16 presentation servers
 - 16 windows management servers
- Complete deployment of the following at POCC, MOCC, AOCC:
 - 12 Monitor/Message Servers
 - 6 DB Servers
 - 3 Trace Servers
 - 6 Preventive Maintenance Servers
 - 6 FAA Telecommunications Infrastructure (FTI)/ NAS Operations Network Switches
- Complete deployment of the following at POCC, MOCC, AOCC:
 - 6 Management Servers
 - 6 Load Balancers
 - 3 Commercially Available Software/Citrix windows
 - Perform site preparation

Program Plans FY 2019 – Performance Output Goals

- Complete key site acceptance test for NLN at first Operations Control Center. (APB milestone)
- Complete design, development, and testing at WJHTC Integration Testing/Operational Testing/Operational Testing 2 for NRN implementation at ARTCCs.

Program Plans FY 2020 – Performance Output Goals

- Complete key site Initial Operational Capability (IOC) for NLN at first Operations Control Center. (APB milestone)
- Complete Operational Test & Evaluation for NRN. (APB milestone)
- Complete deployment of the following at NOCC for the Data Repository/Operations System:
 - 2 Management Servers
 - 3 DB Servers
 - 10 Virtual Machine Container Servers
 - 2 System Management Servers
 - 1 Storage Array
 - 2 DB Switches
 - 2 Core Switches
 - 2 Load Balancers
 - 4 Firewall Appliances w/Intrusion Detection System
 - 1 High Capacity Tape Library
 - 2 Grid Control Servers
 - 2 FTI/ NAS Operations Network Switches

- Complete deployment of the following at Oklahoma City (OKC Training):
 - 2 Racks
 - 2 DB Servers
 - 2 Presentation Servers
 - 10 Virtual Machine Container Servers
 - 2 System Management Servers
 - 2 Core Switches
 - 2 Load Balancers
 - 2 Firewall Appliances w/Intrusion Detection System
 - 5 Monitor/Message Servers
 - 1 Trace Servers
 - 2 Protocol Management Servers
 - 3 FTI/ NAS Operations Network Switches
 - 2 Protocol Converter and Software Licenses
 - 4 Protocol Converter Servers
 - 2 Rack Management Server
 - 2 Network Switches
 - 2 Keyboard Video Mouse (KVM)/Terminal Switch
- Complete deployment of the following at Seattle ARTCC (ZSE):
 - 3 Protocol Converter and Software Licenses
 - 4 Protocol Converter Servers
 - 1 Rack Management Server
 - 4 Network Switches
 - 1 KVM/Terminal Switch
- Complete deployment of the following at Southern California TRACON (SCT), Anchorage ARTCC (ZAN), Honolulu (ZHN), Salt Lake ARTCC (ZLC), Oakland ARTCC (ZOA) and Denver ARTCC (ZDV):
 - 12 Protocol Converter and Software Licenses
 - 18 Protocol Converter Servers
 - 6 Rack Management Server
 - 12 Network Switches
 - 6 KVM/Terminal Switch

Program Plans FY 2021 – Performance Output Goals

- Complete Key site Acceptance Test for NRN at first ARTCC. (APB milestone)
- Complete Key Site Initial Operational Capability (IOC) for NRN at first ARTCC. (APB milestone)
- Achieve In-Service Decision. (APB milestone)
- Complete deployment of eight (8) ARTCC Protocol Converter Racks:
 - 48 Protocol Converter and Software Licenses
 - 8 NAS Operations Network Management Workstations
 - 16 Network Switches
 - 8 KVM/Terminal Switch

Program Plans FY 2022 – Performance Output Goals

- Complete deployment of the remaining 15 ARTCC Protocol Converter Racks:
 - 90 Protocol Converter and Software Licenses
 - 15 NAS Operations Network Management Workstations
 - 30 Network Switches
 - 15 KVM/Terminal Switch
- Complete last site commissioning by September 2022. (APB milestone)

System Implementation Schedule

	2015	2020	2025
Remote Monitoring Logging System (RMLS) Technology Refresh			
RMLS Technology Refresh: FY 2015 - FY 2022	RMLS TR		

B, Automated Maintenance Management System (AMMS), M07.05-01

Program Description

The ability to efficiently manage the maintenance of FAA's equipment and systems is critical to the operation of the NAS. Current stand-alone maintenance systems and processes are labor intensive with limited automated capability. AMMS will allow for the interfacing of maintenance systems through a Service-Oriented Architecture (SOA) environment utilizing System Wide Information Management (SWIM) to create an enterprise infrastructure for sharing data between dispersed maintenance systems. This supports the Risk Based Decision Making initiative through the increased sharing of safety data among FAA organizations. AMMS will develop common enterprise data services for maintenance data and implement data standards for the exchange of data between services, systems and equipment. AMMS will deliver advanced automated maintenance tools that will provide improved data integrity and increased situational awareness, while enabling maintenance practices in support of predictive rather than periodic maintenance.

AMMS will be implemented in segments consisting of a series of data exchanges between services, systems, and equipment. As these interfaces are established, the exchange of data will be standardized, authoritative data sources will be identified and data exchange services through SWIM will be utilized. AMMS will allow existing maintenance systems to evolve and improve current functionality by allowing enterprise access to the following related data categories:

- Maintenance logging Information;
- Event coordination Information;
- Scheduling Information;
- Configuration Management Information;
- Logistics Information;
- Administrative Information;
- Safety Information; and
- Enterprise Monitored NAS Information.

AMMS Segment 1 will focus on improvements to maintenance logging, event coordination, and scheduling functionality that exists within the legacy maintenance tools. The integration of maintenance logs, event coordination data, Flight Check scheduling data, and NOTAM data will be achieved. Air Traffic Control System Specialists, along with Operations Control Center Specialist, will have an enhanced maintenance logging, event coordination, and scheduling tools.

AMMS Segment 1 will improve maintenance capabilities by automating the following:

- Related maintenance logs to a single maintenance event;
- NOTAM data to an associated maintenance event;
- Scheduling of corrective and periodic maintenance activities;
- Coordinating Flight Check schedules and maintenance activities;
- Access to electronic reference data by Air Traffic System Specialists; and
- Data analysis capabilities to enable transition to a Reliability Centered Maintenance philosophy.

AMMS plans to achieve Initial Investment Decision (IID) in FY 2018. Final Investment Decision (FID) is planned in FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Today, Technical Operations faces several critical maintenance challenges as the Agency implements NextGen and service based technologies. Operations Control Center Specialists and Air Traffic System Specialists do not have the required tools needed to provide real-time access to the information needed to maintain and repair NAS services, systems, and equipment. Nor can they efficiently schedule and coordinate maintenance activities.

The AMMS will support operational availability by providing Technical Operations with more timely and accurate information, and improved maintenance tools that will support the Risk Based Decision Making initiative, and enable more effective and efficient maintenance practices.

In order for Technical Operation to continue to maintain an operational availability rating of 99.7%, the implementation of AMMS is required. AMMS will integrate maintenance services, systems and equipment into the enterprise architecture, apply governance towards data exchanges, and provide state of the art tools to maintain the NAS.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the IID:
 - Initial Program Requirements;
 - Business Case Analysis Report;
 - Enterprise Architecture Artifacts;
 - Implementation Strategy and Planning Document (ISPD); and
 - Chief Financial Officer Package.
- Achieve IID.
- Perform engineering activities to complete initial proof of concept platform for demonstration of technical risk reduction and pre-production prototyping of the following key technical components:
 - The event coordination and maintenance logging application;
 - The integration of system interfaces via the SWIM SOA infrastructure;
 - The exchange of maintenance data via the usage of the maintenance data model; and
 - Perform product research assessing the suitability of satisfying AMMS Segment 1 requirements.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the FID:
 - Final Program Requirements;
 - Enterprise Architecture Artifacts;
 - Business Case;
 - ISPD; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID.
- Complete development of the proof of concept platform.

Program Plans FY 2020-2022 – Performance Output Goals

- Output goals will be developed at FID.

2B15, MODE S SERVICE LIFE EXTENSION PROGRAM (SLEP)

FY 2018 Request \$20.9M

- A, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2, S03.01-08
- B, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3, S03.01-13

A, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2, S03.01-08

Program Description

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 uses selective beacon detection technology to provide target data. The Mode S and co-located primary radars provide correlated radar and beacon reports as digital formatted messages and analog video tailored for automation and display systems at TRACON, ARTCC facilities, the U.S. Department of Defense, and other users.

The Mode S SLEP Phase 2 program will implement modifications to the Mode S system to sustain secondary aircraft surveillance in terminal and en route airspace through 2026. The Joint Resources Council approved the Final Investment Decision for the Phase 2 program on June 27, 2012. This program will replace the Beacon Video Reconstitutor with more modern components. Critical Lowest Replaceable Units will be assessed for sustainability in support of the Mode S SLEP Phase 3.

To address interim obsolescence, and supply and support issues, the following will be purchased for depot replenishment:

- Local, Remote and Radar Intelligent Tool Maintenance Terminals;
- Keyboard Cathode Ray Tube; and
- Non-Volatile Memory chips.

The Mode S Program Office is evaluating the depot replenishment of the High Gain Open Planner Array (HGOPA) Antenna based on the FAA Logistic Mode S Sustainment Report dated June 3, 2016. The Mode S Program Office will be conducting an additional HGOPA Antenna Assessment in FY 2017 to determine the requirements for new antenna procurements and/or the number of antennas that can be refurbished to sustain Mode S through 2026. The sustainment of the Mode S system aligns with the NAS Enterprise Architecture and the Surveillance and Broadcast Services Automatic Dependent Surveillance Broadcast back-up strategy. Based on this strategy, the Mode S systems at the 24 long range radar facilities and the top 45 high density terminal facilities will remain in service through 2026.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Currently Mode S systems are functioning at an operational availability of 99.15 percent which does not meet the FAA Performance Metric. Also, the current operational availability of 99.15 percent is below the Mode S specifications of 99.9 percent. Providing for the Mode S service life extension modifications reduces the risk of unscheduled outages and ensures the continuation of service capabilities.

Program Plans FY 2018 – Performance Output Goals

- Complete refurbishment of existing HGOPA antennas for replenishment at FAA Logistics Center, amount to be determined after FY 2017 assessment.

Program Plans FY 2019 – Performance Output Goals

- Complete refurbishment of existing HGOPA antennas at for replenishment FAA Logistics Center, amount to be determined after FY 2017 assessment. (Prior year funding)
- Complete depot replenishment in September 2019. (APB Milestone) (Prior year funding)

Program Plans FY 2020-2022 – Performance Output Goals

- None.

B, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3, S03.01-13

Program Description

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. Mode S systems are co-located with Airport Surveillance Radar Model 9 (ASR-9), ASR-8, and the Common Air Route Surveillance Radar. The Mode S system and the co-located primary radars are capable of providing correlated radar and beacon reports to NAS En Route and terminal automation systems at Terminal Radar Approach Control, Air Route Traffic Control Center facilities, the U.S. Department of Defense, 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.

FAA Logistic Center Mode S Radar Products Division's conducted a Diminishing Manufacturing Sources and Material Shortages 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.

The Mode S SLEP Phase 3 received FAA Joint Resource Council (JRC) Investment Analysis Readiness Decision approval on September 30, 2015. A Market Survey has determined that a competitive procurement to replace 120 LRUs is a cost effective alternative. This strategy was presented and approved by the JRC on December 14, 2016.

A Final Investment Decision (FID) is currently planned in FY 2018. The competitive procurement is anticipated to be awarded in 4th quarter FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Mode S systems are currently functioning at an operational availability of 98.86 percent, which is below the FAA Performance Metric. The planned SLEP modifications will improve the Mode S systems operational availability. The Mode S system is well beyond its expected 20 year life cycle. The Mode S SLEP Phase 3 program identified 11 critical LRUs modifications needed to address obsolescence, end of service life, and diminishing manufacturing sources in order to sustain Mode S operations until 2035.

Program Plans FY 2018 – Performance Output Goals

- Pending FID approval:
 - Obtain Screening Information Request (SIR) Approval
 - Release Final SIR
 - Complete FID Joint Resource Council (JRC) Checklist Items
 - Award Prime Contract
- Achieve FID Approval.

Program Plans FY 2019-2022 – Performance Output Goals

- Output goals will be established at FID

2B16, NEXTGEN – TERMINAL FLIGHT DATA MANAGER (TFDM)

FY 2018 Request \$90.4M

Terminal Flight Data Manager (TFDM) – Core, Segment 1, G06A.03-01

Program Description

The Terminal Flight Data Manager (TFDM) program will deliver to tower ATC and FAA traffic managers NextGen decision support capabilities that integrate flight, surface surveillance, and traffic management information. TFDM will provide an approach 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. The use of Electronic Flight Data and Strips (EFD/EFS) will allow tower controllers to maintain an integrated view of the air traffic environment, improving their situational awareness of airport operations. 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.

Deployment of TFDM will be comprised of the following functions:

- Migration to electronic flight data exchange, electronic flight strips in the tower, and including enhanced tower/TRACON data exchange;
- Enhanced data exchange with flight operators and other airport stakeholders;
- Increased data sharing and Collaborative Decision Making (CDM) based on shared surface situational awareness and automated surface surveillance data; and
- TFDM scheduler/sequencer, including integration of Traffic Flow Management System (TFMS)/Time Based Flow Management (TBFM) information.

As part of the agency's commitment to the NextGen Advisory Committee, the TFDM program deployed some initial capabilities early to select NAS facilities. This achieved a number of benefits for TFDM development, including early industry engagement, achievement of early benefits, and reduction in operational risk. These initial capabilities will be replaced by the production TFDM system.

Early implementation of TFDM consisted of the following:

- Enabled data exchange of additional data elements from the flight operators using the Traffic Flow Management System;
- Deployment of the System Wide Information Management Visualization Tool to provide Surface Situational Awareness (SSA) to TRACON controllers at 11 sites;
- Sustainment of the Phoenix (PHX) Advanced Electronic Flight Strip System (AEFS) prototype and installation of additional AEFS prototypes at approximately 5 sites; Cleveland (CLE), San Francisco (SFO), Las Vegas (LAS), Charlotte (CLT) and Newark (EWR). The AEFS converts paper strips to electronic strips displayed to the controller; and
- Technology refresh of the Electronic Flight Strip Transfer System (EFSTS) at 39 sites. This technology refresh involved only the replacement of the keypads which are used operationally at 39 of the 76 sites with EFSTS systems.

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 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.

Another key component of the TFDM system is the introduction of a surface scheduler/metering capability that 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.

Final Investment Decision (FID) was approved in June 2016 to proceed to contract award and begin solution development and implementation. The prime contract was awarded in June 2016. The program's current implementation plan is based on a two software build approach and deployment to 89 airports from FY 2020 to FY 2028. Build 1 will consist of Electronic Flight Data (EFD); EFD, including EFS in towers, limited SSA on TFMS Traffic Management Unit (TMU) displays in the TRACON, ARTCC, and ATCSCC. Build 2 will consist of Full Functionality TFDM: EFD, including EFS in towers, Surface Surveillance data integration, Full Decision Support Tools (DST) (including surface metering), Traffic Flow Management (TFMS) data exchange and integration, TBFM data exchange and integration SSA on TFMS TMU displays in the TRACON, ARTCC, and ATCSCC.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

TFDM will automate manual processes; integrate existing terminal flight data systems and decision support tools, and provide new decision support capabilities. This will improve ATC coordination and decision making to facilitate more efficient operations and increased airport efficiency. TFDM capabilities will provide multiple NAS benefits, such as reduced surface delay, taxi time, and fuel burn with improved operational and environmental performance that leads to more efficient airport capacity utilization during severe weather and other off-nominal conditions.

Program Plans FY 2018 – Performance Output Goals

- Complete Early User Involvement Events (EUIEs) (APB milestone).
- Complete Critical Design Review (CDR) for Build 2 Development and Integration (APB milestone).
- Complete implementation of the TFDM Test Lab at WJHTC. (APB milestone)
- Complete Implementation of Electronic Flight Strip Transfer System (EFSTS) Key Pack Technology Refresh. (APB milestone).

Program Plans FY 2019 – Performance Output Goals

- Complete Build 1 Development Test (DT). (APB milestone)
- Complete Build 2 EUIEs.

Program Plans FY 2020 – Performance Output Goals

- Complete Build 1 Operational Test (OT). (APB milestone)
- Achieve Build 1 Key-Site Initial Operational Capability (IOC). (APB milestone)
- Conduct Build 1 Independent Operational Assessment (IOA). (APB milestone)
- Achieve Build 1 In Service Decision (ISD). (APB milestone)
- Achieve Build 1 Key-Site Operational Readiness Date (ORD). (APB milestone)
- Complete Build 2 Development Test (DT). (APB milestone)
- Achieve IOC at 4 sites (4 of 89, 4%).

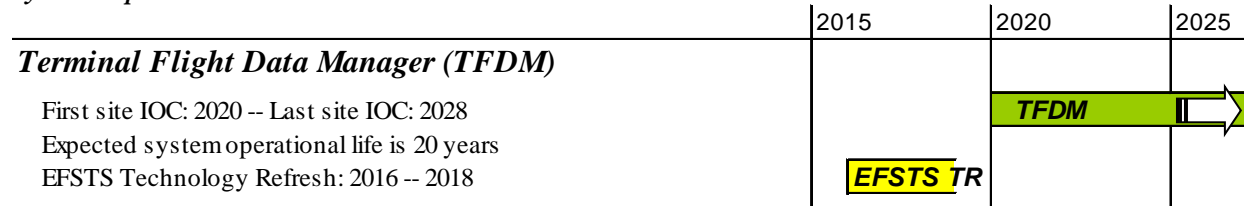
Program Plans FY 2021 – Performance Output Goals

- Complete Build 2 Operational Test (OT). (APB milestone)
- Achieve Build 2 Key-Site Initial Operational Capability (IOC). (APB milestone)
- Conduct Build 2 Independent Operational Assessment (IOA). (APB milestone)
- Achieve Build 2 In Service Decision (ISD). (APB milestone)
- Complete Build 2 Key-Site Operational Readiness Date (ORD). (APB milestone)
- Achieve IOC at 10 sites (14 of 89, 16%)

Program Plans FY 2022 – Performance Output Goals

- Achieve IOC at 11 sites (25 of 89, 28%)
- Achieve Operational Readiness Date (ORD) at site 22. (APB milestone)

System Implementation Schedule



2B17, NAS VOICE RECORDER PROGRAM (NVRP)

FY 2018 Request \$5.0M

NAS Voice Recorder Program (NVRP), C23.02-01

Program Description

The NAS Voice Recorder Program (NVRP) will replace digital voice recorders to comply with new requirements in the Air Traffic Organization (ATO) safety orders. These orders require risk based monitoring of air traffic operational safety events and were not in effect when the Voice Recorder Replacement Program, Digital Audio Legal Recorder was implemented. NVRP will reduce operational costs, meet increasing demand for improved access to audio data, and provide more expeditious remote audio access. These new recorders will also provide increased recording capacity, recording of Voice over Intranet Protocol (VoIP) telephones, and connectivity to the FAA Telecommunications Infrastructure (FTI) enterprise Network Time Protocol.

Voice recorders provide the legally accepted recording capability for conversations between air traffic controllers, pilots, and ground-based air traffic facilities, and are used in all ATC facilities. These recordings are used in the investigation of accidents and incidents and also in the routine evaluation of ATC operations. As the voice recorder technology and voice recorder requirements have evolved, earlier digital voice recorders are now experiencing obsolescence and supportability issues. The typical maximum operational life of a Commercial-Off-the-Shelf (COTS) voice recorder system is 10 years. There are over 460 voice recorders currently operating in ATC facilities which were deployed between 2007 and 2015; therefore, these systems will start to reach the end of their service life in 2017.

A Final Investment Decision (FID) for NVRP is planned for the 1st quarter of FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Voice recorders are used by the FAA for recording conversations between air traffic controllers, pilots, and other personnel at ground-based air traffic facilities. Recorded conversations are used in the investigation of accidents and incidents and in the routine evaluation of ATC operations. Information from voice recorders is also used for Quality Assurance as part of risk analysis and Quality Control to monitor and measure compliance with regulations and to identify issues for corrective action. The recorded data from the voice recorders provide 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.

Program Plans FY 2018 – Performance Output Goals

- Develop products in support of the FID, which may include:
 - Final Program Requirements documentation;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).

Program Plans FY 2019 – Performance Output Goals

- Achieve FID.
- Deliver approximately 18 systems; waterfall to be determined at FID.

Program Plans FY 2020 – Performance Output Goals

- Deliver approximately 35 systems; waterfall to be determined at FID.

Program Plans FY 2021 – Performance Output Goals

- Deliver approximately 46 systems; waterfall to be determined at FID.

Program Plans FY 2022 – Performance Output Goals

- Deliver approximately 75 systems; waterfall to be determined at FID.

2B18, INTEGRATED TERMINAL WEATHER SYSTEM (ITWS) SUSTAINMENT

FY 2018 Request \$1.0M

Integrated Terminal Weather System (ITWS) – Sustainment & Disposition, W07.01-02

Program Description

The ITWS program provides air traffic managers with graphic, full-color displays of essential weather information affecting major U.S. airports. ITWS integrates weather data from a number of sources and provides a single, easily used and understood display of supported products. ITWS depicts the current weather and generates short-term forecasts of terminal weather through the integration of data from FAA and National Weather Service sensors and systems as well as from aircraft in flight. There are 34 ITWS sites that provide weather information to 75 airports.

In 2010, a supportability study concluded the FAA would be unable to sustain the current generation of ITWS Weather Products after 2015 without a technology refresh. Technology refresh of ITWS would include replacement of Commercial Off-The-Shelf (COTS) system components, including processors, displays, computer operating systems, and commercially available software, to ensure the continued supportability of ITWS through 2015. A technology refresh would also enable ITWS to connect with the NextGen Weather Processor (NWP), the Common Support Services–Weather (CSS-Wx) system, and other NAS users such as airport authorities, airlines, etc. to permit seamless interoperability and common situational awareness in support of collaborative decision-making.

In 2013, it was determined that legacy ITWS could be sustained until 2018 with the purchase of additional, refurbished hardware. A scheduled 2014 Final Investment Decision (FID) for the planned technology refresh of ITWS was delayed pending the outcome of the FID for NWP and CSS-Wx. In March 2015, the Joint Resources Council approved the final investment decisions for NWP and CSS-Wx potentially negating the need for a full technology refresh of ITWS. The ITWS program office developed and presented a plan and budget to the JRC for sustaining ITWS until May 2021 when it is expected to be replaced by NWP. This date is based upon the APB milestone for commissioning the first NWP site; and if successful, ITWS decommissioning will begin at that time.

The ITWS program office is funding a lifetime buy of all necessary and available spare parts of the legacy hardware to sustain the current system until it is replaced by NWP. The ITWS program will also fund a contingency plan to mitigate any potential accelerated hardware failures. This effort consists of the adaptation of ITWS software to a new hardware platform, including key-site testing, but without deployment to the NAS. In the event that the legacy ITWS

hardware cannot be sustained until NWP is commissioned, hardware for full replacement will need to be procured and deployed to all ITWS locations; requiring additional funds.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

ITWS sustainment will support the Performance Metric for operational availability by ensuring legacy ITWS equipment is kept fully operational through 2021. The specification for ITWS requires at least 0.999815 availability which has been maintained at all commissioned sites; including 26 of the 30 core airports where ITWS is currently installed. The planned lifetime buy of spare parts and the software port to a new platform will ensure availability is maintained.

Program Plans FY 2018 – Performance Output Goals

- Complete ITWS Software adaptation to a new platform for ITWS Product Generator.
- Complete Key site testing of the Situation Display Workstation.

Program Plans FY 2019 – Performance Output Goals

- Complete Key site testing of the full ITWS platform.

Program Plans FY 2020-2022 – Performance Output Goals

- None.

2B19, NEXTGEN – PERFORMANCE BASED NAVIGATION & METROPLEX PORTFOLIO

FY 2018 Request \$20.0M

- A, NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP), G05N.01-01
- B, NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN) Strategy, G01N.01-02

A, NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP), G05N.01-01

Program Description

NextGen Performance Based Navigation (PBN) – Metroplex RNAV/Required Navigation Performance (RNP) will develop procedures at Metroplexes to improve airspace efficiency. The Airspace Optimization Group integrates airspace design and associated activities including traffic flow analysis, arrival and departure route design and procedures optimization, providing a framework for developing PBN initiatives. Optimizing airspace use and associated development of procedures in Metroplexes includes:

- Examining the use of additional transition access/egress points to/from terminal airspace not tied to ground-based navigation aids;
- Developing and implementing optimized arrival and departure procedures;
- Integrating procedures to decouple conflicting operations to and from primary and secondary/satellite airports serviced by the same complex terminal airspace; and if needed,
- Developing routes through congested airspace to create more efficient routes between major metropolitan areas.

Development of RNAV and RNP routes and procedures will address RTCA recommendations, integrates industry priorities to maximize benefits (via the NextGen Advisory committee and NextGen Integration Working Group), and accelerates NextGen concepts.

Optimization of airspace and procedures using quantitative and qualitative metrics target specific Metroplex areas that have been designated as high priority using criteria established by FAA with input from RTCA. The current program plan will address up to 12 Metroplexes located in unique metropolitan areas. The Metroplex approach began in FY 2010 and will be completed at the selected locations by FY 2021. Among these 12 Metroplexes are the North Texas Metroplex (consisting of one of the core airports (Dallas/Fort-Worth (DFW)) and one regional airport, Dallas Love Field Airport (DAL) and satellite airports) and combined metropolitan areas such as the Central and Southern Florida Metroplex (consisting of multiple core airports (Orlando (MCO), Miami (MIA), Tampa (TPA), Fort Lauderdale (FLL)) as well as regional and satellite airports). The Central and Southern Florida Metroplex is being addressed as a single project to take advantage of overlapping airspace. Las Vegas was added as the 12th Metroplex location. Results from the Study Team guide the design and implementation of those procedures that have the highest benefits. The Design and Evaluation Team efforts include analyses and simulations, assessment of alternatives, and modeling of projected airspace and procedures benefits. These efforts include the following:

- **Study and Scoping:** The Study Phase is conducted by study teams that identify issues and propose potential solutions through facility and industry interface meetings. Industry representation is achieved using lead operator representatives. 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 performs detailed Integrated Airspace and Procedures design work. The work conducted in this phase uses the results of the study teams and is conducted by a Design and Implementation (D&I) team. Industry representation is achieved using lead operator representatives. Human-in-the-Loop simulations and other design analyses may also be performed.
- **Evaluation:** The Evaluation Phase is the second stage conducted by the D&I team. It includes all necessary operational modeling, Safety Management System analyses, and environmental reviews. Industry representation is achieved using lead operator representatives. Analyses conducted during the Design Phase may continue into the Evaluation Phase.
- **Implementation and Training:** The Implementation Phase is the last part of the Optimization of Airspace and Procedures in the Metroplex process conducted by the D&I team. This phase includes all steps required for implementation of the Metroplex project including flight inspections, publishing procedures, planning and executing training. Industry representation is achieved using lead operator representatives.
- **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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 6 – Optimize airspace and Performance Based Navigation (PBN) procedures to improve efficiency an average of 10 percent across core airports by 2018. (FAA Business Planning Metric)*

Relationship to Performance Metric

Developing PBN in Metroplex airspace will allow more efficient use of airspace and improve arrival and departure flows. Metroplex solutions are focused on optimizing procedures and traffic flows and may include airspace structure changes to support optimized routings. Specific operational changes include converting conventional procedures to

PBN, removing level-offs on arrivals, segregating arrival routes to deconflict traffic flows, adding departure points, expediting departures, adding new high-altitude PBN routes, and realigning airspace to support those changes.

Program Plans FY 2018 – Performance Output Goals

- Complete the Evaluation Phase at one Metroplex location (Cleveland/Detroit).
- Complete Post-Implementation Review and Modifications activities at one Metroplex project (Southern California).

Program Plans FY 2019 – Performance Output Goals

- Complete the Evaluation Phase at one Metroplex location (Denver).

Program Plans FY 2020 – Performance Output Goals

- Complete the Evaluation Phase at two Metroplex locations (Florida and Las Vegas). (Prior year funding)
- Complete the Implementation Phase at two Metroplex locations (Denver and Cleveland/Detroit). (Prior year funding)
- Completion of Post-Implementation Phase at two Metroplex locations (Denver and Cleveland/Detroit). (Prior year funding)

Program Plans FY 2021 – Performance Output Goals

- Complete the Implementation Phase at two Metroplex locations (Florida and Las Vegas). (Prior year funding)
- Completion of Post-Implementation Phase at two Metroplex locations (Florida, and Las Vegas). (Prior year funding)

Program Plans FY 2022 – Performance Output Goals

- None.

B, NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN) Strategy, G01N.01-02

Program Description

The NextGen DME program will expand DME coverage in En Route and selected Terminal Airspace to provide a resilient, complimentary navigation service to enable DME/DME Area Navigation (RNAV) aircraft, without Inertial Reference Unit (IRU), to continue Performance Based Navigation (PBN) operations during Global Navigation Satellite Service (GNSS) disruptions.

The NextGen DME program will provide the following benefits:

- Aircraft equipped with RNAV using multiple DMEs (called DME/DME) will continue PBN operations in the event of a GNSS outage;
- Sufficient redundancy will be provided to enable DME/DME aircraft to continue flying PBN procedures in the event of single (critical) DME failures;
- RNAV service will be available to DME/DME RNAV aircraft without the need to carry an IRU; and
- Pilot and controller workload increase will be minimized during GNSS service disruptions, while maintaining PBN capacity and efficiency benefits.

In order to achieve the above benefits, approximately 176 new DMEs are required and approximately 50 existing DMEs with limited capacity need to be replaced. Existing DMEs (approximately 100) that are not needed for the program will be targeted for discontinuance.

The PBN NAS Navigation Strategy identifies performance milestones to provide DME/DME coverage for En Route and Terminal airspace as follows:

- Provide DME/DME coverage, without IRU, and fill redundancy gaps in Class A airspace by 2020.
- Provide DME/DME coverage, without IRU, and fill redundancy gaps for Navigation Service Group (NSG) one and select NSG two airports by 2025.

The NextGen DME program has the following Joint Resources Council (JRC) acquisition decision milestones:

- Achieved JRC Investment Analysis Readiness Decision (IARD) on September 21, 2016
- Final Investment Decision (FID) – Phase 1 – September 2017
- FID – Phase 2 – September 2022

The milestones leading up to FID are conducted and captured under the NextGen Navigation Engineering program, G06N.01-03. Implementation of new and replacement DMEs will be conducted by this program.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Expanding DME/DME RNAV service across the NAS will enable aircraft to continue PBN operations during GNSS disruptions, preventing navigation-based negative impacts to capacity and efficiency benefits at the core airports during arrivals and departures. The NextGen DME program supports the PBN NAS Navigation Strategy by providing a resilient navigation service to enable aircraft to continue PBN operations during a GNSS disruption.

The PBN NAS Navigation Strategy – 2016 provides the foundation for transitioning the NAS to PBN and the requirement for a resilient navigation infrastructure. Resiliency is the ability of the NAS to maintain safety while sustaining an acceptable level of service during system failure scenarios or degraded facility conditions and prevent or mitigate impact to air traffic operations. Within the timeframe of this strategy, FAA will retain and expand the DME infrastructure as necessary to support continued PBN operations and maintain a rationalized network of ground-based navigation equipment to ensure safety for all NAS users.

Program Plans FY 2018 – Performance Output Goals

En Route:

- Procure 4 DMEs for installation.

Terminal:

- Procure 5 DMEs for installation.

Program Plans FY 2019 – Performance Output Goals

En Route:

- Procure 5 DMEs for installation
- Commission 4 DME sites.

Terminal:

- Procure 7 DMEs for installation.
- Commission 5 DME sites.

Program Plans FY 2020 – Performance Output Goals

En Route:

- Commission 5 DME sites.

Terminal:

- Procure 7 DMEs for installation.
- Commission 7 DME sites.

Program Plans FY 2021 – Performance Output Goals

Terminal:

- Procure 10 DMEs for installation.
- Commission 7 DME sites.

Program Plans FY 2022 – Performance Output Goals

Terminal:

- Procure 17 DMEs for installation.
- Commission 6 DME sites.

C: Flight Service Programs

2C01, AVIATION SURFACE WEATHER OBSERVATION SYSTEM

FY 2018 Request \$10.0M

Aviation Surface Weather Observation Network (ASWON) – Technology Refresh, W01.03-01

Program Description

The Aviation Surface Weather Observation Network (ASWON) is a portfolio program that consists of the Automated Surface Observing System (ASOS), Automated Weather Observation System (AWOS), Automated Weather Sensor Systems (AWSS), Stand Alone Weather Sensors, Digital Altimeter Setting Indicator (DASI), F-420 Wind Sensor, and the AWOS Data Acquisition System (ADAS).

All of these systems, except the ADAS, are located at airports and measure and report weather conditions including temperature, barometric pressure, visibility, precipitation type and amount, cloud height and coverage, and wind speed and direction. The ADAS, located in FAA En Route centers, accepts weather data from ASOS, AWSS, and AWOS and retransmits the data to the Integrated Terminal Weather System and the Weather and Radar Processor.

The ASWON Technology Refresh program will provide compatible technology upgrades and/or replacements to the five legacy ASWON systems (ASOS, AWOS, AWSS, DASI, and F-420) which are experiencing obsolescence, supportability, and maintainability issues. This technology refresh effort will enable these systems to continue providing weather information to support the safe operation of the NAS. Successful implementation of technology upgrades will also result in a common hardware platform and software baseline that will reduce costs associated with development, logistics support, and software maintenance.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

ASWON Technology Refresh supports operational availability by replacing obsolete and unsupportable equipment experiencing increasing failure rates. Continued failures of weather sensing equipment will result in a loss of ASWON services and subsequent inability to maintain current operational availability levels of 99.7%.

Program Plans FY 2018 – Performance Output Goals

- Install 70 F-420 Technology Refresh mods (120 of 210, 57%).
- Install 70 DASI Technology Refresh mods (70 of 180, 39%).
- Install 50 ASOS Technology Refresh mods (500 of 571, 9%).

Program Plans FY 2019 – Performance Output Goals

- Install 90 F-420 Technology Refresh mods (210 of 210, 100%).
- Complete F-420 Technology Refresh. (APB milestone)
- Install 110 DASI Technology Refresh mods (180 of 180, 100%).
- Complete DASI Technology Refresh. (APB milestone)
- Install 200 ASOS Technology Refresh mods (250 of 571, 44%).

Program Plans FY 2020 – Performance Output Goals

- Install 321 ASOS Technology Refresh mods (571 of 571, 100%).
- Install ASOS Technology Refresh mods at all sites. (APB milestone)

Program Plans FY 2021-2022 – Performance Output Goals

- None.

System Implementation Schedule

	2015	2020	2025
Aviation Surface Weather Observation Network (ASWON) – Technology Refresh			
First site 2014 -- Last site 2020		ASWON TR	
AWSS Technology Refresh: First site 2014 -- Last site September 2016		AWSS TR	
AWOS Technology Refresh: First site 2016 -- Last site September 2017		AWOS TR	
F-420 Technology Refresh: First site 2017 -- Last site September 2019		F-420 TR	
DASI Technology Refresh: First site 2018 -- Last site September 2019		DASI TR	
ASOS Technology Refresh: First site 2018 -- Last site September 2020		ASOS TR	

2C02, FUTURE FLIGHT SERVICES PROGRAM (FFSP)

FY 2018 Request \$14.0M

Future Flight Services Program, A34.01-01

Program Description

The FAA provides a variety of flight services to the general aviation (GA) community within the Continental US, Puerto Rico, Alaska and Hawaii. Services include pre-flight and in-flight flight planning, flight plan filing, and weather briefing. Additional services include:

- Visual Flight Rules search and rescue operations
- Emergency services to aircraft in distress
- Weather Observation Entry
- Notices to Airmen (NOTAM) coordination, entry and dissemination
- Security related to Special Flight Rules Area / Air Defense Identification Zone / Flight Restricted Zone Flight Plans
- Instrument Flight Rules clearance relay
- Pilot weather report (PIREP) entry

- Instrument Flight Plans and Services provided to the Department of Defense

Over the past decade, emerging technologies in communications, personal computing, and mobile device capabilities have provided opportunities to deliver flight service capabilities more efficiently to stakeholders. User preferences and demands are reflected by the continuing decline in the use of human assisted-services as users take advantage of automated and enhanced technologies (e.g., integrated weather products, electronic flight bags) available through the FAA and the private sector. The Future Flight Services Program (FFSP) will seek to:

- Modernize service delivery methods through the use of a contract structure that will encourage and incentivize continuous innovation, improvement, and cost reduction while providing flight services that meet or exceeds efficiency and safety objectives;
- Continuously assess and adjust flight services based on changes in user needs and performance feedback;
- Leverage and integrate new technologies as they mature;
- Incorporate FAA Next Generation Air Transportation System (NextGen) capabilities as they become available;
- Provide a flexible, scalable, and net centric voice communications system using Voice over Internet Protocol (VoIP) technology; and
- Incrementally enable the commercial market to provide flight services delivery options (e.g. electronic flight bags), if feasible.

The FFSP will provide flight services to the GA community within the Continental US, Puerto Rico, and Hawaii and will seek to expand the web portion of flight services and reduce human delivery of flight services to the greatest extent possible. FFSP will seek to discontinue obsolete services and activities as well as redundant activities provided by other FAA service organizations. This will in turn reduce the overall cost associated with delivering flight services and increase the efficiency of service delivery.

Currently, flight services are delivered by a combination of systems and contractor provided services:

- The Automated Flight Service Station (AFSS) contract with Lockheed Martin Corporation provides the full range of flight services to users in the continental United States, Hawaii and Puerto Rico. The contract provides certified Flight Service Specialists to deliver pre-flight, in-flight, and flight data services (e.g. weather observation entry, PIREP entry, management of the NOTAM system) to users via telephone and radios. Lockheed Martin provides personnel, systems, equipment and facilities to provide flight services under the AFSS contract. The FAA provides Lockheed Martin with access to, and use of its air-to-ground radio and telecommunications infrastructure to facilitate in-flight communications.
- The Direct User Access Terminal Service (DUATS) contracts with CSRA, LLC and Lockheed Martin Corporation, provide users with internet-based pre-flight services (self-briefings and flight plan filing) without the aid of a flight service specialist.
- The Operational and Supportability Implementation System (OASIS) contract with Harris Corporation provides an automation system for the Alaska flight service facilities that enables FAA flight service specialists to provide weather briefing and flight planning assistance to general aviation pilots, emergency services, law enforcement support, regulatory information and other services.

FFSP will subsume AFSS and DUATS scope. The AFSS contract period of performance will expire in September 2019 and the existing DUATS contract period of performance will expire in May 2020. The new service provider will need to establish new flight service facilities; develop, integrate, test and deploy automation and voice communication systems; and hire, train and certify new flight service specialists. Parallel operations will be required to allow for transition from the incumbent to the non-incumbent service provider.

This program supports the transition to a new flight service contract, planned for award in FY 2018. The primary objective of the program is to use automation to improve the delivery of flight service and reduce the overall cost to the FAA. The Initial Investment Decision was approved in June 2016 and the Final Investment Decision (FID) is planned in FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter.*
- *FAA Performance Metric 2 – Reduce the general aviation fatal accident rate to no more than one (1) fatal accident per 100,000 flight hours by 2018.*

Relationship to Performance Metric

The program will enhance GA and NAS users' safety awareness by providing more accurate and efficient updates to changing weather conditions, allowing pilots to make better decisions regarding how to avoid hazardous weather. FFSP will also seek to enable faster initiation of Search and Rescue.

Program Plans FY 2018 – Performance Output Goals

- Finish development of FID business case documentation.
- Conclude Investment Planning and Analysis and senior management review.
- Achieve a FID.
- Award new Future Flight Services contract.

Program Plans FY 2019 – Performance Output Goals

- Transition service provision to a new contract that incentivizes continuous innovation, improvement, and cost reduction while providing flight services that meet or exceed efficiency and safety objectives
 - Achieve Initial Operational Capability.
 - Discontinue the DUATS contract.
 - Pursue ongoing service modernization and cost savings in collaboration with stakeholders.
- Additional output goals will be developed at FID based on vendor proposals.

Program Plans FY 2020 – Performance Output Goals

- Transition service provision to a new contract that incentivizes continuous innovation, improvement, and cost reduction while providing flight services that meet or exceed efficiency and safety objectives
 - Achieve Full Operational Capability.
 - Discontinue the AFSS contract.
 - Pursue ongoing service modernization and cost savings in collaboration with stakeholders.
- Additional output goals will be developed at FID based on vendor proposals.

Program Plans FY 2021 – Performance Output Goals

- Output goals will be developed at FID based on vendor proposals.

Program Plans FY 2022 – Performance Output Goals

- None.

2C03, ALASKA FLIGHT SERVICE FACILITY MODERNIZATION (AFSFM)

FY 2018 Request \$2.7M

Alaska Flight Service Facility Modernization (AFSFM), F05.04-02

Program Description

The AFSFM program modernizes or replaces Flight Service facilities in Alaska to ensure security, sustainment, and the continuity of Flight Service operations, and adaptability to geographical changes in service demand. Over a third of the 17 existing Alaska Flight Service facilities were constructed in the 1970's and now require extensive renovations to meet current building codes, fire life safety, Architectural Barriers Act Accessibility Standard, and electrical standards. The Flight Service buildings must be updated to meet Occupational Safety and Health Administration (OSHA) and Americans with Disabilities Act requirements and the electrical and safety systems will be modernized

to ensure they meet Industry Standards. Recent technology advancements, commercial business opportunities, and other socioeconomic factors drive the demand for flight services. The AFSFM program will replace existing Flight Service Stations (FSS) and/or relocate flight service operations capability to locations based on an assessment of future service demand.

The program is also responsible for correcting deficiencies at FSS locations such as substandard lightning, grounding and bonding protection, electrical systems, and/or heating and cooling systems that could disrupt Flight Service operations. These deficiencies could also endanger FAA personnel health and safety and increase the risk of service outages.

The AFSFM program team, comprised of Flight Service, Alaska Technical Operations, and Western Service Center personnel, conducts on-going analysis of Alaska facilities to identify and prioritize actions required to maintain and sustain them. Site plans and schedules are developed for proposed projects at each facility.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The AFSFM program will directly contribute to the FAA's Strategic Priority to Deliver Benefits through Technology and Infrastructure by sustaining operational availability and capabilities of existing Alaska Flight Services Facilities. This will be accomplished by completing required upgrades to the facilities and addressing any quality of life issues that may affect on-site FAA personnel.

Program Plans FY 2018 – Performance Output Goals

These projects may be superseded if a higher priority need is entered into the Corporate Work Plan (CWP) prior to its start:

- Upgrade Heating System Boilers at Fairbanks FSS.
- Complete roof replacement at Deadhorse FSS.
- Complete roof replacement at Talkeetna FSS.
- Complete refurbishment of the Heating, Ventilation, and Air Conditioning (HVAC) system at Deadhorse FSS.

Program Plans FY 2019 – Performance Output Goals

These projects may be superseded if a higher priority need is entered into the CWP prior to its start:

- Complete roof replacement at Nome FSS.
- Complete roof replacement at Kotzebue FSS.
- Complete refurbishment of the HVAC system at Nome FSS.

Program Plans FY 2020 – Performance Output Goals

These projects may be superseded if a higher priority need is entered into the CWP prior to its start:

- Refurbish/upgrade building interior (break room, pilot briefing room, rest rooms, etc.) at Deadhorse FSS.
- Complete refurbishment of the HVAC system at Kotzebue FSS.

Program Plans FY 2021 – Performance Output Goals

These projects may be superseded if a higher priority need is entered into the CWP prior to its start:

- Refurbish/upgrade building interior (break room, pilot briefing room, rest rooms, etc.) at Kotzebue and Nome FSSs.
- Replace Lighting in the Operations Area at Juneau FSS.
- Upgrade HVAC System at Talkeetna FSS.

Program Plans FY 2022 – Performance Output Goals

These projects may be superseded if a higher priority need is entered into the CWP prior to its start:

- Refurbish/upgrade building interior (break room, pilot briefing room, rest rooms, etc.) Homer, Barrow and McGrath FSSs.
- Upgrade HVAC System in the Equipment Room at the Barrow FSS.
- Upgrade Heating System Boilers at Juneau FSS.

2C04, WEATHER CAMERA PROGRAM

FY 2018 Request \$1.3M

Weather Camera Program – Future Segments, M08.31-02

Program Description

The Weather Camera Program manages the operational Weather Cameras installed at airports and strategic en route locations in Alaska to provide pilots, dispatchers, and flight service station specialists with real-time video weather information. The program office ensures that weather camera services are operational and readily accessible to pilots and aviation users. It provides camera operations restoral activities; logistics management, and technician training, and it manages all of its procurement and contract requirements including telecommunication services and site facility leases and agreements. Images are updated every 10 minutes and stored for six hours to be used in a loop function for weather trending analysis by pilots. These images are made available through a user-friendly, web-enabled application: <http://avcams.faa.gov>. In addition to improving aviation safety benefits, the cameras improve operator efficiency by reducing unnecessary flight time caused by weather-related deviations while in-flight.

The Program Office manages a total of 230 FAA owned camera facilities in the state of Alaska and is actively using non-FAA-owned camera images to supplement the expansion of its services to areas where FAA owned cameras do not exist. This approach to expanding camera services is being called Third Party Image Hosting. There are currently 9 Third Party Image Hosting camera facilities in Alaska and 120 Canadian owned camera facilities that are being used to support General Aviation operations and Alaska FAA Flight Services for pilots who fly routes from Alaska to the CONUS through Canada.

In 2017, the Weather Camera Program Office will request a Strategy Decision from the JRC to expand camera services to aviators that fly throughout the CONUS and Hawaii by using Third Party Image Hosting. By expanding third party weather imaging for CONUS and Hawaii on the program's website, it is expected that aviation communities in these areas will also realize benefits in flight safety, decision-making, and efficiency. The website will provide camera images from state DOT owned airports and other critical en route locations such as mountain passes and other areas where weather-related accidents and flight interruptions are known to occur.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 2 – Reduce the general aviation fatal accident rate to no more than one (1) fatal accident per 100,000 flight hours by 2018.*

Relationship to Performance Metric

The Weather Camera Program contributes to reducing the general aviation fatal accident rate to no more than one fatal accident per 100,000 operational flight hours by reducing the number of weather-related aviation accidents and fatalities. The Weather Camera Program works to improve aviation safety and efficiencies by providing current visual weather information to aviation pilots and users by delivering real-time camera images. These images are designated as an FAA Advisory weather product to be used for enhanced situational awareness and provide pilots, dispatchers and Flight Service Station Specialists with up-to-date weather conditions at airports, mountain passes, and strategic locations where weather is known to be a potential hazard. When combined with other available weather information products, such as Meteorological Aerodrome Reports, these weather camera images become a compelling "go or no-go" flight decision tool. The camera images are made available free on the public website <http://avcams.faa.gov>.

The National Transportation Safety Board (NTSB) has recognized the safety benefits being provided to general aviation by the Weather Camera Program. On August 15, 2013, the NTSB submitted to the FAA, a formal Safety Recommendation, A-13-025 through -027, to implement weather camera services throughout the CONUS and Hawaii in order to help reduce the number of weather related general aviation accidents.

Program Plans FY 2018 – Performance Output Goals

- Pending JRC Strategy Decision:
 - Expand the Third Party Image Hosting initiative by adding non-FAA owned images to the new website; the number will be determined in FY 2017.
 - Phase 1 Develop and Procure Cloud Service – Migrate Weather Camera Public Servers and Internet services to Cloud Services.

Program Plans FY 2019 – Performance Output Goals

- Pending JRC Strategy Decision:
 - Expand the Third Party Image Hosting initiative by adding non-FAA images to the new website; the number will be determined in FY 2018.
 - Phase 2 Develop and Procure Cloud Service – Migrate Weather Camera Internal Servers and telecommunication services to Cloud Services.

Program Plans FY 2020-2022 – Performance Output Goals

- None.

D: Landing and Navigation Aids Programs

2D01, VHF OMNIDIRECTIONAL RADIO RANGE (VOR) WITH DISTANCE MEASURING EQUIPMENT (DME)

FY 2018 Request \$11.0M

- A, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program – Phase 1, N06.01-01 / X, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program – Phase 2, N06.01-02
- B, Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC), N06.00-00

A, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program – Phase 1, N06.01-01 / X, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program – Phase 2, N06.01-02

Program Description

The VOR Minimum Operational Network (MON) Implementation Program will perform the work required to downsize the VOR network to the minimum required for use as a backup navigation system in the event of an unplanned Global Positioning System (GPS) localized outage and allow aircraft not equipped with GPS to navigate and land under Instrument Flight Rules (IFR). This program supports the NAS transition from the current VOR airways to Performance Based Navigation (PBN) consistent with NextGen goals.

NextGen initiatives rely on PBN enabled by GPS and Distance Measuring Equipment (DME). PBN consists of Area Navigation (RNAV) and Required Navigation Performance (RNP) capabilities. PBN provides more efficient use of

en route and terminal airspace to improve capacity and efficiency. This transition strategy is described in the Federal Register Notice/Volume 76, Number 241, which was approved for public release in December 2011.

The VOR MON will enable pilots to:

- Revert from PBN to VOR navigation;
- Tune and identify a VOR at an altitude of 5,000 feet above ground level;
- Navigate using VOR procedures through a GPS outage area;
- Navigate using VOR procedures to a MON airport within 100 nautical miles to an ILS or VOR instrument approach for landing; and
- Navigate along VOR Airways especially in mountainous terrain where surveillance services are not available.

This program's final policy is described in the Federal Register Notice/Volume 81, Number 143 and intends to transition the legacy network of approximately 957 VORs to a MON of approximately 649 VORs by 2025.

The Investment Analysis Readiness Decision (IARD) was approved in March 2014. The program consists of two Phases.

VOR MON Implementation Program – Phase 1 (N06.01-01):

Final Investment Decision (FID) was approved on September 30, 2015 to discontinue approximately 74 VORs by the end of September 2020.

VOR MON Implementation Program – Phase 2 (N06.01-02):

Phase 2 is scheduled for FID September 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 6 – Optimize airspace and Performance Based Navigation (PBN) procedures to improve efficiency an average of 10 percent across core airports by 2018. (FAA Business Planning Metric)*

Relationship to Performance Metric

The FAA is transitioning from the current navigation system enabled by VOR to PBN using RNAV and RNP instrument flight procedures. RNAV and RNP navigation relies on GPS, so the need for VORs will decline as the transition to PBN progresses; however, a MON needs to be maintained so pilots have a backup capability if GPS is unavailable. The FAA is planning to implement a layered backup navigation strategy relying on DME/DME navigation as an RNAV backup and VOR MON as a conventional backup navigation capability to provide service in case of a GPS outage.

Program Plans FY 2018 – Performance Output Goals

VOR MON Implementation Program – Phase 1 (N06.01-01):

- Complete the discontinuance of four VORs.
- Perform removal, redesign, or replacement of VOR instrument flight procedures and routes tied to VORs planned for discontinuance.
- Provide support to the Services Centers in conducting Safety Risk Management (SRM) activities required prior to VOR discontinuance.
- Conduct Service Volume flight checks on VORs.
- Develop draft of the following products in support of the VOR MON Program Phase 2 FID.
 - Final Program Requirements (FPR) Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document (ISPD); and
 - Program Execution Plan

VOR MON Implementation Program – Phase 2 (N06.01-02):

- None.

Program Plans FY 2019 – Performance Output Goals

VOR MON Implementation Program – Phase 1 (N06.01-01):

- Complete the discontinuance of 25 VORs.
- Perform removal, redesign, or replacement of VOR instrument flight procedures and routes tied to VORs planned for discontinuance.
- Provide support to the Services Centers in conducting SRM activities required prior to VOR discontinuance.
- Conduct Service Volume flight checks on VORs.

VOR MON Implementation Program – Phase 2 (N06.01-02):

- None.

Program Plans FY 2020 – Performance Output Goals

VOR MON Implementation Program – Phase 1 (N06.01-01):

- Complete the discontinuance of 36 VORs.
- Perform removal, redesign, or replacement of VOR instrument flight procedures and routes tied to VORs planned for discontinuance.
- Provide support to the Services Centers in conducting SRM activities required prior to VOR discontinuance.
- Conduct Service Volume flight checks on VORs.
- Develop the final products in support of VOR MON Program Phase 2 FID.
 - FPR Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final ISPD; and
 - Program Execution Plan.
- Achieve the VOR MON Phase 2 FID.

VOR MON Implementation Program – Phase 2 (N06.01-02):

- None.

Program Plans FY 2021 – Performance Output Goals

VOR MON Implementation Program – Phase 1 (N06.01-01):

- None.

VOR MON Implementation Program – Phase 2 (N06.01-02):

- Complete the discontinuance of 46 VORs pending Phase 2 FID approval.
- Perform removal, redesign, or replacement of VOR instrument flight procedures and routes tied to VORs planned for discontinuance.
- Provide support to the Services Centers in conducting SRM activities required prior to VOR discontinuance.
- Conduct Service Volume flight checks on VORs.

Program Plans FY 2022 – Performance Output Goals

VOR MON Implementation Program – Phase 1 (N06.01-01):

- None.

VOR MON Implementation Program – Phase 2 (N06.01-02):

- Complete the discontinuance of 47 VORs pending Phase 2 FID approval.
- Perform removal, redesign, or replacement of VOR instrument flight procedures and routes tied to VORs planned for discontinuance.
- Provide support to the Services Centers in conducting SRM activities required prior to VOR discontinuance.
- Conduct Service Volume flight checks on VORs.

B, Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC), N06.00-00

Program Description

This program replaces, relocates, or improves VORs associated with Distance Measuring Equipment (DMEs) (VOR/DME) and VORs associated with Tactical Air Navigation (TACANs) (called VORTACs). The VOR provides navigational guidance for civilian aircraft in both the en route and terminal areas. Decisions concerning the VOR Minimum Operational Network (MON) will determine, whether a select number of VOR systems will remain in service or be shut down. If retained, they will serve as a backup to satellite navigation and continue to define VOR routes and procedures for legacy users. Therefore, VORs must remain in service and may be relocated, technologically refreshed, or replaced. The VORs are all beyond their estimated service life of 20 years, with approximately 70% over 30 years old.

There are approximately 967 VORs associated with either a DME or a TACAN currently operating in the United States. They are used by pilots as a primary navigation aid, and direct lines between VORs are used to define established air routes. The VOR provides azimuth information to the aircraft and the DME provides its distance; slant range because of the aircraft's altitude.

This program currently procures and installs Doppler VOR (DVOR) electronic kits and DVOR antenna kits to dopplerize a conventional VOR. There are numerous VORs that have signal restrictions due to encroachment of obstacles that block the transmission of VOR signals. These restrictions are having a serious impact on en-route, arrival and departure procedures. Natural encroachment also comes from trees located outside the boundaries of the FAA controlled area where the VOR is located which have grown tall enough to cause electromagnetic interference. Many manmade obstacles can cause the same interference. Examples include newly constructed tall buildings; nearby industrial parks with a high concentration of metal buildings; overhead transmission lines; towers for radio, television and cell service; and more recently, wind farms. Dopplerizing a VOR eliminates the signal reflection restrictions caused by most of these obstacles.

The program plans to establish a new contract to purchase replacement VOR systems.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The service life of VORs is either near or beyond the designed useful life of these systems. Sustaining, relocating, or dopplerizing these systems maintains their operational availability at or above 99.7%.

Program Plans FY 2018 – Performance Output Goals

- Procure two DVOR Doppler Antenna Kits.
- Complete two on-going DVOR projects.

Program Plans FY 2019 – Performance Output Goals

- Procure two DVOR Doppler Antenna Kits.
- Complete two on-going DVOR projects.

Program Plans FY 2020 – Performance Output Goals

- Procure two DVOR Doppler Antenna Kits.
- Complete two on-going DVOR projects.

Program Plans FY 2021 – Performance Output Goals

- Procure two DVOR Doppler Antenna Kits.
- Complete two on-going DVOR projects.

Program Plans FY 2022 – Performance Output Goals

- Procure two DVOR Doppler Antenna Kits.
- Complete two on-going DVOR projects.

2D02, INSTRUMENT LANDING SYSTEMS (ILS)

FY 2018 Request \$7.0M

Instrument Landing Systems (ILS), N03.01-00

Program Description

This program supports the installation of ILS and/or High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) for the establishment of new Category II/III precision approach procedures. An ILS precision approach system is comprised of a grouping of electronic devices such as Localizer, Glide Slope, 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 aircraft to land safely with a stabilized approach to a runway which improves both system safety and the capacity for landing properly equipped aircraft in adverse weather conditions at runways equipped with an ILS.

The ILS provides both vertical and lateral guidance information for the pilot to allow safe landings 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. Some aircraft are equipped with an autopilot which can use signals from a Category IIIC ILS to automatically guide the plane to a safe landing.

The ALSF-2 is a lighting system installed along the extended centerline extending a distance of 2,400' outward into the approach zone and ending at the runway threshold. ALSF-2 provides visual cues to help the pilot see the runway when the aircraft is at or above ILS minimum altitude.

There are three categories of ILS. Each category is defined by the lowest altitude at which a pilot is able to decide whether to land or abort, the decision height, and how far away the pilot can see the runway, or runway visual range. With some exceptions for unique geography around an airport, the definitions for ILS categories are:

- Category I: Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2,400 feet (with touchdown zone and centerline lighting, RVR 1,800 feet)
- Category II: DH 100 feet and RVR 1,200 feet
- Category IIIa: No DH or DH below 100 feet and RVR not less than 700 feet
- Category IIIb: No DH or DH below 50 feet and RVR less than 700 feet but not less than 150 feet
- Category IIIc: No DH and no RVR limitation, requires an autopilot

This program supports ILS sustainment activities at the busiest large hub airports (Navigation Service Group (NSG) 1) and at remaining large and all medium hub airports (NSG 2).

Approximately 55 ILSs are more than 25 years old. Currently, the ILSs are being replaced because they have exceeded their expected service life and/or the manufacturer no longer provides support. The FAA is aggressively pursuing implementation of satellite navigation but until that transition is complete, the ILS remains the world standard for providing approach and landing services.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

Establishing ILS precision approach capability allows for lower minimums for landings and helps to maximize the use of the NAS. Lowering minimums allows airport operations to safely continue in poor weather conditions beyond what would otherwise be possible; effectively increasing the airport capacity.

Program Plans FY 2018 – Performance Output Goals

- Procure four ILS systems and ancillary equipment.
- Complete approximately four ILS replacement projects.

Program Plans FY 2019 – Performance Output Goals

- Procure three ILS systems and ancillary equipment.
- Complete three ILS replacement projects.
- Complete one on-going ALSF-2 establishment project.

Program Plans FY 2020 – Performance Output Goals

- Procure seven ILS systems and ancillary equipment.
- Complete seven ILS replacement projects.

Program Plans FY 2021 – Performance Output Goals

- Procure seven ILS systems and ancillary equipment.
- Complete seven ILS replacement projects.

Program Plans FY 2022 – Performance Output Goals

- Procure seven ILS systems and ancillary equipment.
- Complete seven ILS replacement projects.
- Complete one on-going ALSF-2 establishment project.

2D03, WIDE AREA AUGMENTATION SYSTEM (WAAS) FOR GPS

FY 2018 Request \$102.3M

Wide Area Augmentation System (WAAS) – Phase IV Segment 1, N12.01-07 / X, Wide Area Augmentation System (WAAS) – Phase IV Segment 2, N12.01-08

Program Description

WAAS consists of a network of 38 precisely located ground reference stations distributed across the United States, Canada and Mexico that monitor the global positioning system (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.

Phase IV, Dual Frequency Operations, began in 2014 to leverage the improvements the Department of Defense (DoD) will make as part of its GPS modernization program.

WAAS addresses the following performance gaps:

- Lack of precise navigation capabilities (i.e., airports/runways that do not have conventional ground-based navigation aids to support precise navigation); and
- Lack of stable vertical guidance for precision approaches to airports not equipped with Instrument Landing System (ILS).

WAAS provides or supports the following improvements and capabilities:

- WAAS provides precise aircraft position information that enables the realization of several NextGen operational improvements;
- The WAAS program will continue to develop full Localizer Performance with Vertical guidance (LPV)/Localizer Performance (LP) procedures for all remaining qualified runways enabling more approaches and access into airports under low visibility conditions;
- WAAS LPV approaches enable rationalization of the existing Category I ILS inventory;
- WAAS supports the redesign of airspace to establish Area Navigation (RNAV) routes in the terminal and en route environments increasing efficiency and capacity;
- WAAS enables Alaskan users to operate under Instrument Flight Rules (IFR) on routes currently classified as uncontrolled airspace due to lack of radar coverage improving operator efficiency, access and safety; and
- WAAS is currently supporting near-term demonstrations/validations of operational improvements for vertical flight aircraft, business/regional jets, and legacy air carriers that are made possible by airspace redesign and WAAS LPV approaches.

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

In May FY 2014, the WAAS program obtained a Final Investment Decision (FID) from the Joint Resources Council for Phase IV Segment 1, Dual Frequency Operations (DFO). DFO Segment 1 incorporates WAAS infrastructure upgrades to support the use of the new L5 frequency and to prepare for the full dual frequency user capability planned for implementation in DFO Segment 2. DFO Segment 1 will include continued sustainment of the GEO constellation required to provide the broadcast of the WAAS signal. In addition, Phase IV Segment I prepares WAAS for the eventual replacement of the GPS L2 P(Y) signal. In 2008, the DoD notified the GPS user community through a Federal Register Notice (Vol. 73, NO. 96) that the accessibility of the L2 P(Y) signal cannot be assured beyond December 2020. In order to sustain WAAS operations, the FAA must replace the use of the GPS L2 P(Y) signal with the second civil frequency (L5). In May of 2015 the DOT, DoD and DHS released the 2014 Federal Radionavigation Plan stating that GPS L2 P(Y) would not be discontinued until two years after GPS L5 reaches full operational capability. Per the current GPS launch estimates, the GPS L2 P(Y) signal would be discontinued circa 2026 at the earliest. Efforts are underway to revise program plans for Segment 2 based on the GPS incurred delays.

WAAS Phase IV Segment 1 includes the following activities:

- Technology Refresh: Ongoing technology refresh for integration of a new WAAS reference receiver and safety computer, upgrades to the terrestrial communication system, and development and fielding of new processors. There will be a continuing need for replacement GEOs throughout the WAAS lifecycle to ensure current and future WAAS signal in space remains available. WAAS requires a minimum of three GEO satellites to meet performance requirements.
- NAS Implementation: Includes feasibility studies, procedure design, procedure development, flight inspection and surveys for WAAS procedures. Also includes data collection by operators; benefits analysis, avionics integration and development of WAAS-specific procedures within the NAS.
- Technology Evolution: Perform research activities to support current WAAS capability such as threat model assessments, ionospheric effects analysis, safety analyses and improving/maintaining interoperability with international Satellite Based Augmentation Systems. Conduct research on future capabilities to extend satellite navigation supported operations, and support studies for the development and validation of standards supporting integration of modernized signals and services such as Advanced Receiver Autonomous Integrity Monitoring (ARAIM).
- GEO Satellite Acquisitions: Develop satellite payloads and associated ground infrastructure for replacement GEO satellites. This activity covers satellite payload and ground uplink station design, development, testing and operational cutover into WAAS.
- GEO Sustain Lease Services: The WAAS requires a minimum of three commercial GEOs to meet its performance requirements. This activity provides the required leased services for the three WAAS GEOs.

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

Segment 2 will develop and deploy a WAAS Dual Frequency User Service that will provide user data allowing usage of the L5 signal. This new capability is contingent on having a full constellation of GPS satellites (>24) broadcasting the L5 signal and the availability of new dual frequency (L1/L5) avionics. Users who equip with new dual frequency (L1/L5) avionics will be able to process both GPS frequencies to correct for signal delays caused by the ionosphere resulting in improved availability and reliability of WAAS LPV-200 service. The expectation is that users will equip with dual frequency (L1/L5) avionics when the Segment 2 upgrades are completed and operational. For those users who do not upgrade their avionics, WAAS will continue to support single frequency users during Phase IV. DFO Segment 2 will include continued sustainment of the constellation of GEO satellites required to broadcast the WAAS signal. WAAS will continue to support FAA NextGen initiatives to meet new & growing air transportation demands through identification of WAAS equipage benefits for users through 2025.

WAAS Phase IV Segment 2 will include the following activities: Technology Refresh; NAS Implementation; Technology Evolution; GEO Satellite Acquisitions; and GEO Sustain Lease Services.

The FID for WAAS Phase IV Segment 2 is planned in FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 2 – Reduce the general aviation fatal accident rate to no more than one (1) fatal accident per 100,000 flight hours by 2018.*

Relationship to Performance Metric

WAAS provides vertical and horizontal guidance enabling pilots to make stable, vertically guided approaches to all qualified runway ends in the continental United States and most of Alaska, in most meteorological conditions. The WAAS navigation signal allows pilots to fly with reduced position uncertainty regardless of location within the NAS, enhancing safety. In terminal area and approach operations, a Flight Safety Foundation Report found a nearly 8 fold reduction in approach accident rates; 7 per million for precision approaches compared to 53 per million when non-precision approaches were used. Specifically, 141 accidents could be prevented over a 20 year time period and saving over 250 lives when using WAAS for vertically guided approaches at airports where stable vertical guidance is not available or not used today. Currently, ILS provides precision vertically guided approaches at only 1,284 of the nation's 19,000 runway ends. WAAS is able to provide the same level of precision with 3,748 LPVs, as of December 2016.

Program Plans FY 2018 – Performance Output Goals

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

- Complete draft investment analysis documentation for WAAS Phase IV Segment 2: Acquisition Program Baseline and execution plans; Program Requirements document; Business Case; Implementation Strategy and Planning Document; Program Management Plan; and other documents as necessary.
- Technology Refresh:
 - Complete GEO 6 integration and testing of ground and satellite components.
 - Establish GEO 7 Contract.
 - Complete development and validation test for DFO Release 2, GEO 5.
 - Complete DFO Release 2 deployment and integration of GEO 5 into operational WAAS. (APB milestone)
 - Complete development and validation test for DFO Release 3, G-III Multicast Structure. (APB milestone)
 - Transition of WAAS Mexico Connectivity (Ring 1) to FTI Gateways.
 - Complete Statement of Work and ancillary documents for DFO Segment 2.
 - Conduct Market Survey for DFO, Segment 2.
 - Complete Maintenance Release development and deployment to include antenna position updates as well as minor software modifications necessary to continue WAAS operations.

- NAS Implementation:
 - Develop and publish 170 WAAS LPV/LP approach procedures with possible additional LPV procedures due to changes in Flight Standards criteria.
 - Establish a project and demonstrate helicopter low-level IFR infrastructure to include Helicopter RNAV Point-in-Space approach procedures in support of FAA Helicopter EMS Safety Mandate.
- Technology Evolution:
 - Complete system level evaluation of Prototype Dual Frequency Algorithms.
 - Complete Initial Draft of Dual Frequency Antenna Minimum Operational Performance Standards (MOPS).
 - Commence ARAIM safety case.
- GEO Satellite Acquisition:
 - Release GEO 7 Screening Information Request (SIR).
- GEO Sustain Lease Services:
 - Provide leases for three WAAS geostationary satellites.

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

- None.

Program Plans FY 2019 – Performance Output Goals

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

- Achieve FID for WAAS Phase IV Segment 2 from the JRC.
- Pending approval of FID:
 - Technology Refresh:
 - Complete development and validation test for DFO Release 4, Corrections & Verification (C&V) Safety Computer Validation. (APB milestone)
 - Field new Safety Computer at first and last WAAS Master Station (WMS). (APB milestones)
 - Complete development and validation test for DFO Release 5, GEO 6.
 - Complete DFO Release 5 deployment and integration of GEO 6 into operational WAAS. (APB milestone)
 - Award contract for new generation Signal Generator (SIGGEN).
 - Release DFO, Segment 2 SIR.
 - Complete Maintenance Release development and deployment to include antenna position updates as well as minor software modifications necessary to continue WAAS operations.
 - NAS Implementation:
 - Develop and publish 160 WAAS LPV/LP approach procedures with possible additional LPV procedures due to changes in Flight Standards criteria.
 - Technology Evolution:
 - Develop technical papers and reports in support of RTCA development and evaluation of Dual Frequency MOPS.
 - Develop prototype of ARAIM offline ground monitors.
 - GEO Satellite Acquisition:
 - Complete GEO 7 Preliminary Design Review.
 - GEO Sustain Lease Services:
 - Provide leases for three WAAS geostationary satellites.

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

- None.

Program Plans FY 2020 – Performance Output Goals

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

- None.

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

- Pending approval of FID:
 - Technology Refresh:
 - Conduct WAAS Phase IV Segment 1 Post Implementation Review.
 - Complete design changes for new GUS receiver and SIGGEN.
 - Award DFO Segment 2 contract.
 - Complete Maintenance Release development and deployment to include antenna position updates as well as minor software modifications necessary to continue WAAS operations.
 - NAS Implementation:
 - Develop and publish 25 WAAS LPV/LP approach procedures with possible additional LPV procedures due to changes in Flight Standards criteria.
 - Technology Evolution:
 - Complete design of L5 algorithm changes.
 - Establish draft MOPS for ARAIM and conduct testing of ARAIM system elements.
 - Develop technical papers and reports in support of RTCA development and evaluation of Dual Frequency MOPS.
 - GEO Satellite Acquisition:
 - Complete GEO 7 Critical Design Review.
 - GEO Sustain Lease Services:
 - Provide leases for three WAAS geostationary satellites.

Program Plans FY 2021 – Performance Output Goals

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

- None.

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

- Pending approval of FID:
 - Technology Refresh:
 - Develop system modifications in support of tech refresh of obsolete components.
 - Complete Maintenance Release development and deployment to include antenna position updates as well as minor software modifications necessary to continue WAAS operations.
 - NAS Implementation:
 - Develop and publish 25 WAAS LPV/LP approach procedures with possible additional LPV procedures due to changes in Flight Standards criteria.
 - Initiate Industry Partnership to expand WAAS to a new aviation sector.
 - Technology Evolution:
 - Conduct integrated testing of ARAIM.
 - Conduct L5 algorithm testing with avionics and prototype WAAS Dual Frequency Service.
 - Use prototype avionics to validate system performance for WAAS L5 messages.
 - GEO Satellite Acquisition:
 - Complete integration and testing of GEO 7 ground components.
 - GEO Sustain Lease Services:
 - Provide leases for three WAAS geostationary satellites.

Program Plans FY 2022 – Performance Output Goals

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

- None.

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

- Pending approval of FID:
 - Technology Refresh:
 - Develop system modifications in support of tech refresh of obsolete components.
 - NAS Implementation:
 - Develop and publish 25 WAAS LPV/LP approach procedures with possible additional LPV procedures due to changes in Flight Standards criteria.
 - Technology Evolution:
 - Complete Dual Frequency Antenna Minimum Operational Performance Standards (MOPS).
 - GEO Satellite Acquisition:
 - Complete deployment and integration of GEO 7 into WAAS.
 - GEO Sustain Lease Services:
 - Provide leases for three WAAS geostationary satellites.

2D04, RUNWAY VISUAL RANGE (RVR)

FY 2018 Request \$4.0M

A, Runway Visual Range (RVR) – Replacement/Establishment, N08.02-00

Program Description

The RVR program establishes and replaces the Tasker 500 and New-Generation (NG) RVR equipment with the new Personal Computer (PC)-Based RVR equipment. Replacement decisions are prioritized based on the level of activity at the airport and life-cycle issues. There are 287 commissioned RVR systems in the NAS. The Tasker 500 RVRs use Transmissometer technology to measure visibility. The NG RVR and PC RVR use forward-scatter technology to measure visibility.

RVR provides air traffic controllers with a measurement of the visibility at key points along a runway; touchdown, midpoint and rollout. That data 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. Properly equipped aircraft with a trained crew may continue operations under reduced visibility Category I, Category II and Category III conditions. Depending on the category of approach, the runway may require multiple visibility sensors to achieve the lowest minimums; for example, more visibility sensors are required for a Category II or III approach than Category I. Each category is defined by the lowest altitude at which a pilot is able to decide whether to land or abort (decision height) and visibility conditions on the runway. This program also provides equipment to upgrade qualified runways from Category I to a Category II/III precision approach.

- Category I operations may use a rollout sensor of an RVR system.
- Category II operations require a touchdown and rollout sensor of an RVR system.
- Category III operations require a touchdown, midpoint and rollout sensor of an RVR system.

The RVR decreases diversions and delays at an airport by providing an accurate measure of the runway visibility. The RVR information affects airline scheduling 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.

The NG RVR and PC-based RVR are also safer than the Tasker 500 RVR systems, because their visibility sensors are mounted on frangible structures that break away if accidentally struck by an aircraft during take-off or landing.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The Tasker 500 and NG RVR systems are maintenance intensive, resulting in excessive downtime impacting airport capacity and reduces adjusted operational availability. The replacement or upgraded equipment requires less maintenance and repair time, which reduces system downtime, and supports the performance measure to maintain operational availability of the NAS.

Program Plans FY 2018 – Performance Output Goals

- Procure eight RVR systems.
- Install RVR systems at eight locations.

Program Plans FY 2019 – Performance Output Goals

- Procure 14 RVR systems.
- Install RVR systems at 14 locations.

Program Plans FY 2020 – Performance Output Goals

- Procure 12 RVR systems.
- Install RVR systems at 12 locations.

Program Plans FY 2021 – Performance Output Goals

- Procure 12 RVR systems.
- Install RVR systems at 12 locations.

Program Plans FY 2022 – Performance Output Goals

- Procure 12 RVR systems.
- Install RVR systems at 12 locations.

2D05, APPROACH LIGHTING SYSTEM IMPROVEMENT PROGRAM (ALSIP)

FY 2018 Request \$3.0M

Approach Lighting System Improvement Program (ALSIP) Continuation, N04.03-00

Program Description

The ALSIP improves 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, and the entire approach lighting system, with lightweight and low-impact frangible structures that collapse or break apart upon impact. There are 30 Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) and 1 High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) systems that do not meet the frangible requirements.

The 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 the pilot with visual information on whether the aircraft is aligned with the runway, height perception, roll guidance, and horizontal references for Category I Precision and Special Authorization Category II Approaches. An operational MALSR or ALSF-2, in conjunction with an ILS, will support continued airport operations (with lower minimums) during conditions of low visibility.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

To meet current standards, this program replaces legacy rigid structure approach lighting systems with lightweight, low-impact frangible structures that collapse or break apart upon impact. This reduces both the potential damage to an aircraft, and the risk of a fatality, should a collision occur with a frangible structure during take-off or landing.

Program Plans FY 2018 – Performance Output Goals

- Complete MALSR replacement at one location.

Program Plans FY 2019 – Performance Output Goals

- Complete MALSR replacement at one location.

Program Plans FY 2020 – Performance Output Goals

- Complete MALSR replacement at three locations.
- Complete ALSF-2 replacement at one location.

Program Plans FY 2021 – Performance Output Goals

- Complete MALSR replacement at three locations.

Program Plans FY 2022 – Performance Output Goals

- Complete MALSR replacement at three locations.

2D06, DISTANCE MEASURING EQUIPMENT (DME)

FY 2018 Request \$3.0M

Sustain Distance Measuring Equipment (DME), N09.00-00

Program Description

The DME 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 markers. DME is a radio navigation aid used by pilots to determine the aircraft's slant distance from the DME location.

The program supports a Commercial Aviation Safety Team (CAST) recommendation to implement DME on various airport runways. The CAST includes representatives from FAA, airline and airport personnel, and has identified 451 runway ends that require implementation of DME capability. These systems will support efforts to reduce the number of controlled-flight-into-terrain (CFIT) accidents at the most vulnerable locations in the NAS. The FAA has agreed to implement the 177 highest priority CAST DME installations.

For safety reasons, the aviation industry wants to discontinue using step-down non-precision approach procedures in which a pilot descends to the minimum allowable altitude to visually locate the runway. Using DMEs reduces the need for this type of approach. Due to the continuous ranging information provided by a DME, procedure designers have greater flexibility of where step down fixes are located and how many are needed; this leads to better specification and control over the vertical descent profile and reduces CFIT risk.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The new DME can respond to more than 250 interrogators from aircraft simultaneously without being saturated, potentially doubling the number of aircraft that can simultaneously interrogate a DME. The new configuration will eliminate the need for training and maintenance of multiple DME systems within the NAS, provide improved reliability compared to existing DME systems and have a positive impact on airport capacity.

The new DME meets all user operational needs with increased capacity, efficiency, and predictability, while enhancing safety, mitigating environmental impacts, and operating in a seamless global environment by:

- Increasing current interrogation capacity by 150%
- Reducing training and maintenance costs
- Eliminating the need for step-down non-precision approach procedures
- Reducing the need for off-airport facilities
- Providing a world-wide standard for navigation equipage
- Serving as a back-up system for GPS/WAAS

Program Plans FY 2018 – Performance Output Goals

- Procure 5 DME systems.
- Complete 20 DME establish/sustainment projects.

Program Plans FY 2019 – Performance Output Goals

- Procure 20 DME systems.
- Complete 15 DME establish/sustainment projects.

Program Plans FY 2020 – Performance Output Goals

- Procure 35 DME systems.
- Complete 35 DME establish/sustainment projects.

Program Plans FY 2021 – Performance Output Goals

- Procure 40 DME systems.
- Complete 40 DME establish/sustainment projects.

Program Plans FY 2022 – Performance Output Goals

- Procure 40 DME systems.
- Complete 40 DME establish/sustainment projects.

2D07, VISUAL NAVAIDS - ESTABLISH/EXPAND

FY 2018 Request \$2.0M

Visual Navaids for New Qualifiers, N04.01-00

Program Description

This program supports the procurement, installation, and commissioning of Precision Approach Path Indicator (PAPI) systems and Runway End Identifier Lights (REIL) systems at new qualifying runways. A 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. The PAPI system consisting of four light assemblies arranged perpendicular to the edge of the runway. The PAPI system projects a pattern of red and white lights along the desired glide slope

enabling pilots to confirm they are on the glide slope; and if not, to determine if they are above or below it to correct their rate of descent. A REIL is a visual aid that provides the pilot with a rapid and positive identification of the approach end of a runway. The REIL system consists of two simultaneously flashing white lights, one on each side of the runway landing threshold.

The program also supports a Commercial Aviation Safety Team (CAST) recommendation to implement a visual glide slope indicator approach capability on various airport runways including those affected by Land and Hold Short Operations (LAHSO) requirements. The CAST includes representatives from FAA, airline and airport personnel and has identified 781 runway ends requiring implementation of a visual glide slope indicator approach capability; this would reduce the number of the controlled flight into terrain accidents during approach and landing.

LAHSO is an air traffic control tool used to increase airport capacity by allowing coordinated approaches on intersecting runways. Vertical guidance is required for air carrier operations on the hold short runway to avoid landing long and conflicting with operations on the other runway.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Installing PAPI lights at both CAST and non-CAST locations enhances system safety by reducing the probability of a Controlled Flight into Terrain accident during approach and landing. Installing the REIL system reduces accidents because the system clearly identifies the runway end to the pilot, especially in the presence of multiple lights in the runway environment.

Program Plans FY 2018 – Performance Output Goals

- Procure five PAPI systems.
- Install PAPI systems at five locations.

Program Plans FY 2019 – Performance Output Goals

- Procure two PAPI ancillary systems.
- Install PAPI systems at two locations.

Program Plans FY 2020 – Performance Output Goals

- Procure four PAPI ancillary systems.
- Install PAPI systems at four locations.

Program Plans FY 2021 – Performance Output Goals

- Procure four PAPI ancillary systems.
- Install PAPI systems at four locations.

Program Plans FY 2022 – Performance Output Goals

- Procure four PAPI ancillary systems.
- Install PAPI systems at four locations.

2D08, INSTRUMENT FLIGHT PROCEDURES AUTOMATION (IFPA)

FY 2018 Request \$8.5M

**Instrument Flight Procedures Automation (IFPA) – Sustainment Technology Refresh,
Segment 1, A14.02-02 / Instrument Flight Procedures Automation (IFPA) – Sustainment 2,
A14.02-03**

Program Description

IFPA is a suite of Information Technology tools, consisting of the Instrument Procedures Development System (IPDS), Instrument Approach Procedure Automation (IAPA), Instrument Flight Procedures (IFP) database, Airports and Navigations Aids database, Obstacle Evaluation system, and the Aeronautical Information Services Production Workflow System (APWS). These tools are used to develop and publish new and revised instrument flight procedures. IFPA includes functionality for developing approaches, missed approaches, circling approaches, airways, and departures. In addition, IFPA contains an integrated obstacle evaluation application that replaces a manual dependent process.

As additional runways are equipped to handle instrument operations, new and revised instrument flight procedures must be developed and published. New approach and departure procedures are being developed to take advantage of Required Navigation Performance (RNP) capabilities and GPS assisted approaches that can reduce the flight path distance before landing or after takeoff. FAA's Aeronautical Information Services directorate (AJV-5) maintains more than 24,000 instrument flight procedures in use at over 4,000 paved runways. The procedures are available to pilots through a printed booklet and electronic media to determine the appropriate altitude, heading, and other information needed to fly precision and non-precision approaches and departures into and out of a selected airport.

A technology refresh of IFPA hardware and software will be accomplished in segments, according to the baselined lifecycle (FY 2012-2032).

IFPA – Technology Refresh, Segment 1 (A14.02-02):

In November 2010, the IFPA Technology Refresh Segment 1 cost and schedule baseline was approved by the Joint Resources Council (JRC). Beginning in FY 2012 extending through FY 2016, the legacy Automated Process Tracking System (APTS) workflow software was planned to be replaced with new commercial-off-the-shelf (COTS) business process workflow software. The APTS will be renamed to APWS during the technology refresh. The new APWS will complete replacement of the core workflow processes which flow and meter new IFP development requests, IFP amendments, IFP NOTAMs, and IFP Obstacle Evaluations. APWS will provide new workflow processes associated with FAA's NAV Lean initiative (Navigation Procedures Implementation Plan) that streamlines the process for requesting, prioritizing, developing and implementing IFPs; and provide new business management functions integrated with the new workflow system.

In FY 2013, the IPDS tool was upgraded for COTS architecture changes, including conversion for the Windows-7 operating system, and was deployed in 4th quarter FY 2015. In FY 2016 AJV-5 began to transition its IPDS space-based IFP design functionality over to the Terminal Area Route Generation, Evaluation & Traffic Simulation (TARGETS) tool, a more modern and supportable tool for the future. TARGETS has been a long-standing Air Traffic operations simulation tool developed and supported by the Performance Based Navigation (PBN) Programs & Policy group (AJV-14). Technology Refresh of the IFPA server infrastructure began in FY 2013 and was completed in FY 2014.

Originally planned for completion in FY 2016, the development of the APWS experienced technical difficulties in FY 2015. The APWS prime contractor experienced high rates of development and testing defects requiring additional funding exceeding the program's approved baseline. The work was stopped in August 2015 and an assessment initiated to investigate options for continuing the program. In 1st quarter of FY 2016, the program office obtained approval for a solicitation for a new solution.

A revised program baseline providing development of a new APWS solution, and migration of the IPDS tool to the TARGETS tool, was approved by the JRC in February 2017. The baseline change decision for Segment 1 extended the approved baseline to FY 2020.

IFPA – Sustainment 2 (A14.02-03):

The IFPA Sustainment 2 program has been re-planned because of the revised baseline for Segment 1, and will now exclude the APWS tool. Sustainment 2 will perform technology refresh of IFPA COTS hardware, with new personal computers required for the TARGETS tool (2nd quarter FY 2018) and new servers (2nd quarter FY 2019) in support of the integrated IFPA technical architecture. The TARGETS tool will undergo enhancement to handle the Windows-10 COTS Operating System (OS), coupled with any other identified COTS software changes. By the completion of Sustainment 2, TARGETS will provide all space-based and ground-based navigation procedure design, allowing the decommissioning of two legacy tools, IPDS and IAPA.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The IFPA system ensures continued progress toward increasing instrument flight procedures development and maintenance productivity. Approved capital investment business case productivity gains of 32% were achieved by FY 2011. IFPA continues to improve the quality of products through process reengineering and elimination of manual processes. It provides the ability to produce 250+ Performance Based Navigation (PBN) IFP's annually, 3,000+ IFP amendments annually, perform 70,000+ obstacle evaluations annually, and maintain a 1% production error rate.

Program Plans FY 2018 – Performance Output Goals

IFPA – Technology Refresh, Segment 1 (A14.02-02):

- Complete APWS Critical Design Review (CDR). (APB milestone)
- Complete APWS First Iteration Development Test (DT). (APB milestone)
- Complete APWS First Iteration Functional Integration Testing. (APB milestone)
- Deploy TARGETS Release 5.3. (APB milestone)
- Deploy TARGETS Release 5.4. (APB milestone)

IFPA – Sustainment 2 (A14.02-03):

- Install TARGETS COTS Personal Computer Hardware. (APB milestone)

Program Plans FY 2019 – Performance Output Goals

IFPA – Technology Refresh, Segment 1 (A14.02-02):

- Complete APWS Last Iteration Development Test (DT). (APB milestone) (Prior year funding)
- Complete APWS Last Iteration Functional Integration Testing. (APB milestone) (Prior year funding)

IFPA – Sustainment 2 (A14.02-03):

- Deploy TARGETS Release 5.5. (APB milestone)
- Deploy TARGETS Release 5.6. (APB milestone)
- Install IFPA COTS Computer Server Hardware. (APB milestone)

Program Plans FY 2020 – Performance Output Goals

IFPA – Technology Refresh, Segment 1 (A14.02-02):

- Complete APWS User Acceptance Testing (UAT). (APB milestone) (Prior year funding)
- APWS Operational Capability Complete. (APB milestone) (Prior year funding)

IFPA – Sustainment 2 (A14.02-03):

- Complete TARGETS Enterprise Integration – Development Test (DT). (APB milestone)
- Complete TARGETS Enterprise Integration – Operational Test (OT). (APB milestone)

Program Plans FY 2021 – Performance Output Goals

IFPA – Technology Refresh, Segment 1 (A14.02-02):

- None.

IFPA – Sustainment 2 (A14.02-03):

- Complete TARGETS Enterprise Integration – User Acceptance Test (UAT). (APB milestone)
- Complete TARGETS Enterprise Integration – Deployment. (APB milestone)

Program Plans FY 2022 – Performance Output Goals

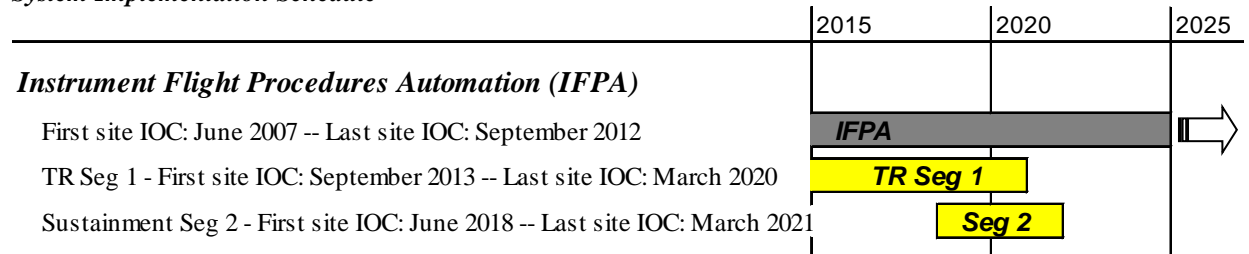
IFPA – Technology Refresh, Segment 1 (A14.02-02):

- None.

IFPA – Sustainment 2 (A14.02-03):

- None.

System Implementation Schedule



2D09, NAVIGATION AND LANDING AIDS – SERVICE LIFE EXTENSION PROGRAM (SLEP)

FY 2018 Request \$3.0M

Nav aids – Sustain, Replace, Relocate, N04.04-00

Program Description

This program sustains and/or replaces Approach Lighting Systems (ALS) at sites where there is a high risk for failure of these systems and where their failure would result in increased visibility minima, causing schedule impacts due to delayed, diverted, or cancelled flights, not only at the site of occurrence, but at connecting sites and throughout the NAS. The ALS include Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) for Category I approaches and High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) for Category II/III approaches.

Instrument Landing Systems (ILS) will be replaced at airports that provide less than 0.25% of total US enplanements and at airports with less than 0.50% of total US non-military itinerant operations. ILS components include electronic devices such as localizers, glide slopes and marker beacons. In some cases, Mark-1F ILSs that are removed from an airport will be relocated and installed at another airport to replace existing Mark-1D and Mark-1E ILSs.

This program also replaces Runway End Identifier Lights (REIL); a visual aid that provides the pilot with a rapid and positive identification of the approach end of a runway. The REIL system consists of two simultaneously flashing white lights, one on each side of the runway landing threshold.

In addition, this program supports the Replacement Lamp Monitoring System (RLMS) project which provides service life extension for ALSF-2 (CAT II/III systems) by replacing the constant current regulators and installing an improved monitoring system at some locations. These changes have successfully increased the system's adjusted operational availability from 98.4 to 98.7.

This program also supports product improvements, modifications, and technology upgrades to visual lighting system components. Ongoing efforts include:

- Improve approach lighting system semi-flush fixtures;
- Replace existing MALSR green threshold and white steady burning lights with LED lights; and
- Replace existing ALSF-2 threshold light bar lamp holder fixtures that are susceptible to misalignment caused by jet blast.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The older electronic guidance systems and lighting systems are maintenance intensive, resulting in excessive downtime, which negatively impacts airport capacity. Replacement or upgraded equipment requires less maintenance and repair time, reducing system downtime and contributing to maintaining the operational availability of the NAS.

Program Plans FY 2018 – Performance Output Goals

- Procure three ALSF-2 RLMS kits.
- Complete three ALSF-2 RLMS installations.

Program Plans FY 2019 – Performance Output Goals

- Complete one MALSR replacement project.
- Procure four ALSF-2 RLMS kits.
- Complete four ALSF-2 RLMS installations.

Program Plans FY 2020 – Performance Output Goals

- Complete eight ILS replacement projects.
- Complete two MALSR replacement projects.
- Procure six ALSF-2 RLMS kits.
- Complete six ALSF-2 RLMS installations.
- Complete 10 REIL replacement projects.

Program Plans FY 2021 – Performance Output Goals

- Complete eight ILS replacement projects.
- Complete two MALSR replacement projects.
- Procure six ALSF-2 RLMS kits.
- Complete six ALSF-2 RLMS installations.
- Complete 10 REIL replacement projects.

Program Plans FY 2022 – Performance Output Goals

- Complete 11 ILS replacement projects.
- Complete three MALSR replacement projects.
- Procure 20 REIL systems.
- Complete 20 REIL replacement projects.

2D10, VASI REPLACEMENT – REPLACE WITH PRECISION APPROACH PATH INDICATOR

FY 2018 Request \$5.0M

Replace Visual Approach Slope Indicator (VASI) with Precision Approach Path Indicator (PAPI), N04.02-00

Program Description

The International Civil Aviation Organization (ICAO) has recommended that all international airports replace the Visual Approach Slope Indicator (VASI) lights with Precision Approach Path Indicators (PAPI) lights. This standardizes the equipment used by pilots to visually determine they are on the proper glide slope for landing. The program supports the procurement, installation, and commissioning of PAPI systems in order to comply with this ICAO recommendation. The VASI and PAPI systems have a set of lights that are arranged so that the pilot sees all red lights when the aircraft is below the glideslope and all white lights when the aircraft is above the glideslope. This visual reference helps the pilot maintain the appropriate descent rate to the runway.

At the inception of this program, there were approximately 1,387 older (pre-1970's) VASIs at international and other validated locations requiring replacement. There are now 628 VASI systems remaining in the NAS. The first priority of the program is to replace VASI systems at approximately 329 ICAO designated runway ends. This will be completed in fiscal year 2018. The replacement of the remaining VASI systems at non-ICAO airports in the NAS will be completed in fiscal year 2051.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

Replacing VASI with PAPI improves on-time performance by increasing the availability of the visual approach slope guidance systems used to help pilots touch down at the appropriate location on the runway.

Program Plans FY 2018 – Performance Output Goals

- Procure 10 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 10 locations.

Program Plans FY 2019 – Performance Output Goals

- Procure 15 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 15 locations.

Program Plans FY 2020 – Performance Output Goals

- Procure 20 Precision Approach Path Indicator ancillary systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 20 locations.

Program Plans FY 2021 – Performance Output Goals

- Procure 30 Precision Approach Path Indicator ancillary systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 30 locations.

Program Plans FY 2022 – Performance Output Goals

- Procure 40 Precision Approach Path Indicator ancillary systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 40 locations.

2D11, RUNWAY SAFETY AREAS – NAVIGATION MITIGATION

FY 2018 Request \$1.6M

Runway Safety Area – Navigation Mitigation, N17.01-01 / Runway Safety Area – Phase 2, N17.01-02

Program Description

The Runway Safety Area (RSA) program improves the overall safety of the runways at the major airports in the National Airspace System (NAS). The RSA must be free of all objects that are three inches above the grade and are not frangible. The relocation or removal of existing rigid objects will decrease the potential for damage to aircraft and minimize injuries or fatalities to aircraft passengers and crew members if an aircraft has to use the RSA in an emergency.

The FAA currently owns and operates numerous NavAids that need to be modified to satisfy the language of Title 14 Code Federal Regulations (CFR) Part 139 (Certification of Airports). Although measured incremental progress has been made to restructure these FAA-owned NavAids, a concerted, focused initiative will be necessary to comply with the current RSA airport design standards defined in the Advisory Circular 150/5300-13A. Legislation requires FAA to report on the agency's progress toward RSA improvements.

The RSA is defined as a surface surrounding a runway suitable for reducing risk of damage to airplanes in the event of an undershoot, overshoot, or runway excursion. To the extent practical, an RSA must be free of objects that are not fixed-by-function. All objects remaining within the RSA must be frangible to within three inches above the grade. The installation of frangible components, relocation or removal of existing rigid objects will decrease the potential for damage to aircraft and minimize injuries or fatalities to aircraft passengers and crew members if an aircraft needs to use the RSA in an emergency.

Runway Safety Areas - Navigation Mitigation (N17.01-01):

The program corrects FAA-owned facilities and equipment in RSAs by taking action on those navigation systems that are not in compliance with the RSA Standards. This work includes the installation of frangible connections on identified structures to the relocation of facilities within the RSA if no other solution is available. Projects to be executed under N17.01-01 are scheduled to be completed by December 31, 2018.

Runway Safety Areas - Navigation Mitigation – Phase 2 (N17.01-02):

The RSA Follow-on Improvements – Phase 2 will correct FAA-owned facilities and equipment that are not in compliance with RSA Standards and not part of the N17.01-01 CIP effort. This work will include the installation of frangible connections on identified structures to the relocation of facilities within and outside the RSA.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

RSA compliance provides a measure of safety to reduce the extent of personal injury and/or aircraft damage in the unlikely event an aircraft should unintentionally leave a runway, either before takeoff or during/following landing, by relocating or removing existing rigid objects that pose a potential hazard. This program will modify any FAA-owned

equipment that does not conform to current RSA standards to ensure compliance with Part 139 in Title 14 of the US CFR.

Program Plans FY 2018 – Performance Output Goals

Runway Safety Areas - Navigation Mitigation (N17.01-01):

- Complete 11 RSA improvements.

Runway Safety Areas - Navigation Mitigation – Phase 2 (N17.01-02):

- None.

Program Plans FY 2019 – Performance Output Goals

Runway Safety Areas - Navigation Mitigation (N17.01-01):

- Complete 6 RSA improvements. (Prior year funding)

Runway Safety Areas - Navigation Mitigation – Phase 2 (N17.01-02):

- Complete 1 RSA project.

Program Plans FY 2020 – Performance Output Goals

Runway Safety Areas - Navigation Mitigation (N17.01-01):

- None.

Runway Safety Areas - Navigation Mitigation – Phase 2 (N17.01-02):

- Complete 10 RSA projects.

Program Plans FY 2021 – Performance Output Goals

Runway Safety Areas - Navigation Mitigation (N17.01-01):

- None.

Runway Safety Areas - Navigation Mitigation – Phase 2 (N17.01-02):

- Complete 12 RSA projects. (Prior year funding)

Program Plans FY 2022 – Performance Output Goals

Runway Safety Areas - Navigation Mitigation (N17.01-01):

- None.

Runway Safety Areas - Navigation Mitigation – Phase 2 (N17.01-02):

- Complete 2 RSA projects. (Prior year funding)

2D12, NAVAIDS MONITORING EQUIPMENT

FY 2018 Request \$2.0M

NAVAIDS Monitoring Equipment (NME), M08.41-02

Program Description

The Nav aids Monitoring Equipment (NME) program will replace or upgrade the existing consolidated air traffic control and monitoring systems operating in the NAS. These systems, which are typically located in the tower and equipment room, replace multiple legacy control and monitoring panels used by air traffic control specialists (ATCS) and airway transportation system specialists (ATSS) for controlling and monitoring a predefined set of Nav aids such as instrument landing systems (ILS), airport lighting systems (ALS), runway visual range (RVR) equipment, runway end identifier lights (REIL), precision approach path indicator (PAPI) light arrays, and other Nav aids located on the airport. Through the NME user interface, ATCS and ATSS will have the ability to change the state (i.e. on/off, brightness) and monitor the status (i.e. operational, non-operational) of connected Nav aids equipment.

The NME program will provide efficiencies by establishing a common requirements baseline and by providing a streamlined software, training and logistics platform across all systems. NME will be deployed at approximately 32 airports across the NAS.

An Investment Analysis Readiness Decision was approved in December 2016. An Initial Investment Decision is planned in FY 2018 and the Final Investment Decision (FID) in FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

The NME system will provide an interface to navigational aid equipment that is used by air traffic controllers and pilots during daily arrivals and departures at airports throughout the NAS. The NME will assist in maintaining average daily airport capacity by providing a user interface that will be used by air traffic controllers to monitor and control multiple navigational aid systems such as ILS, RVR equipment, and PAPI from a single location. Air traffic control will be able to configure the interfaced navigational aids equipment to support multiple airport flows. The NME system will also be responsible for managing the interlocking functionality of the instrument landing systems to ensure that frequencies on the opposing ends of runways are not transmitted concurrently.

Program Plans FY 2018 – Performance Output Goals

- Complete Initial Program Requirement Document.
- Complete Initial Business Case Analysis Report.
- Complete Initial Implementation Strategy and Planning Document.
- Achieve IID.

Program Plans FY 2019 – Performance Output Goals

- Complete Final Program Requirement Document.
- Complete Final Business Case Analysis Report.
- Complete Final Implementation Strategy and Planning Document.
- Achieve FID.

Program Plans FY 2020-2022 – Performance Output Goals

- None.

E: Other ATC Facilities Programs

2E01, FUEL STORAGE TANK REPLACEMENT AND MANAGEMENT

FY 2018 Request \$28.1M

Fuel Storage Tank Replacement Management, F13.01-00

Program Description

The Fuel Storage Tank (FST) Replacement and Management program replaces, modernizes, upgrades, and sustains bulk liquid and pressure vessel storage systems that support FAA operations across the NAS. The FST systems include the storage tank (both above ground and underground tanks containing a variety of liquids: gasoline, diesel, propane, oils, glycol, etc.); the flow control devices (pipes, hoses, pumps, valves, etc.); electronic leak detection and inventory control devices (fuel monitoring systems); and electronic/electrical system operation devices (control boards, technician operations stations, switched relays, etc.). The FAA active tank system inventory includes over 3,800 units that must store and provide adequate fuel for the systems being supported. These units must also be prevented from leaking. Historical data is retained on over 1,900 previously closed/removed systems.

The majority of FAA storage tanks support electrical generator operations. Standby generators provide NAS facilities with an alternative power supply during periods of commercial power outages. Primary generators provide the sole source of electrical power for NAS operations where no commercial power is available. A loss of integrity on any FST component will affect the operation of the generator systems, which could ultimately result in a total loss of power at an air traffic control facility.

Fuel storage tanks contain substances that, if accidentally released, could cause an adverse environmental impact or result in personal injury. In response to the risk of accidental release, the Federal government, various State legislatures, county governments, and city jurisdictions have passed statutes specifying the minimum requirements for the construction, installation, removal, operation, and maintenance of storage tank systems. Additional regulations have been established by State, local and international building codes, fire protection codes, airport operating authority requirements, and Occupational Safety and Health Administration (OSHA) mandates. Failure to comply with all elements of these regulatory requirements exposes the FAA to the risk of fines and other penalties, including loss of the right to use or refill the systems.

Program costs are based on an average 20-year lifecycle for FST systems. An annual average of 190 FST system replacements is required to sustain the portfolio and maintain NAS operational integrity. System components have differing lifecycles, so component replacements continue during full 20-year system lifecycles. Additionally, changes in the regulatory environment require immediate response to assure that fielded units meet current standards. This program is included in the ATC Facilities Sustainment Strategic Plan.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The FST Replacement and Monitoring program reduces the potential for delays by ensuring uninterrupted service of navigation aids, automation systems, and other air traffic control systems due to a loss of power. Fuel system component replacements are prioritized based on a successful ranking application, which evaluates the system's critical operation requirements to assure operational availability is sustained. Fuel systems are electronically monitored to assure system integrity and to minimize adverse impacts to personal and environmental safety.

Program Plans FY 2018 – Performance Output Goals

- Complete replacement, modernization, or upgrade of 135 fuel storage systems per year at facilities selected under the FST Program Prioritization Scheme and validated through the Air Traffic Control Facilities / Engineering Services (ATCF/ES) directorate Portfolio Model.

Program Plans FY 2019-2022 – Performance Output Goals

- Complete replacement, modernization, or upgrade of 114 fuel storage systems per year at facilities selected under the FST Program Prioritization Scheme and validated through the Air Traffic Control Facilities / Engineering Services (ATCF/ES) directorate Portfolio Model.

2E02, UNSTAFFED INFRASTRUCTURE SUSTAINMENT

FY 2018 Request \$35.7M

- Unstaffed Infrastructure Sustainment (UIS), F12.00-00
- X, FAA Employee Housing and Life Safety Shelter System Services, F20.01-01

Unstaffed Infrastructure Sustainment (UIS), F12.00-00

Program Description

There are approximately 12,000 unstaffed facilities within the NAS. The Unstaffed Infrastructure Sustainment (UIS) program provides for the modernization of NAS buildings, structures, supporting electrical and heating, ventilation, and air conditioning (HVAC) equipment, and other real property assets that make up each facility. The program helps to ensure the reliable delivery of Air Traffic Control services and is an important component of the ATC Facilities Sustainment Strategic Plan.

A portfolio analysis of unstaffed facilities revealed that many:

- Are not compliant with applicable FAA regulations and standards;
- Cannot protect vital air traffic control systems or equipment against premature failure (e.g., roof leaks, air conditioner failures, etc.) due to environmental impacts;
- While operable, have a fair to poor overall facility condition index (FCI) (Good Condition is 1.0 – 0.95, Fair Condition is 0.95 – 0.90, Poor Condition is below 0.90);
- Have impaired or poor facility accessibility, and
- Have very old radio towers/tower components that need major modernization or replacement.

The UIS program includes the replacements and/or upgrades of real property and unstaffed structures. These projects include upgrades, modernizations, refurbishments, and replacements of:

- NAS antenna and equipment towers;
- (HVAC equipment;
- Buildings and shelters;
- Roofs;
- Electrical panels and distribution wiring;
- Locks, alarm sensors, and lighting;
- Access roads, grounds, fencing, and
- Safety components including ladders and railings.

Infrastructure improvements help protect electronic equipment to ensure the reliable delivery of air traffic services.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The FAA UIS program supports the FAA's Strategic Priority to Deliver Benefits through Technology and Infrastructure by renovating or replacing existing FAA-owned unstaffed facilities and structures serving the NAS. The NAS requires reliable and continuous operation of surveillance, navigation, communication, and weather equipment. In addition, the infrastructure protects the electronic equipment from weather hazards, radio interference, and unauthorized entry. Failure of the infrastructure can result in NAS equipment failures, which may result in a reduction of available capacity to the NAS.

Program Plans FY 2018 – Performance Output Goals

- Complete 150 unstaffed infrastructure projects located in all three service areas for Communication, Navigation, Surveillance, and Support Services.
- Complete replacement of 120 antenna towers to improve maintenance and safety conditions for FAA employees.

Program Plans FY 2019 – Performance Output Goals

- Complete 150 unstaffed infrastructure projects located in all three service areas for Communication, Navigation, Surveillance, and Support Services.
- Complete replacement of 120 antenna towers to improve maintenance and safety conditions for FAA employees.

Program Plans FY 2020 – Performance Output Goals

- Complete 150 unstaffed infrastructure projects located in all three service areas for Communication, Navigation, Surveillance, and Support Services.
- Complete replacement of 120 antenna towers to improve maintenance and safety conditions for FAA employees.

Program Plans FY 2021 – Performance Output Goals

- Complete 160 unstaffed infrastructure projects located in all three service areas for Communication, Navigation, Surveillance, and Support Services.
- Complete replacement of 120 antenna towers to improve maintenance and safety conditions for FAA employees.

Program Plans FY 2022 – Performance Output Goals

- Complete 165 unstaffed infrastructure projects located in all three service areas for Communication, Navigation, Surveillance, and Support Services.
- Complete replacement of 120 antenna towers to improve maintenance and safety conditions for FAA employees.

X, FAA Employee Housing and Life Safety Shelter System Services, F20.01-01

Program Description

FAA Employee Housing and Life Safety Shelter Services manage, sustain, and buy/build/lease adequate housing and shelters for FAA employees at locations where private market housing is scarce or non-existent. This program also establishes a standard housing and shelter services policy, internal cost controls, life-cycle planning, exploration of use of commercially-managed housing services, and infrastructure management (including roads, community heating systems, water supply, sewage treatment/disposal, and other utilities). This program is included in FAA's ATC Facilities Strategic Sustainment Plan.

In remote locations or overseas the FAA owns, or in a few cases leases, approximately 150 dwelling units that are used for three purposes:

- Provide permanent housing for FAA employees in remote locations;
- Provide temporary quarters for FAA employees at remote locations (for example islands in the Bering Sea); and
- Provide 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 NAS facilities maintenance services. Additionally aviation inspectors and flight standards routinely use temporary lodging. All employees work to ensure safe, efficient, and expeditious movement of air traffic. Adequate and reasonably priced housing is not commercially available in these locations for employees and their families. All FAA organizations including ATO and non-ATO

use these housing and shelter services. FAA Housing and Life Safety Shelter System Services are vital elements of the Human Resources Management Plan.

This program refurbishes facility structures and roofs, mechanical systems, heating, ventilating, and air conditioning (HVAC) systems, roads and grounds, and other infrastructure directly related to housing and shelters.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The location of this housing is in areas where commercial housing is limited or non-existent. Maintenance of the NAS equipment and manning of air traffic facilities in these locations is vital to the safety of the traveling public. Without this investment in the existing housing, the cost of maintaining the air traffic services in the remote areas will be greatly increased due to the increased cost of travel needed to perform the work. In many cases, the technicians would need to travel to the worksite and back each day by aircraft as there is no housing available. Manning of the Flight Service Stations in remote Alaska is highly dependent on having adequate housing available. For example, air traffic controllers at the Grand Canyon would have a 60 mile commute over a mountain pass if the housing at Grand Canyon were not there.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete lifecycle replacement of major housing components for heating plant in Alaska.

Program Plans FY 2020-2022 – Performance Output Goals

- None.

2E03, AIRCRAFT RELATED EQUIPMENT PROGRAM

FY 2018 Request \$12.5M

- A, Aircraft Related Equipment (ARE) Program, M12.00-00
- B, NextGen Flight Simulation Testing and Research Technologies (Flight START) – Technology Refresh Program - Additional Projects, M12.01-04
- X, William J. Hughes Technical Center Laboratories – Flight Program Consolidation – Sustainment, F14.01-01

A, Aircraft Related Equipment (ARE) Program, M12.00-00

Program Description

The Aircraft Related Equipment (ARE) program supports the FAA's worldwide Flight Inspection (FI) mission to evaluate and certify Instrument Flight Procedures (IFPs) and ground-based and space-based navigational equipment. This mission includes some facilities for the Department of Defense, other Federal, State, private, and international customers. The FAA is currently operating a fleet of 29 FAA-owned and 2 leased aircraft to support the Flight Inspection Services (FIS) mission. The aircraft consist of: 17 Beechcraft 300; 5 Learjet 60; 6 Challenger 600 series; 1 Gulfstream IV; and 2 Citation XL (leased). The Gulfstream IV and the leased aircraft are operated by the Washington Flight Program (Hangar 6) at Ronald Reagan Washington National Airport. The ARE program outfits and updates the FIS aircraft fleet with the systems required for inspecting, certifying, modernizing and sustaining the

NAS and to meet NextGen requirements. The FIS aircraft must also be equipped with modern avionics to operate in the evolving global environment.

The ARE program provides FI aircraft with specialized test equipment to meet current and future performance requirements such as the Automated Flight Inspection System and the Next Generation Automated Flight Inspection System (NAFIS). ARE also provides a communication system for data gathered while airborne and the dissemination of post flight inspection results.

The new test equipment and avionics provides the capability for the flight validation & inspection of:

- Wide Area Augmentation System (WAAS)/Localizer Performance with Vertical Guidance (LPV/LP) approaches;
- Required Navigation Performance (RNP) IFPs;
- Area Navigation (RNAV) Standard Instrument Departures (SIDs);
- RNAV Standard Terminal Approach Routes (STARs);
- Distance Measuring Equipment (DME/DME) and Global Positioning System (GPS) routes;
- Automatic Dependent Surveillance – Broadcast (ADS-B);
- Wide Area Multilateration (WAM); and
- Ground Based Augmentation System Landing System (GLS).

The ARE program is grouped into three activities:

Aircraft Modernization:

Projects support avionics technology refresh and new/changing regulatory requirements for operating aircraft in Domestic and International airspace.

Flight Inspection System (Sustainment):

Projects support mission equipment technology refresh and new/changing regulatory requirements necessary to continue flight inspection of legacy NAS systems.

Flight Inspection System Modernization:

Projects support new mission equipment requirements and new/changing regulatory requirements necessary to provide flight inspection of Performance Based Navigation and implementation of evolving NextGen systems.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The FAA sustains system availability by ensuring the accuracy of navigational aid electronic signals, as well as validating and certifying the approach/departure flight procedures and terminal routes at all airports within the NAS and at military facilities world-wide. To perform this mission the fleet of FI aircraft must be modernized and updated to be compatible with the latest equipment and procedures. In FY 2015, a total of 12,926 flight inspections were conducted of existing ground-based navigational aids and existing IFPs; 1,107 had reportable discrepancies. This equates to 8.6% of published IFPs and associated ground-based navigational aids requiring further attention. A total of 2,496 IFPs required flight inspection in order to publish a new or amended flight procedure. The results of those flight inspections required 431 IFPs to be adjusted or were found to be unsatisfactory. Of the new or amended IFPs, 17.3% required correction and thereby avoided potentially unsafe IFPs from being published.

Program Plans FY 2018 – Performance Output Goals

Aircraft Modernization:

- Complete acquisition and/or installation of the following:
 - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule to be updated in FY 2017.
 - ADS-B Transponders for the Beech 300 fleet.
 - GLS CAT II/III equipment for Challenger 600-series aircraft.
 - Heads Up Display / Enhanced Vision System for the two Challenger 605 aircraft.
 - Advanced Avionics package on one of two Challenger 605 aircraft.
 - Fusion avionics upgrade on the one Challenger 604 aircraft.
 - Very High Frequency (VHF) and Global Navigation Satellite System Radio Frequency Interference (RFI) sensors for the Beech 300 and Challenger 600-series aircraft.
 - Flight Inspection Transponder & Lo-Power Selection for the two Challenger 605 aircraft.

Flight Inspection System Sustainment:

- Complete NAFIS updates for deployed aircraft.

Flight Inspection System Modernization:

- Deploy NAFIS Phase II on two Beech 300 aircraft.
- Deploy NAFIS Phase II on two Challenger aircraft.

Program Plans FY 2019 – Performance Output Goals

Aircraft Modernization:

- Complete acquisition and/or installation of the following:
 - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule to be updated in FY 2018.
 - ADS-B Transponders and Controller Pilot Data Link Capability (CPDLC) for the three Challenger 601 aircraft.
 - GPS antennas to include the L5 band on all aircraft types.

Flight Inspection System Sustainment:

- Deploy NAFIS Phase II updates for three Challenger aircraft.
- Develop NAFIS Phase II Block Upgrades.

Program Plans FY 2020 – Performance Output Goals

Aircraft Modernization:

- Complete acquisition and/or installation of the following:
 - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule to be updated in FY 2019.
 - Flight Management System (FMS) upgrade for the Beech 300 fleet.
 - Avionics system upgrades for the Challenger 601 fleet.

Flight Inspection System Sustainment:

- Deploy NAFIS Phase II updates for three Lear 60 aircraft.

Program Plans FY 2021 – Performance Output Goals

Aircraft Modernization:

- Complete acquisition and/or installation of the following:
 - FMS upgrade for the Beech 300 fleet based on the multi-year schedule to be established in FY 2020.
 - Avionics system upgrades for the Challenger 601 fleet and the Lear 60 fleet based on the multi-year schedule to be established in FY 2020.

Flight Inspection System Sustainment:

- Deploy NAFIS Phase II updates for two Lear 60 aircraft.

Program Plans FY 2022 – Performance Output Goals

Aircraft Modernization:

- Complete acquisition and/or installation of the following:
 - Avionics system upgrades for the Lear 60 fleet based on the multi-year schedule to be established in FY2021.
 - Acquire new Beech 300 propeller system for 17 aircraft.

Flight Inspection System Sustainment:

- Execute NAFIS updates for deployed aircraft based on the schedule to be established in FY 2021.

**B, NextGen Flight Simulation Testing and Research Technologies (Flight START) –
Technology Refresh Program - Additional Projects, M12.01-04**

Program Description

The NextGen Flight Simulation Testing and Research Technologies Technology Refresh Program will upgrade specific components of the Boeing and Airbus aircraft simulators used by the Flight Operations Simulation Branch. The FAA is responsible for approving special instrument approach procedures and the introduction of new concepts and technologies for aircraft navigation. The upgrade of these aircraft simulators will enable FAA to analyze and test the viability of new concepts and technologies and develop appropriate regulations for their use in the NAS.

The FAA acquired a Boeing narrow-body simulator (M12.01-01) and an Airbus wide-body Fly-By-Wire (FBW) simulator (M12.01-02) to support the implementation of new technology and changes to procedures. Both are 6-axis, full flight aircraft simulators that are configurable to the performance and handling characteristics of a narrow-body aircraft with two jet engines (Boeing 737), or a wide-body aircraft with two/four jet engines (A330/A340), utilizing electronic FBW flight control technologies.

The Airbus A320/330/340 simulator with side-stick control complements the narrow-body Boeing 737-800 next generation 6-axis full flight aircraft simulator in performing realistic, high fidelity operational evaluation activities to support 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.

An Investment Analysis Readiness Decision was approved in November 2016. A final investment decision (FID) is planned in 2nd quarter of FY 2018 for approval of the specific software or components to be replaced or upgraded in each simulator scheduled for technology refresh.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9-year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

The flight simulators improve air safety by providing the FAA with the capability to conduct NextGen operational evaluations on the impact of introducing new technologies and integrating advanced systems within the NAS. The simulators can also be connected with organic or geographically separated air traffic control labs and aircraft simulator assets to support on-going and future research and development projects to provide Flight Standards Service regulators with analysis data to ensure the safe implementation of new technologies. The aircraft simulators will improve safety by providing accident investigators, other inspectors, and analysts with the capability to replicate and analyze both incident and trend data for potential input and evaluation of procedure and/or equipment modifications.

Program Plans FY 2018 – Performance Output Goals

- Achieve FID.
- Purchase and install the Boeing 737-8 features; Roll Control Alerting System, updated Cockpit Display System software.
- Purchase and install latest Flight Management System version for the Boeing simulator.
- Complete update of the High Level Architecture for both simulators; integrate the NextGen Prototyping Network.
- Complete update of the Boeing Motion System DN1.
- Purchase and install updated Visual System for both simulators.
- Complete update of the High Level Architecture for both simulators.

Program Plans FY 2019 – Performance Output Goals

- Purchase and install the upgraded input/output Interface (currently R3, transition to XR) including a new host computer for the Airbus simulator.
- Purchase and install the latest industry standard aircraft flight data update for the A320 Flight Package.
- Purchase and install the latest industry standard aircraft flight data update for the A330 Level D simulator.
- Complete FAA training for the updated input/output (I/O) (XR) interface.

Program Plans FY 2020 – Performance Output Goals

- Purchase and install the upgraded I/O interface (XR) including a new host computer for the Boeing simulator.
- Complete update of the High Level Architecture (XR) for both simulators.

Program Plans FY 2021 – Performance Output Goals

- Purchase and install Enhanced Flight Vision System updates.
- Purchase and install the Boeing 737 MAX 8 update.

Program Plans FY 2022 – Performance Output Goals

- None.

X, William J. Hughes Technical Center Laboratories – Flight Program Consolidation – Sustainment, F14.01-01

Program Description

The FAA's Flight Program Operations' Research, Development, Test & Evaluation (RDT&E) mission is located at the William J. Hughes Technical Center (WJHTC), Atlantic City International Airport (ACY), New Jersey. The RDT&E mission serves many customers throughout the FAA and encompasses aircraft operations, aircraft maintenance, aircraft engineering and modifications, and an aircraft tracking range. The program currently operates, maintains, and modifies six aircraft of five different types. The aircraft are certificated under Federal Aviation Regulation Part 91, with a full deviation from Part 125 for the larger aircraft. These flying laboratories are equipped, or can be readily modified in house to support any and all FAA projects requiring flight test. When required by specific RDT&E projects, the mission may also utilize rental and loaned aircraft. As an adjunct to the aircraft, the RDT&E mission also operates and maintains a sophisticated aircraft tracking range. This range, which includes both laser and radar tracking systems, provides verification of aircraft "truth-in-space" location and track.

The RDT&E flight mission supports airborne evaluations required by WJHTC programs and laboratories. This program provides an integrated platform for research, development, test, evaluation, and operational field support for all NAS and NextGen acquisition programs within the FAA. These aircraft are used to support development and testing of prototype systems and NextGen solutions for integration into the NAS. Once operational, these systems are used for future development, system upgrades, and testing necessary to support operational field sites. Sustaining these aircraft in system configurations and capabilities that match airborne evaluation requirements of the WJHTC laboratories is critical to providing around the clock operational support to En Route, Terminal, and other ATC facilities.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The Research and Development Flight Program serves as FAA's research, development, testing, evaluation, and operational field support for evaluations requiring airborne data collection. The ability to conduct airborne evaluations enables the FAA to evaluate new concepts and programs while operating in the NAS using an accurately replicated operational environment. This increases the accuracy and reliability of the data used to develop new programs and helps critical acquisition programs maintain cost and schedule targets, and improves the overall operational efficiency of the agency.

Program Plans FY 2018 – Performance Output Goals

- Complete airborne evaluation of:
 - Unmanned Aircraft Systems (UAS):
 - Aircraft/Operator Detection
 - Enhanced Sense and Avoid Systems
 - Regulatory Development for Visual Line-of-Sight operations
 - System Wide Information Management (SWIM)
 - Aircraft Access to SWIM
 - Alternate Fuels Program:
 - General Aviation Unleaded Fuel Performance
 - Commercial Aviation Alternative Fuels Initiative
 - Bio-Fuels
 - Cybersecurity technical upgrades
 - Technical upgrades and airspace procedures for Commercial Space Transportation Safety
 - Airborne Collision Avoidance System:
 - Active Surveillance
 - Operational Specific Variant (e.g. Closely Spaced Parallel Runways)
 - Regulatory Development Minimum Operational Performance Standards
- Complete airborne and ground evaluation of Runway Incursion Reduction Program systems and procedures.

Program Plans FY 2019-2022 – Performance Output Goals

- Complete airborne evaluation of:
 - Enhanced navigation systems including Performance Based Navigation:
 - Ground Based Augmentation System Category II/III
 - GPS Satellite Based Augmentation Localizer Performance with Vertical Guidance
 - Helicopter Terminal Instrument Procedures
 - Helicopter Required Navigation Performance 0.3 Departure and En Route Operations
 - Trajectory Operations
 - Automatic Dependent Surveillance- Broadcast (ADS-B) technical upgrades:
 - Satellite Based ADS-B
 - Closely Spaced Parallel Operations (ADS-B In)
 - Flight Interval Management
 - Development/Test Automatic Dependent Surveillance-Rebroadcast
 - Controller Pilot Data Link Communication technical upgrades for Next Generation Communications:
 - Coverage evaluations of the NAS and Gulf of Mexico
 - Cybersecurity Technical upgrades
 - Ground Based Threats
 - Airborne Threats
 - Infrastructure Threats
 - Technical upgrades and airspace procedures for Commercial Space Transportation Safety
 - UAS platforms and technical components
 - Low Visibility Operations:
 - Enhanced Flight Vision Systems for Taxi
 - Enhanced Flight Vision Systems for Approach
 - Synthetic Vision Guidance System for Approach
- System Safety Management (SMS) Program – Update of SMS for flight program operations.

2E04, AIRPORT CABLE LOOP SYSTEMS – SUSTAINED SUPPORT

FY 2018 Request \$8.0M

Airport Cable Loop Systems Sustained Support, F10.00-00

Program Description

This program replaces existing on-airport, copper-based, FAA-owned signal/control cable lines that have deteriorated. These lines feed airport surveillance radar, air/ground communications, and landing systems data and information to the tower, and operational and maintenance information to FAA-staffed facilities. The primary emphasis will be on projects at airports with high traffic counts and enplanements. Obsolete underground telecommunications cable infrastructure systems are vulnerable to failure and could cause flight delays related to outages. Where cost-effective, the program will install fiber-optic cable in a ring formation to provide redundancy and communications diversity. The ring configuration allows information to flow from either side if there is a break in the cable. The airport cable loop program takes advantage of opportunities to save cost by coordinating projects with major construction projects (e.g. tower relocations and runway projects).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Airport Cable Loop Systems Sustained Support will reduce the number of unplanned outages attributed to deteriorating on-airport copper cables by replacing existing unsupportable communications equipment and deteriorated FAA-owned underground cable. The program improves signaling and communications, which allows

for increased operational availability of infrastructure systems. There have been 1498 delays and outages associated with cable loop from 2004 to 2015 for all of the airports in the NAS.

Program Plans FY 2018 – Performance Output Goals

- Start electronics installation at Houston, TX (IAH), Ft Lauderdale, FL (FLL) and Oakland, CA (OAK).
- Complete electronics installation at Denver, CO (DEN).
- Develop detailed plan for engineering and construction for Salt Lake City, UT (SLC).
- Complete four smaller scale projects (regionals), sites to be determined at the A/G Communications Integrated Requirements Team (AGIRT) in FY 2018.

Program Plans FY 2019 – Performance Output Goals

- Start electronics installation at Salt Lake City, UT (SLC).
- Complete electronics installation at Ft Lauderdale, FL (FLL) and Oakland, CA (OAK).
- Complete engineering and start construction at two airports whose plan was developed in FY 2018.
- Develop plan for two airports determined in FY 2017.
- Develop detail plan for engineering and construction for Omaha, NE (OMA).
- Complete four smaller scale projects (regionals), sites to be determined at the AGIRT in FY 2019.

Program Plans FY 2020 – Performance Output Goals

- Start electronics installation at Omaha Airport, NE (OMA).
- Complete engineering and start construction at two airports whose plan was developed in FY 2019.
- Develop plan for two airports determined in FY 2018.
- Develop detail plan for engineering and construction for San Diego, CA (SAN).
- Complete four smaller scale projects (regionals), sites to be determined at the AGIRT in FY 2020.

Program Plans FY 2021 – Performance Output Goals

- Complete construction at Houston, TX (IAH).
- Complete construction and electronics installation at Salt Lake City, UT (SLC).
- Start engineering for two airports whose plan was developed in FY 2020.
- Develop plan for two airports determined in FY 2019.
- Complete four smaller scale projects (regionals), sites to be determined at the AGIRT in FY 2021.

Program Plans FY 2022 – Performance Output Goals

- Complete electronics installation at Houston, TX (IAH)
- Complete construction at San Diego, CA (SAN)
- Start engineering for two airports whose plan was developed in 2021.
- Develop plan for two airports determined in FY 2020.
- Complete four smaller scale projects (regionals), sites to be determined at the AGIRT in FY 2022.

2E05, ALASKAN SATELLITE TELECOMMUNICATION INFRASTRUCTURE (ASTI)

FY 2018 Request \$20.9M

Alaskan Satellite Telecommunication Infrastructure (ASTI), C17.02-01 / X, Alaskan Satellite Telecommunication Infrastructure (ASTI) Enhancement, C17.02-02

Program Description

The ASTI program will modernize the Alaskan NAS Interfacility Communications System (ANICS) to support NAS Systems & Services. ANICS provides 90% of the communications to En Route, Terminal Air Traffic Control (ATC), and Flight Service in Alaska and the associated oceanic airspace for critical, essential, and routine ATC services in Alaska. ASTI accommodates legacy serial interfaces for NAS systems and provides ability to migrate to modern interfaces. ASTI can support expected NextGen higher bandwidth services and provide physical diversity via diverse

satellites / antennas. ASTI uses existing FAA owned infrastructure (antennas, etc.) and overcomes lack of commercial terrestrial infrastructure (like in CONUS) that would be cost prohibitive.

ASTI (C17.02-01):

The ASTI program will provide Alaska with critical, essential, and routine air traffic control telecommunications services including:

- Remote Control Air Ground and Remote Communications Outlets 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, Automated Weather Observation System (AWOS), and AWOS Data Acquisition System;
- Wide Area Augmentation System Reference Station; and
- Automatic Dependent Surveillance-Broadcast.

The ASTI program will provide important operational benefits that include:

- Improving network availability to required levels;
- Improving information system security to meet Federal standards;
- Reducing the number and duration of outages;
- Enabling more efficient use of satellite transponder bandwidth;
- Containing Operations and Maintenance costs; and
- Improving life cycle support (i.e., training, second level engineering support, radome maintenance and depot level supply support).

The ASTI program achieved its final investment decision on June 2011. In May 2017, the ASTI program office requested and was given approval by the Joint Resources Council (JRC) for a Baseline Change Decision (BCD). The ASTI program was determined to be the only viable solution for the timely replacement of the nearly unsustainable legacy ANICS deployed in the 1990s. The BCD revised the ASTI schedule to complete the majority of system deployment in FY 2018 with final implementation to be completed in FY 2019.

ASTI Enhancement (C17.02-02):

The ASTI Enhancement program was established in conjunction with the ASTI May 2017 BCD to address system activities that were underestimated in the original ASTI program baseline. The program will establish yearly software/hardware releases to allow for continual maintenance to the base system deployed. The yearly releases will help to ensure that components fielded under ASTI are maintained and remain operational through the system lifecycle by:

- Resolving all Problem Trouble Reports not addressed during the deployment phase of the base program;
- Addressing end-of-life products as they are identified and make changes as necessary to ensure continued operations;
- Keeping the system current with evolving network security requirements; and
- Updating the system architecture to meet Internet Protocol (IP) bandwidth and maintainability requirements.

Specifics of the yearly releases will be established as future requirements are identified.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

ASTI supports maintaining operational availability of the NAS. ASTI system availability has fallen below 0.9999 and is declining. Aviation access in the NAS is improved by minimizing outages for critical and essential

communications links between pilots and air traffic controllers. These links between FAA facilities and pilots are essential to ensure the flow of accurate and reliable information on air traffic movement, weather, and radar data.

Program Plans FY 2018 – Performance Output Goals

ASTI (C17.02-01):

- Complete Limited Deployment (start Full Deployment). (APB Milestone)
- Operational Readiness Date (ORD) achieved at 50% of the sites. (APB Milestone)

ASTI Enhancement (C17.02-02):

- None.

Program Plans FY 2019 – Performance Output Goals

ASTI (C17.02-01):

- Last-site Operational Readiness Date (ORD). (APB Milestone)

ASTI Enhancement (C17.02-02):

- Deploy Software/Hardware Sustainment Release 1.

Program Plans FY 2020 – Performance Output Goals

ASTI (C17.02-01):

- Closeout annual recurring software and recurring teleco costs for last implementation sites.

ASTI Enhancement (C17.02-02):

- Deploy Software/Hardware Sustainment Release 2.

Program Plans FY 2021 – Performance Output Goals

ASTI (C17.02-01):

- None.

ASTI Enhancement (C17.02-02):

- Complete Deployment of Software/Hardware Sustainment Release 3.

Program Plans FY 2022 – Performance Output Goals

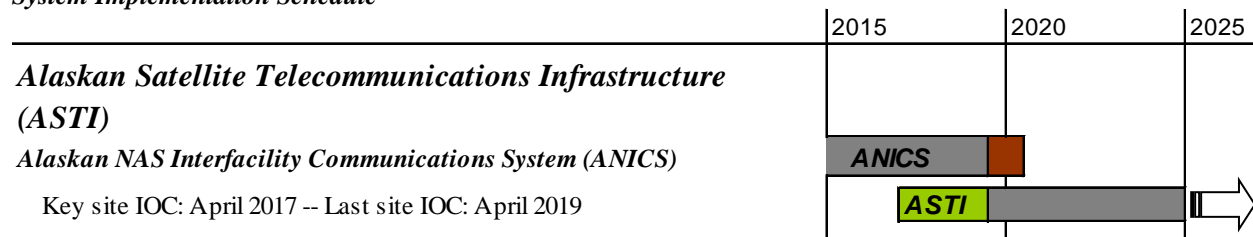
ASTI (C17.02-01):

- None.

ASTI Enhancement (C17.02-02):

- None.

System Implementation Schedule



2E06, FACILITIES DECOMMISSIONING

FY 2018 Request \$13.9M

Decommissioning – Real Property Disposition, F26.01-01

Program Description

The Decommissioning – Real Property Disposition program works with other FAA program offices to identify and plan for the timely disposition of real property assets that are no longer required by the agency. When the FAA decommissions a site or system, this program is responsible for conducting an assessment of the property and

determining the best course of action for its disposal. When a program office identifies excess real property at a decommissioned site, this program provides the technical expertise to plan and initiate disposal of the unneeded real property assets. Planning for the orderly disposition of property at multiple locations across the country is prioritized considering cost, available technical resources for site restoration and disposal, and potential environmental or safety impacts to surrounding communities if disposition is delayed. With the implementation of NextGen, demand for disposal of real property is expected to increase as sites no longer needed for NAS operations are decommissioned.

The NAS Enterprise Architecture identifies the transition of many systems that will require disposal. For example:

- Many ground to ground communication systems such as Radio Communication Links (RCL) are transitioning to the FAA Telecommunications Infrastructure service;
- Some locations of ground based navigation systems will no longer be required as the transition to satellite navigation continues;
- Surveillance and weather radar systems will be transitioning to the NextGen Surveillance and Weather Radar Capability requiring disposal of existing radars; and
- Consolidation of air traffic control facilities may require disposal of existing buildings.

The four services provided by the program are:

- Identifying, verifying, and scheduling the disposition and site restoration work;
- Investigating and documenting the structures to be removed at each site, determining the required restoration associated with the site, and developing scopes of work and schedules with milestones;
- Final disposition of decommissioned infrastructure and property restoration including infrastructure removal or demolition, removal and disposal of debris and hazardous materials, and evaluation of impact upon cultural and historic preservation, wetlands, and natural resource protection; and
- Conducting Phase I Environmental Due Diligence Audits reports for government-owned properties, as required by the General Services Administration and applicable laws.

The program serves a critical role in the removal of these facilities from the FAA's asset inventory and the subsequent reduction of Operations and Maintenance costs, lease costs (where applicable), and associated liabilities. This program is included in the ATC Facilities Sustainment Strategic Plan.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

This program improves management of FAA's real property assets by reducing maintenance costs and disposing of excess assets. Cost savings averaging \$5M per year have been achieved through the termination of leases and avoided maintenance costs resulting from the disposal of real property that is no longer needed by the FAA.

Program Plans FY 2018 – Performance Output Goals

- Complete approximately 75 Real Property Disposal Projects, approximately 25 per Service Area. These projects typically include, Visual Aids Navigational Aids, Radio Communications sites including Towers. This will include disposal of Radio Communications Link Repeater (RCLR) /Radio Communications Link Terminal (RCLT) Tower sites.
- Dispose of 8 Very High Frequency Omnidirectional Range (VOR) sites.

Program Plans FY 2019 – Performance Output Goals

- Complete approximately 75 Real Property Disposal Projects, approximately 25 per Service Area. These projects typically include, Visual Aids Navigational Aids, Radio Communications sites including Towers. This will include disposal of RCLR /RCLT Tower sites.
- Dispose of 12 VOR sites.

Program Plans FY 2020 – Performance Output Goals

- Complete approximately 75 Real Property Disposal Projects, approximately 25 per Service Area. These projects typically include, Visual Aids Navigational Aids, Radio Communications sites including Towers. This will include disposal of RCLR /RCLT Tower sites.
- Dispose of 12 VOR sites.

Program Plans FY 2021 – Performance Output Goals

- Complete approximately 75 Real Property Disposal Projects, approximately 25 per Service Area. These projects typically include, Visual Aids Navigational Aids, Radio Communications sites including Towers. This will include disposal of RCLR /RCLT Tower sites.
- Dispose of 12 VOR sites.

Program Plans FY 2022 – Performance Output Goals

- Complete approximately 75 Real Property Disposal Projects, approximately 25 per Service Area. These projects typically include, Visual Aids Navigational Aids, Radio Communications sites including Towers. This will include disposal of RCLR /RCLT Tower sites.
- Dispose of 12 VOR sites.

2E07, ELECTRICAL POWER SYSTEMS – SUSTAIN/SUPPORT

FY 2018 Request \$110.0M

Power Systems Sustained Support (PS3), F11.01-01 / X, Power Systems Sustained Support (P3S) – Future Segments, F11.01-02

Program Description

The Power Systems Sustained Support (PS3) programs are responsible for sustaining components of existing power systems and cable infrastructure to maintain and improve the overall electrical power quality, reliability, and availability. The PS3 programs replace and refurbish FAA NAS electrical power systems and include the installation of electrical components that condition, generate, distribute, and regulate power, and components that protect NAS facilities and equipment from lightning and other electromagnetic disturbances. These components are necessary to allow reliable and continued operation of sensitive electronic equipment when there are interruptions, surges, or fluctuations of commercial power. These components are also used to protect facilities, people and equipment from damage. The type of a power system deployed at site varies by load requirement, power sensitivity, and the criticality of the equipment that it supports. These programs are included in the ATC Facilities Sustainment Strategic Plan.

Power Systems Sustained Support (PS3) (F11.01-01):

This program sustains the following components and services:

- PS3 Program Management and System Engineering: PS3 issues policy, engineering orders, standards, specifications, handbooks, studies, etc. to define, refine and document NAS power system requirements. It provides program and project support throughout the project and system life cycle, including design, system validation, quality control, quality assurance, and safety improvement.
- Engine Generators (EG): EGs provide backup power at selected General National Airspace System (GNAS) and terminal facilities and are the primary source of power at some remote locations for NAS electronic systems when commercial power is unavailable or becomes unreliable. The PS3 program replaces engine generators having a 20-year useful life if they provide backup power and a 5-year useful life if they provide prime power. When installed, some existing fuel lines, from EG to fuel tank, may be replaced to comply with environmental compliance codes. Likewise, existing fuel tanks may be disposed of where fuel storage requirements have been downsized. Work will be coordinated with the Fuel Storage Tank Sustainment Program.
- Power Conditioning System (PCS)/Uninterruptible Power Supply (UPS): PCS/UPS is a power quality and backup system that conditions commercial power and provides a short-duration power source that prevents power disruptions and surges from adversely affecting electronic system performance and critical NAS

infrastructure. The PS3 program replaces and refurbishes PCS/UPS systems that reach their expected useful life of 20 years.

- **Lightning Protection, Grounding, Bonding and Shielding (LPGBS):** LPGBS minimizes electrical hazards to personnel, facilities, and electronic equipment caused by lightning, voltage surges, electrostatic discharge, and power faults. Sites are hardened sufficiently to prevent NAS delay or loss of service, to minimize or preclude outages, and to enhance personnel safety. The useful life of LPGBS elements is 25 years.
- **Direct Current Backup System (DC BUS):** Using commercial power as the source, a DC BUS provides and distributes conditioned DC and AC voltages to NAS electronic equipment. It has batteries to provide several hours of power if commercial power fails. PS3 replaces DC BUSs that have a useful life of up to 15 years. DC BUSs may replace EGs where cost effective. When replacing EGs, the DC BUS program will remove and dispose of fuel tanks and fuel lines. Work will be coordinated with the EG Sustainment Program and Fuel Storage Tank Sustainment Program.
- **NAS Batteries:** Large-scale battery complexes serve as backup power sources for key NAS electronic installations at en route, terminal, and GNAS facilities. These batteries provide power for 15 minutes to 72 hours, depending on the load, during major power system disruptions and maintain the function of key systems. The PS3 program replaces Air Route Traffic Control Centers (ARTCC) Critical and Essential Power System (ACEPS) and GNAS battery installations every 4- to 20-years to ensure reliability.
- **Electrical Line Distribution (ELD):** The ELD is the infrastructure at airports and ancillary facilities that distributes commercial and backup power to key NAS equipment. The ELD is comprised primarily of distribution cable, transformers, and switchgear. ELD equipment beyond its 25 year useful life is replaced.
- **ARTCC Critical and Essential Power System (ACEPS):** The FAA operates ACEPS at 21 ARTCCs and 3 large Terminal Radar Approach Control (TRACONs) facilities where high quality power is required. ACEPS is comprised of engine generators, switchgear, and UPS. PS3 replaces and refurbishes ACEPS where the engine generators have a useful life of 24 years and other components have useful lives that range from 7 to 20 years.
- **Critical Power Distribution System (CPDS):** The CPDS is comprised of components such as electrical distribution equipment, transfer switches, engine-generators, UPS, and batteries. The FAA has standardized CPDS types which are optimally matched to the criticality and activity level of each NAS facility being served. The CPDS project replaces all components except for the engine-generators, UPS, and batteries.
- **Environmental Remote Monitoring System (ERMS):** ERMS provides the interface between power systems (EGs, DC BUS, PCS/UPS) and remote monitoring systems to provide system status to the Operations Control Centers. The status information allows a timely response to system-related issues.
- **Alternative Energy Systems (AES):** This activity integrates a broad range of clean energy technologies to meet NAS operational demands. FAA energy use includes energy generated from solar, wind, and fuel cells. The use of AES technologies supports Executive Order 13693 to maintain Federal leadership in sustainability and greenhouse gas emissions reduction. PS3 replaces AES installations that provide power to NAS equipment.

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):

The Future Segments program will continue the same sustainment and services activities as the base program starting in FY 2019. A Final Investment Decision (FID) is planned for 2nd quarter FY 2017.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

All NAS facilities depend on the availability, reliability, and quality of electrical power. Power systems sustain operational availability by reducing the incidence of NAS delays caused by equipment outages. The PS3 program replaces and improves electrical power equipment at airports, terminal facilities, and en route facilities, minimizing disruption of air traffic and maximizing availability and reliability of NAS systems.

Program Plans FY 2018 – Performance Output Goals

Power Systems Sustained Support (PS3) (F11.01-01):

- Complete PS3 segment. (APB milestone)
- Complete the following projects, the number of sets may vary based upon validation and priority for the year:
 - Engine generator replacement (50 sets).
 - PCS/UPS (8 sets).
 - LPGBS Elements (5 sets).
 - DC BUS (20 sets).
 - NAS battery Set Replacement (96 sets).
 - ELD replacements (197,000 lf).
 - ACEPS (4 sets).
 - CPDS (2 sets).
 - ERMS (81 sets).

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):

- None.

Program Plans FY 2019 – Performance Output Goals

Power Systems Sustained Support (PS3) (F11.01-01):

- None.

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):

- Complete the following projects, the number of sets may vary based upon validation and priority for the year:
 - Engine generator replacement (29 sets).
 - PCS/UPS (12 sets).
 - LPGBS elements (4 sets).
 - DC BUS (20 sets).
 - NAS battery set replacement (131 sets).
 - ELD replacements (90,000 linear feet).
 - ACEPS (4 sets).
 - CPDS (1set).
 - ERMS (81 sets).
 - AES (1set).

Program Plans FY 2020 – Performance Output Goals

Power Systems Sustained Support (PS3) (F11.01-01):

- None.

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):

- Complete the following projects, the number of sets may vary based upon validation and priority for the year:
 - Engine generator replacement (31 sets).
 - PCS/UPS (15 sets).
 - LPGBS elements (4 sets).
 - DC BUS (26 sets).
 - NAS battery set replacement (140 sets).
 - ELD replacements (100,000 linear feet).
 - ACEPS (4 sets).
 - CPDS (1 set).
 - ERMS (81 sets).
 - AES (1 set).

Program Plans FY 2021 – Performance Output Goals

Power Systems Sustained Support (PS3) (F11.01-01):

- None.

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):

- Complete the following projects, the number of sets may vary based upon validation and priority for the year:
 - Engine generator replacement (31 sets).
 - PCS/UPS (15 sets).
 - LPGBS elements (4 sets).
 - DC BUS (26 sets).
 - NAS battery set replacement (140 sets).
 - ELD replacements (100,000 linear feet).
 - ACEPS (4 sets).
 - CPDS (1 set).
 - ERMS (81 sets).
 - AES (1 set).

Program Plans FY 2022 – Performance Output Goals

Power Systems Sustained Support (PS3) (F11.01-01):

- None.

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):

- Complete the following projects, the number of sets may vary based upon validation and priority for the year:
 - Engine generator replacement (39 sets).
 - PCS/UPS (22 sets).
 - LPGBS elements (12 sets).
 - DC BUS (9 sets).
 - NAS battery set replacement (149 sets).
 - ELD replacements (172,000 lf).
 - ACEPS (4 sets).
 - CPDS (4 sets).
 - ERMS (10 sets).
 - AES (1 set).

2E08, ENERGY MANAGEMENT AND COMPLIANCE (EMC)

FY 2018 Request \$2.4M

Energy Management and Compliance (EMC), F13.04-02

Program Description

The Energy Management and Compliance (EMC) program centrally orchestrates cost-effective reductions of energy and water use at Air Traffic Organization (ATO) facilities. This is accomplished 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 not only reduces operational costs to the ATO but also increases reliability of the NAS by reducing the likelihood of facility outages and disruptions. The EMC program promotes energy and water-use efficiency and the use of clean and renewable energy sources for all activities and acquisitions. This program is included in the ATC Facilities Sustainment Strategic Plan.

The EMC program also contributes to the FAA’s progress toward meeting Federal greening mandates, including:

- National Energy Conservation Policy Act;
- Energy Policy Act of 2005;
- Energy Independence and Security Act of 2007,
- Executive Order 13693; and
- DOT/FAA Strategic Sustainability Performance Plan.

The EMC program provides a coordinated approach for identifying and implementing cost-effective investments in FAA infrastructure to reduce ongoing utility expenses. The EMC program achieves this by focusing on six specific capability areas:

1. Improving monitoring of ATO energy performance, including engineering, designing, planning, and testing a cost-effective approach for installing advanced electric meters to comply with the provisions of 42 U.S. Code, Section 8253.
2. Implementing energy and water efficiency projects at targeted sites using capital funding to improve ATO performance, including infrastructure improvements with the greatest cost-to-benefit ratios and the shortest payback periods.
3. Coordinating performance-based contracts to execute energy and water efficiency improvements using third party financing, thereby maximizing the amount of infrastructure investment at NAS facilities that can be achieved with capital funding.
4. Increasing the number of High Performance Sustainable Buildings (HPSB) in ATO's portfolio by implementing targeted infrastructure improvements at selected large staffed facilities in compliance with Executive Order 13693.
5. Improving building operating performance by designating trained ATO energy managers for the highest energy-using ATO facilities to monitor energy and water consumption and develop cost-effective recommendations to reduce energy and water use.
6. Benchmarking ATO performance and documenting progress by completing 10 annual data call reports mandated by executive orders and legislative statutes.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The EMC program supports the FAA Performance Metric to implement cost-efficiency initiatives by reducing the utility expenditures (energy and water) of ATO facilities. The EMC program achieves this by providing technical expertise on energy and water management, implementing targeted infrastructure investments, training ATO personnel on optimizing facility performance, and tracking and reporting on energy and water usage. The EMC program has the potential to reduce electrical costs annually by approximately 2.5 percent at facilities where advanced meters are installed, 12-13 percent at facilities where energy improvements are performed, and 14 percent at facilities where high performance sustainable building upgrades are performed.

Program Plans FY 2018 – Performance Output Goals

- Install advanced electric meters at two facilities.
- Perform energy and water improvements at three facilities.
- Provide required quarterly and annual reports on progress against legislative and executive order mandates to the Department of Energy (DOE) and the Office of Management and Budget (OMB).

Program Plans FY 2019 – Performance Output Goals

- Perform energy and water improvements at five facilities.
- Provide required quarterly and annual reports on progress against legislative and executive order mandates to the DOE and the OMB.

Program Plans FY 2020 – Performance Output Goals

- Perform energy and water improvements at seven facilities.
- Perform HPSB upgrades at four facilities.
- Provide required quarterly and annual reports on progress against legislative and executive order mandates to the DOE and the OMB.

Program Plans FY 2021 – Performance Output Goals

- Perform energy and water improvements at seven facilities.
- Perform HPSB upgrades at four facilities.
- Provide required quarterly and annual reports on progress against legislative and executive order mandates to the DOE and the OMB.

Program Plans FY 2022 – Performance Output Goals

- None.

2E09, CHILD CARE CENTER SUSTAINMENT

FY 2018 Request \$1.0M

Child Care Centers – Infrastructure Improvements, F22.01-01

Program Description

Available on-site child care greatly enhances the FAA's ability to recruit and retain a highly qualified, diverse work force. The FAA's child care centers were constructed and furnished in the early 1990's and require upgrading and modernizing to provide for the current needs of employees and to meet current safety and building code requirements. Many of these centers require refurbishment including roof replacements, heating, ventilation, and air conditioning system upgrades, fire suppression system replacement, and other facility infrastructure system upgrades. This is a multi-year modernization program that will address facility requirements for 11 FAA operated Child Care Centers located at 10 Air Route Traffic Control Centers (ARTCCs) and 1 Terminal Radar Approach Control (TRACON).

Federal agencies are authorized to support provisioning of child care centers under the Tribble Amendment (Public Law 99-591). These sites were established and approved based on formal needs assessments of employees, surveys of surrounding private child care availability, and employee and management support. The child care centers are managed as non-profit corporations by boards of directors consisting of Agency employees/parents. Tuition and fund raising efforts by the nonprofit corporation pay for the child care center's staff and operations costs (exclusive of maintenance and utilities).

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 4 – Empower and Innovate with the FAA's People.*
- *FAA Performance Metric 1 – The FAA is rated in the top 25 percent of places to work in the federal government by employees. (Business Planning Metric)*

Relationship to Performance Metric

Agency support of on-site child care centers has a direct positive correlation with the OPM Employee Viewpoint survey. The top ten General Services Administration child care center customers all score within the top 20 on the Employee Viewpoint survey. The Child Care Centers – Infrastructure Improvements program supports improving the FAA's ranking on the OPM Federal Viewpoint survey. Access to high quality, accessible child care programs and resources provides a sense of stability for parents and results in increased employee productivity. Survey research also indicates that available on-site child care results in less absence and stress related to child care issues.

Program Plans FY 2018-2021 – Performance Output Goals

- Complete upgrade/modernization projects at 11 centers including, but is not limited to sprinkler systems, storage cabinets, and appliances. The number of projects will be based on an annual facility condition survey/onsite assessment of Child Care Center locations.

Program Plans FY 2022 – Performance Output Goals

- None.

2E10, FAA TELECOMMUNICATIONS INFRASTRUCTURE 2

FY 2018 Request \$2.0M

FAA Telecommunications Infrastructure – 2, C26.01-02

Program Description

Telecommunications is essential to the operations of the NAS and the FAA. The FTI-2 program will be the successor to the existing FTI program through which the FAA currently obtains approximately 25,000 telecomm services to more than 4,000 locations. FTI telecommunications services are designed, engineered, and provisioned to meet FAA-specific availability, latency, and security requirements. In addition to “traditional” telecommunications services, FTI also provides enterprise messaging services based upon Service-Oriented Architecture technologies and specialized infrastructure services such as a domain name service, network time protocol service and security gateway services.

The FTI-2 program will provide all of the capabilities currently available from the current FTI contract plus the next generation of telecommunications, messaging, and infrastructure services required by FAA programs during the FTI-2 program life cycle. The FTI-2 program will address challenges associated with the phase-out of legacy telecommunication services offered by commercial carriers that are based upon time division multiplexing (TDM). Today, nearly 90% of the FAA’s telecommunications services are dependent upon TDM-based technology. It is unlikely that all FAA systems that rely on existing TDM services will be able to modernize their telecommunications interfaces by the target phase-out date. The FTI-2 program will need to address the challenge of continuing to support the legacy interfaces when TDM-based services are no longer available as a commercial offering.

In planning for FTI-2, the FAA is currently assessing opportunities to use new technology and service delivery models to improve the quality and efficiency of telecommunications services. It has not yet been determined whether the scope of services to be addressed by the FTI-2 program will be obtained through one or more competitive procurements. While there are economies of scale provided by a single consolidated procurement, there may be other benefits to partitioning the services into groupings with similar performance characteristics. The program has begun market research and analysis activities to assess telecommunications industry and technology trends and the ability to satisfy critical FAA requirements.

The program is working toward investment decisions; the Investment Analysis Readiness Decision (IARD) is planned for FY 2019, Initial Investment Decision (IID) is planned in FY 2020, and Final Investment Decision (FID) is planned in FY 2021.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

FTI-2 will support the performance target of achieving cost savings and cost avoidance by providing a cost-effective means to meet the telecommunications connectivity requirement of NAS programs. FTI-2 will also provide the ability to dynamically allocate bandwidth to support the NextGen concept of operations for load sharing, i.e., the ability to only pay for the capacity that is needed, when it is needed. Analysis is under way to quantify the potential cost benefits of the program.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the IARD:
 - Safety Assessment Plan;
 - Solution Concept of Operations; and
 - Functional Analysis.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the IARD:
 - Preliminary Program Requirements;
 - Enterprise Architecture Products;
 - Initial Implementation Strategy and Planning Document
 - Shortfall Analysis/Quantification;
 - Range of Alternatives;
 - Business Case; and
 - Lifecycle cost estimate
- Achieve IARD for FTI-2

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the IID:
 - Updated Program Requirements;
 - Initial Business Case;
 - Initial implementation strategy and planning documents for each alternative; and
 - Final Investment Analysis Plan.
- Achieve IID for FTI-2.
- Complete draft Screening Information Request (SIR).

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of the FID:
 - Acquisition program baseline;
 - Final program requirements document;
 - Final business case;
 - Final implementation strategy and planning document;
 - Program management plan; and
 - Updated architecture products and amendments.
- Achieve FID for FTI-2.
- Complete and release final SIR.
- Pending JRC approval:
 - Develop the following products:
 - Implementation Strategy and Planning Document (ISPD)
 - Power and Space NAS Change Proposals
 - Security Certification and Authorization Package
 - Operational Test Plans and Procedures
 - Other output goals will be determined at FID.

Program Plans FY 2022 – Performance Output Goals

- Pending JRC approval:
 - Finalize evaluation of vendor proposals.
 - Award contract.
 - Other output goals will be determined at FID.

2E11, DATA, VISUALIZATION, ANALYSIS AND REPORTING SYSTEM (DVARs)

FY 2018 Request \$5.5M

Data, Visualization, Analysis and Reporting System (DVARs), M08.28-05

Program Description

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. Planning for facility and system enhancements requires the ability to track, monitor, and analyze the daily NAS operations. PDARS facilitates the modeling, measurement, and analysis of new runways, airfield improvements, air traffic procedures, and other technological implementations that improve airport capacity and system efficiency.

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. The DVARs requirements identify opportunities for technology insertions, analytical upgrades, and migration to enterprise architecture that implements service oriented architecture features defined by input from the user community. 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.

Program work includes:

- Replacement of PDARS through the development and implementation of the DVARs utilizing a phased approach;
- Leveraging new technologies to enhance the current capabilities of PDARS through the implementation of DVARs at a centralized FAA data center to provide streamlined system updates and expand user access;
- Providing critical system enhancement to the existing PDARS to ensure continued currency of the system through system replacement;
- Using PDARS/DVARs operational data to baseline the measurement and analysis of Next Generation Air Transportation System (NextGen) capability improvements such as support to Airspace Optimization (Metroplex); and
- Transitional activities for migrating PDARS functions and data to DVARs.

Final Investment Decision for Segment 1 is planned in FY 2017.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 2 – Maintain an average daily capacity for core Airports of 58,006, or higher, arrivals and departures.*

Relationship to Performance Metric

This program will facilitate the modeling, measurement, and analysis of airfield improvements, air traffic procedures, and other technological implementations to improve airport capacity and system efficiency. In advance of large-scale airport construction projects, capacity and delay impacts are also assessed in order to improve coordination between airports, aircraft operators, and ATC.

Program Plans FY 2018 – Performance Output Goals

- Pending JRC approval:
 - Complete final Design Review.
 - Develop DVARS data and processing system to meet program requirements.

Program Plans FY 2019 – Performance Output Goals

- Pending JRC approval:
 - Complete implementation of DVARS data and processing system capabilities.
 - Develop DVARS visualization to meet program requirements.
 - Develop DVARS reporting capability to meet program requirements.

Program Plans FY 2020 – Performance Output Goals

- Pending JRC approval:
 - Complete implementation of DVARS visualization capability.
 - Complete implementation of DVARS reporting capability.

Program Plans FY 2021 – Performance Output Goals

- Pending JRC approval:
 - Complete full implementation of DVARS to meet requirements for initial operating capability.
 - Review DVARS continuous operations objective requirements and produce lower level requirements list for implementation.
 - Complete design of DVARS continuous operations to meet program objectives.

Program Plans FY 2022 – Performance Output Goals

- Pending JRC approval:
 - Complete implementation of DVARS continuous operations capability.
 - Develop DVARS requirements for future enhancements to meet user needs.
 - Implement identified system upgrades.

2E12, TIME-DIVISION MULTIPLEXING TO INTERNET PROTOCOL (TDM-TO-IP) MIGRATION
FY 2018 Request \$3.0M

Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration, M56.01-01

Program Description

Major U.S. telecommunications carriers have stated their intention to discontinue TDM-based services as early as calendar year 2020. 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. FAA makes extensive use of the infrastructure of commercial telecommunications carriers to reach more than 4,000 facilities operated both within and outside the Continental United States. As these carriers phase-out TDM-based infrastructure and migrate to IP-based technology the potential impacts to the FAA are significant as the majority of NAS services are currently dependent upon the precision timing, deterministic performance, and low latency of TDM-based services.

This program will oversee the investment portfolio for TDM-to-IP Migration and begin the systems interface development work in order to modernize NAS Systems to be IP-compatible. 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 (referred to as a “Type A” solution)
- Modernize the system communications interface of NAS systems with standalone conversion boxes in order to be IP-compatible as part of the standard technology refresh process (“Type B” solution)
- Implement network-provided TDM-to-IP conversion device (“Type C” solution)

The program is planning for an Investment Analysis Readiness Decision (IARD) in 1st quarter of FY 2019 and a Final Investment Decision (FID) in 1st quarter FY 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

This program will prevent NAS systems from being impacted by the transition to Carrier Ethernet IP-based technology by commercial telecommunications carriers.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the IARD:
 - Shortfall Analysis/Qualification;
 - Enterprise Architecture (EA) Products (25%);
 - Safety Assessment; and
 - Rough Order of Magnitude Cost

Program Plans FY 2019 – Performance Output Goals

- Complete 25% development of the Type B solution.
- Develop the following products in support of the IARD:
 - EA Products (100%);
 - Draft Final Program Requirements; and
 - Investment Analysis Plan.
- Achieve IARD for the TDM-to-IP Migration program.

Program Plans FY 2020 – Performance Output Goals

- Complete 50% development of the Type B solution.
- Complete 25% of the Migration Plans for all Portfolio Programs.
- Develop the following products in support of the FID:
 - Final Program Requirements document;
 - Final Business Case;
 - Funding Options & Operational Risk Analysis;
 - Final Implementation Strategy and Planning Document;
 - Variable Quantity Execution Plan; and
 - In-Service Review Checklist.
- Achieve FID for the TDM-to-IP Migration program.

Program Plans FY 2021 – Performance Output Goals

- Complete 75% development of the Type B solution.
- Complete 50% of the Migration Plans for all Portfolio Programs.

Program Plans FY 2022 – Performance Output Goals

- Complete 100% development of the Type B solution.
- Complete 100% of the Migration Plans for all Portfolio Programs.

2E13X, INDEPENDENT OPERATIONAL ASSESSMENT

FY 2018 Request \$0.0M

X, Independent Operational Assessment (IOA), M25.00-00

Program Description

The Independent Safety Assessments Team conducts Independent Operational Assessments (IOA) of designated systems and system modifications in an operational environment in support of productions and in-service decisions to ensure operational readiness and compliance with Safety Risk Management. These in-service decisions allow nationwide deployment and operational use of the system and ensures that the associated operational and safety risk is minimized, therefore, reducing system lifecycle operations cost and improving the safety of the NAS. The IOA Team may monitor portions of Development Test, Operational Test, Site Acceptance Test, Field Familiarization, system assessments conducted prior to contract award, and Research and Development demonstrations of designated programs. To maintain its independence, the IOA Team does not directly participate in these activities, but instead monitors them to identify potential safety risks and operational concerns, as well as possible areas of improvement in the assessment process.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

This program supports the safety performance metric of reducing commercial air carrier fatalities by conducting and ensuring operational assessments of designated NAS systems, processes and procedures are within acceptable levels of safety risk prior to deployment and implementation in the NAS. This independent oversight contributes to the proactive identification of safety risk and the follow up actions to increase safety.

Program Plans FY 2018-2022 – Performance Output Goals

A list of designated systems or modifications to be assessed will be determined and documented in the IOA Memorandum at the beginning of each fiscal year.

- Develop final IOA report.

ACTIVITY 3: NON-AIR TRAFFIC CONTROL FACILITIES AND EQUIPMENT

A: Support Programs

3A01, HAZARDOUS MATERIALS MANAGEMENT

FY 2018 Request \$35.3M

Environmental Cleanup / Hazardous Materials (HAZMAT), F13.02-00

Program Description

The Hazardous Materials Management (HAZMAT) program remediates FAA-owned or FAA-leased sites that were contaminated by the FAA or by its previous owner; and is included in the ATC Facilities Sustainment Strategic Plan. As of the beginning of FY 2017, the FAA has identified approximately 657 contaminated Areas Of Concern (AOCs) nationwide that require investigation, remediation, and closure activities. Environmental cleanup site investigations have confirmed that toxic contamination resulted from a variety of hazardous substances including cleaning solvents, fuels, pesticides, asbestos, polychlorinated biphenyls (PCBs), and heavy metals. The FAA has several facilities with mandatory remediation and monitoring schedules in place as part of negotiated agreements with regulatory agencies; some of the contaminated sites are located at the Mike Monroney Aeronautical Center and the William J. Hughes Technical Center. These agreements require the FAA to remediate contaminated soil and groundwater. Extensive contamination at the FAA Technical Center prompted the Environmental Protection Agency (EPA) to place the site on the EPA National Priorities List, indicating its status as one of the Nation's most environmentally dangerous sites (i.e., a Superfund site).

Annually, the FAA publishes the Environmental Site Cleanup Report. This document contains current and expected future cleanup activities for the 657 contaminated AOCs mentioned above. An estimate of out-year environmental remediation (ER) liabilities is also included in this report. At the beginning of FY 2017, ER liability was estimated at approximately \$492 million; with contingency and inflation added, total ER liability is approximately \$838 million. Significant progress is being made toward remediation of AOCs but additional AOCs being identified each year and remediation of some higher cost AOCs are expected to remain open for many years or decades. During FY 2016, 150 AOCs were closed and an additional 110 AOCs were added with an overall reduction of the program's ER liability estimate of \$158 million.

The HAZMAT program is responsible for remediating these contaminated AOCs to comply with applicable environmental regulations. The FAA must continue mandated program activities to achieve compliance with all Federal, State, and local environmental cleanup regulations, including the Resource Conservation and Recovery Act of 1976, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), and the Superfund Amendment and Reauthorization Act of 1986. FAA program activities include conducting site investigations; managing hazardous materials (including hazardous waste accumulation, handling, and disposal); installing groundwater monitoring wells; remediating site contamination; and operating air pollution controls. The FAA performs assessment, remediation, and closure activities as aggressively and proactively as funding will allow. Future planned efforts include conducting contaminant investigations, implementing site remediation projects, and completing required regulatory closures.

The following activities are covered under the Environmental Cleanup program:

- Site cleanups required under CERCLA;
- Site cleanups required by State or local cleanup or spill regulations;
- Fuel Storage Tank (FST) site remediation for cleanup efforts;
- Asbestos, lead, and PCB cleanups for spills or other releases into the environment;
- Corrective actions and hazardous waste spill responses pursuant to the Resource Conservation and Recovery Act;
- Hazardous waste characterization; and
- Environmental Cleanup program management, policy, and oversight support.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The HAZMAT program supports the FAA’s performance metric to implement cost-efficiency initiatives by improving financial management of environmental cleanup activities for contaminated sites within existing NAS legacy FAA properties. The program achieves this objective through continued refinement of project cost estimating as well as progress tracking of assessment, remediation, and closure activities for contaminated sites and by FY 2016 ER liability estimate was reduced by \$158 million.

Program Plans FY 2018 – Performance Output Goals

- Complete remediation activities at 70 AOCs, resulting in a finding that no further resources need to be applied to these AOCs.

Program Plans FY 2019 – Performance Output Goals

- Complete remediation activities at 70 AOCs, resulting in a finding that no further resources need to be applied to these AOCs.

Program Plans FY 2020 – Performance Output Goals

- Complete remediation activities at 70 AOCs, resulting in a finding that no further resources need to be applied to these AOCs.

Program Plans FY 2021 – Performance Output Goals

- Complete remediation activities at 70 AOCs, resulting in a finding that no further resources need to be applied to these AOCs.

Program Plans FY 2022 – Performance Output Goals

- Complete remediation activities at 70 AOCs, resulting in a finding that no further resources need to be applied to these AOCs.

3A02, AVIATION SAFETY ANALYSIS SYSTEM (ASAS)

FY 2018 Request \$12.0M

Regulation and Certification Infrastructure for System Safety (RCISS) – Segment 3, A17.01-03

Program Description

RCISS is an existing technology refresh program to upgrade and maintain the Information Technology (IT) enterprise infrastructure that supports the Aviation Safety (AVS) safety workforce. This IT infrastructure includes automation

hardware, software, and communication components which support AVS safety data and applications. Most current and planned capital investment initiatives for AVS rely on the IT infrastructure being deployed by RCISS, including the Aviation Safety Knowledge Management Environment (ASKME-A26.01-01), System Approach for Safety Oversight (SASO-A25.02-02), and Aerospace Medicine Safety Information System (AMSIS-A35.01-01) programs. In addition, RCISS infrastructure supports emerging capabilities such as the Pilot Records Database (PRD), Enterprise Information Management, and several AVS sponsored Unmanned Aircraft System applications.

RCISS Segment 3 will perform technology refresh on the AVS IT infrastructure established by Segments 1 and 2 and enhance delivery of IT infrastructure services in accordance with government and industry best practices. For example, where applicable, RCISS will invest in Cloud-based solutions to provide the safety workforce with access to data and applications that is secure, reliable, and cost-effective.

Segment 3 program activities include technology refresh of the following IT infrastructure components and continues support to AVS's Safety Workforce of over 6,000 people:

- Mobile toolkits (consisting of mobile tablet computers and peripherals);
- Telecommunications solutions;
- Application servers and data storage devices hosting national AVS safety applications;
- COTS Software licenses; and
- Cloud-based solutions.

RCISS technology refresh is based on the service life of individual components and incrementally performed each year. For example, mobile toolkits deployed to the safety workforce have a service life of four years and approximately 25% of mobile toolkits are replaced each year. The program will also procure contractor support services to provide specialized technical expertise in modernizing and maintaining the RCISS enterprise infrastructure.

A Final Investment Decision (FID) was approved in March 2017.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Inspection and review of airline safety programs and practices are integral to the FAA safety program. The IT infrastructure provided by the RCISS program will enable real-time access by the safety workforce while working in the field (e.g. inspectors, engineers, investigators, and medical examiners) to airline safety records and the required actions to meet regulations and directives. RCISS enabled the realization of the quantifiable safety benefits claimed by the SASO and ASKME investments by providing the IT infrastructure on which these AVS business applications reside. RCISS will continue to enable the safety benefits promised by these programs, as well as other key AVS safety investments such as AMSIS and PRD.

Program Plans FY 2018 – Performance Output Goals

- Complete Deployment 11 technology refresh of approximately 25% of mobile toolkits.
- Complete Deployment 11 technology refresh of 100% of newly identified enterprise data center systems that have reached end-of-life.
- Complete Deployment 11 technology refresh of approximately 14% of local telecommunications switches.

Program Plans FY 2019 – Performance Output Goals

- Complete Deployment 12 technology refresh of approximately 25% of mobile toolkits.
- Complete Deployment 12 technology refresh of 100% of newly identified enterprise data center systems that have reached end-of-life.
- Complete Deployment 12 technology refresh of approximately 14% of local telecommunications switches.

Program Plans FY 2020 – Performance Output Goals

- Complete Deployment 13 technology refresh of approximately 25% of mobile toolkits.
- Complete Deployment 13 technology refresh of 100% of newly identified enterprise data center systems that have reached end-of-life.
- Complete Deployment 13 technology refresh of approximately 14% of local telecommunications switches.

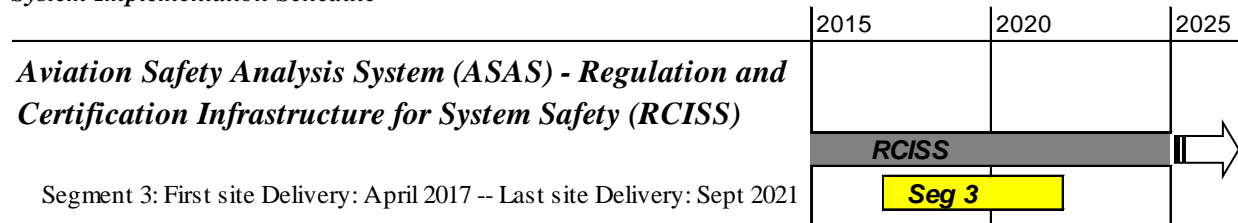
Program Plans FY 2021 – Performance Output Goals

- Complete Deployment 14 technology refresh of approximately 25% of mobile toolkits.
- Complete Deployment 14 technology refresh of 100% of newly identified enterprise data center systems that have reached end-of-life.
- Complete Deployment 14 technology refresh of approximately 14% of local telecommunications switches.

Program Plans FY 2022 – Performance Output Goals

- Pending FID approval:
 - Complete Deployment 15 technology refresh of approximately 25% of mobile toolkits.
 - Complete Deployment 15 technology refresh of 100% of newly identified enterprise data center systems that have reached end-of-life.
 - Complete Deployment 15 technology refresh of approximately 14% of local telecommunications switches.

System Implementation Schedule



3A03, NATIONAL AIRSPACE SYSTEM (NAS) RECOVERY COMMUNICATIONS (RCOM)

FY 2018 Request \$12.0M

NAS Recovery Communications (RCOM), C18.00-00

Program Description

The RCOM program provides the technical expertise to manage the technology and equipment acquisition for FAA’s emergency Command and Control Communications (C3) system. This system enables the FAA Administrator and staff to directly manage the NAS during local, regional, and national emergencies should normal communications with facilities be interrupted for any reason. The C3 system provides and enhances communication capabilities through a variety of fixed-position, portable, and transportable emergency communications systems to support crisis management and enables the FAA and other Federal agencies to exchange both classified and unclassified information to protect national security during an emergency. The C3 system also supports and modernizes the Washington Operations Center Complex and several FAA “continuity of operations” sites to ensure that FAA executives have command, control, and communications available at all times. The C3 system includes the following:

- VHF/FM and HF Radio Equipment
- Emergency Operations Network (EON)
- Emergency Operations Facility
- Communications Support Team (CST)
- Secure Communications (COMSEC)
- Information Technology Support
- Satellite Telephone Emergency Network (STEN)

In addition to the above, there are classified systems, facilities and projects that the RCOM program either manages or supports that are not named or described in this document. These support both intra and interagency agreements and initiatives.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 7 – Exceed Continuity Communications activation levels, as identified in the Federal Continuity Directive (FCD) Annex H, by 5 percent. (FAA Business Planning Metric)*

Relationship to Performance Metric

The RCOM program contributes to the FAA Strategic Priority “Make Aviation Safer and Smarter” by ensuring that the FAA’s C3 capability can provide classified and unclassified, time-critical, public and NAS information for the FAA Administrator during emergencies. The C3 system provides collaborative communications and adaptive situational awareness for enhanced decision making. The FAA Administrator shares this information with staff members, key regional managers, the Secretary of Transportation, and other national-level executive personnel.

Program Plans FY 2018 – Performance Output Goals

- Complete the site preparation and installation of Very High Frequency/Frequency Modulation (VHF/FM) equipment for the Cleveland District.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Philadelphia District.
- Perform network equipment refresh for the Emergency Response Vehicle.
- Complete equipment refresh of Microwave Network at 3 locations.
- Complete technology refresh of STEN equipment for Primary Alternate Facility (PAF), Hawaii, Virgin Islands, and Puerto Rico.
- Complete technology refresh of EON Geographic Information System (GIS) hardware and software.
- Complete technology refresh of Daily Report Application.
- Complete design and engineering for a STEN Fixed Based Technical Refresh.
- Complete technical evaluation to determine requirement fees for Secure Fax Machine refresh.
- Complete High Frequency radio technology refresh at the PAF.
- Complete server technology refresh at FAA HQ.

Program Plans FY 2019 – Performance Output Goals

- Complete the site preparation and installation of VHF/FM equipment for the Philadelphia District.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Columbia District.
- Develop EON GIS application for use on FAA mobile phones and tablets.
- Complete equipment refresh of Microwave Network for one link.
- Complete technology refresh of STEN equipment at the Air Traffic Control System Command Center, Mike Monroney Aeronautical Center, and William J. Hughes Technical Center.
- Complete technology refresh of CST Emergency Response Vehicle communications equipment.
- Complete EON Sharepoint infrastructure upgrade.
- Complete server technology refresh at PAF.
- Complete Homeland Security Data Network (HSDN) at FAA Western Pacific location.

Program Plans FY 2020 – Performance Output Goals

- Complete the site preparation and installation of VHF-FM equipment for the Columbia District.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Washington District.
- Complete equipment refresh of the Microwave Network for one link.
- Complete the design and engineering for network refresh of Emergency Operations Center (EOC).
- Develop software to enhance EON's internal and external data sharing capabilities.
- Complete technology refresh of EON GIS software.
- Complete technology refresh of Storage Area Network and Network Switches technology refresh.
- Complete HSDN at FAA Northwest Mountain building.
- Complete NetApp technology refresh at FAA HQ and PAF.

Program Plans FY 2021 – Performance Output Goals

- Complete site preparation and installation of VHF-FM equipment for the Washington District.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Fort Worth District.
- Complete technology refresh of network equipment including firewalls, routers, and switches.
- Perform technology refresh on facility equipment at the PAF.
- Complete technology refresh of COMSEC equipment.
- Complete equipment refresh of the Microwave Network for two links.

Program Plans FY 2022 – Performance Output Goals

- Complete site preparation and installation of VHF-FM equipment for the Fort Worth District.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Chicago District.
- Complete Audio/Visual technology refresh at PAF.
- Complete network equipment refresh at PAF.
- Complete NetAPP refresh at EOC.
- Perform vehicle upgrades and quarterly testing for CST.
- Complete technology refresh of Microwave Network for one link.
- Complete inspection and replace selected site infrastructure as needed at Microwave Network site locations (shelters, doors, heating, ventilation, and air conditioning systems, and Uninterruptible Power Supply).
- Complete technology refresh on HSDN system.

3A04, FACILITY SECURITY RISK MANAGEMENT

FY 2018 Request \$20.4M

Facility Security Risk Management (FSRM) – Two, F24.01-02

Program Description

The FSRM program was established in response to Presidential Decision Directive (PDD) 63, Critical Infrastructure Protection. PDD 63 has been superseded by Homeland Security Presidential Directive 7, Critical Infrastructure Identification, Prioritization and Protection which requires all Federal agencies to assess the risks to their critical infrastructure and take steps to mitigate that risk. This program provides risk mitigation at all FAA staffed facilities by providing an integrated security system that includes access control, surveillance, x-ray machines, metal detection, and intrusion detection. Other upgrades may include adding guardhouses, visitor parking, fencing, perimeter hardening, window blast protection, and lighting. This program is included in the ATC Facilities Sustainment Strategic Plan.

The objective of the program is to comply with Public Law 106-528, Airport Security Improvement Act of 2000 and complete security upgrades at approximately 1050 staffed facilities. Approximately 215 of the 1050 facilities still require upgrades to install equipment to read Personal Identity Verification access cards. Improved security is accomplished through the installation and maintenance of physical security systems and guard services at designated FAA facilities using the System Security Design and Integration, Corrective Maintenance Contract II, and National Security Officer Services contracts.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The FSRM program provides the infrastructure enhancements needed to reduce the risk of disruption of operations at facilities critical to the NAS. These enhancements reduce the risk of unauthorized access and provide early identification of potential security problems. This program supports the operational availability metric because enhanced security reduces the risk of an event leading to the loss of NAS service.

Program Plans FY 2018 – Performance Output Goals

- Complete perimeter hardening at 12 Security Level 3 and Security Level 4 facilities.
- Complete implementation of standardized facility protective measures at remaining sites (148 sites). (APB milestone)
- Complete technical refresh at 40 sites.
- Complete installation of X-ray machines at 5 sites by September 30, 2018.

Program Plans FY 2019 – Performance Output Goals

- Complete perimeter hardening at 12 Security Level 3 and Security Level 4 facilities.
- Complete technical refresh at 40 sites.

Program Plans FY 2020 – Performance Output Goals

- Complete perimeter hardening at 12 Security Level 3 and Security Level 4 facilities.
- Complete technical refresh at 40 sites.

Program Plans FY 2021 – Performance Output Goals

- Complete perimeter hardening at 12 Security Level 3 and Security Level 4 facilities.
- Complete technical refresh at 125 sites.

Program Plans FY 2022 – Performance Output Goals

- Complete hardening of ARTCCs and Large TRACONS at 28 sites. (APB milestone)
- Complete retrofit of fencing at 136 sites. (APB milestone)

3A05, INFORMATION SECURITY

FY 2018 Request \$20.7M

- Information Systems Security, M31.00-00
- X, Critical Infrastructure Cybersecurity, M31.05-01

Information Systems Security, M31.00-00

Program Description

The FAA must ensure the integrity and availability of all critical systems, networks, and infrastructure under conditions of increased threat from cyber terrorism and malicious activities by hackers and other unauthorized personnel. The Homeland Security Presidential Policy Directive 21 identifies the NAS as one of 16 critical infrastructure sectors and directs FAA to protect and ensure the integrity, confidentiality, and availability of all NAS Information Systems. Under the Federal Information Security Management Act of 2014, 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.

The FAA Office of Information Security & Privacy Service is a partnership between the FAA Chief Information Officer's organization and other FAA lines of business and staff offices with a focus on protecting FAA information, information systems, and infrastructure. The Security Operations Center (SOC) provides the following services:

- Leverage existing NAS laboratory capabilities for enterprise security solutions, including products available through Department of Homeland Security's Continuous Diagnostics and Mitigation (CDM) initiative;
- Ensure the integrity and availability of FAA's critical information and information systems under conditions of increased cyber terrorism and malicious activities;
- Security architecture and engineering;
- Manage and support-year round 24 hours a day security operations;
- Support policy, compliance, standards, and cybersecurity requirements;
- Support for system certification and compliance through utilization of security vulnerability scanning, code review, and penetration testing;
- Continuous monitoring support by providing technical solutions;
- Leverage technologies that provide input for risk profile management;
- Perform cyber forensics analysis;
- Provide advanced threat analysis;
- Detect, report, and track cyber security events; and
- Monitor cyber security events and initiate appropriate activities.

The Office of the Chief Information Officer takes a comprehensive, proactive approach to addressing the growing threat to aviation safety and security and preventing and isolating intrusions into the FAA's infrastructure. This cyber defense strategy involves hardening the internal backbone of the system and network elements, and isolating and backing-up those elements to avoid disruptions to services.

This cybersecurity effort provides products and services for FAA's three operating domains; NAS, Research and Development (R&D), and Mission Support, to protect FAA's information, information systems, and infrastructure and to respond to computer security incidents. The SOC is comprised of facilities and security technologies, and uses FAA and contract personnel working as a unified entity to provide extremely effective, enterprise-focused cyber security services to its customers. The SOC is a 24x7x365 day operation supporting the FAA as well as all other modes within the Department of Transportation (DOT). It is the central reporting point for all cyber events occurring within the FAA and DOT. The SOC also represents the DOT as the single source provider of the cyber "big picture" when reporting to the Department of Homeland Security.

Advanced Persistent Threat (APT) events are targeted attacks on federal government systems, which pose a serious and imminent threat to those systems and are specific in nature, objective, and pattern. APT allows the recording of these events and the identification of systems that have been compromised or affected by both opportunistic and targeted cyber-attacks. The APT events are one type of event the SOC detects, analyzes and responds to daily in defense of the FAA infrastructure.

The FAA is evolving its risk-based approach to computer network defense by integrating new technologies into the cybersecurity program to protect FAA information and information systems, and enhance the capability to respond to emerging cyber threats. This includes participation in the CDM program led by U.S. Department of Homeland Security (DHS), with a phased transition to the FAA. Congress established the CDM program to provide an adequate, risk-based, cost-effective cybersecurity and more efficiently allocate cybersecurity resources. The DHS CDM program leverages the buying power of government organizations to achieve savings for consistent, government-wide set of cybersecurity tools and services to help protect federal government networks. The FAA Office of Information Technology (AIT) is currently working with DHS to implement CDM in a manner that demonstrates measurable cybersecurity results and leverages strategic sourcing to achieve cost savings. The CDM program provides capabilities and tools that enable network administrators to know the state of their respective networks at any given time by identifying and ranking problems for priority resolution. The CDM program also continues to monitor networks for flaws and anomalies, and alerts network managers to attacks and intrusions, enabling faster response to mitigate

vulnerabilities. This program 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 FAA CDM program will be implemented in three phases and will cover 15 continuous diagnostic capabilities. The first phase of CDM implementation is nearing completion. Implementation of Phase 2 and Phase 3 will begin in FY 2017. CDM program ownership will transfer from DHS to the FAA beginning in FY 2018.

- CDM Phase 1 addresses hardware and software asset management, configuration settings management (compliance), and vulnerability management. These are foundational capabilities to protect systems and data. Phase 1 also introduces Boundary Protection capabilities, as well as CDM Dashboards to improve situational awareness, and enhance users' ability to identify and respond to emerging cyber threats (Implementation FY 2016 through FY 2017)
- CDM Phase 2 addresses least privilege and infrastructure integrity by identifying the users of these assets through monitoring and managing user-based accounts and services. It includes capabilities to ensure users are trusted through identity verification and background investigations. Users receive both general and specific security training for their assigned roles prior to system access and are issued reliable credentials that assign only the privileges required for their specific roles. (Implementation FY 2017)
- CDM Phase 3 addresses Boundary Protection and Event Management for Managing the Security Lifecycle which supports the Agency's ability to identify, protect, detect, respond to, and recover from events by leveraging emerging big data risk management technology to create a security orchestration overlay. This model provides the tools for security teams to break down data silos and correlate threat information to achieve an intelligent, integrated, risk-based approach to vulnerability response management. It also establishes processes for automatically generating and tracking tickets, remediating prioritized vulnerabilities, and providing reports when events are successfully mitigated. (FY 2018 and Beyond)

The CDM program offers commercial off-the-shelf (COTS) tools that enhance government network security through automated control testing and progress tracking. Expanding CDM capabilities enables FAA to increase network sensor capacity, automate sensor collections, and prioritize risk alerts. In addition, CDM:

- Delivers near-real time results;
- Provides services to implement sensors to perform automated search for known cyber flaws;
- Provides the ability to collect data, such as scan reports from sensors and export customized reports through the CDM Dashboard;
- Provides progress reports to track results which can be used to compare and provide situational awareness of security posture throughout department/agency networks;
- Prioritizes and alerts network managers to their most critical cyber risks based on standardized and weighted risk scores within minutes versus on a quarterly or annual basis;
- Enables defenders to identify and mitigate flaws at network speed; and
- Lowers operational risk and exploitation of government IT systems and networks.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 6 – Address 80% of high value risks within 30 days. Continue to provide information to the Cybersecurity Steering Committee to assure consistent risk acceptance decisions. Visualize vulnerabilities on all IP based systems.*

Relationship to Performance Metric

The FAA supports and implements security strategies and plans through: (1) effective preparation, detection, response, and recovery regarding cyber-attacks; (2) integration of information security efforts into all acquisition and operation phases to protect FAA people, buildings, and information; and (3) support for efforts to safeguard homeland security, in particular the FAA's component of the nation's critical infrastructure and industry.

Program Plans FY 2018 – Performance Output Goals

- Implement solutions and services to achieve Continuous Diagnostics and Mitigation (CDM) Phase 2 goals including management of access control, credentials and authentication, account access, and security-related behavior.
- Evaluate and deploy new technologies to combat APT.
- Deploy full packet capture capability at two new strategic network points.
- Deploy Wireless Intrusion Detection/Wireless Application Protocol (WID/WAP) to 50 FAA facilities.
- Complete software code vulnerability security analysis on 150 legacy and developmental agency systems.

Program Plans FY 2019 – Performance Output Goals

- Evaluate solutions and services to achieve CDM Phase 3 to manage events to prepare for and respond to incidents and contingencies.
- Evaluate and deploy new technologies to combat APT.
- Deploy full packet capture capability at two new strategic network points.
- Deploy WID/WAP to 50 FAA facilities.
- Complete software code vulnerability security analysis on 150 legacy and developmental agency systems.

Program Plans FY 2020 – Performance Output Goals

- Implement solutions and services to achieve CDM Phase 3 to manage events to prepare for and respond to incidents and contingencies.
- Evaluate and deploy new technologies to combat APT.
- Deploy full packet capture capability at two new strategic network points.
- Implement hardware and software for wireless intrusion detection and secure enterprise wireless network connectivity at approximately 50 FAA facilities.

Program Plans FY 2021 – Performance Output Goals

- Increase analytical reporting for Continuous Monitoring of CDM capabilities through new tools and sensors for agency hardware, software, vulnerability and configuration assets across all three operating domains: NAS, Mission Support and R&D, to include cloud implementations.
- Evaluate and deploy new technologies to combat APT.
- Deploy full packet capture capability at two new strategic network points.
- Implement hardware and software for wireless intrusion detection and secure enterprise wireless network connectivity at approximately 50 FAA facilities.
- Implement secure, internet-only guest access for non-FAA personnel at FAA facilities where wireless is deployed.

Program Plans FY 2022 – Performance Output Goals

- Evaluate and implement new wireless technologies to address evolving cyber threats and vulnerabilities through the use of certificates to further secure FAA government furnished equipment.
- Evaluate and deploy new technologies to combat insider and advance persistent threats on the agency network.
- Develop and deploy full packet capabilities at new identified network locations.
- Improve security architecture, cyber strategic planning and risk management capabilities.
- Impose strong authentication requirements in the MyAccess platform to establish and manage secure public access to FAA information systems in accordance with OMB requirements.

X, Critical Infrastructure Cybersecurity, M31.05-01

Program Description

The Critical Infrastructure Cybersecurity program provides identification, protection, detection, response, and recovery services and capabilities for Air Traffic Control (ATC) systems across the NAS. The program provides these services and capabilities to ensure that the NAS remains secure and resilient. A loss of NAS integrity and availability would not only disrupt Continental United States (CONUS) ATC operations, but would have international consequences and severely impact the Department of Homeland Security air interdiction mission and the Department of Defense National Defense mission.

The NAS, which is physically and logically segregated from the FAA's Information Technology Mission Support environment, is comprised of over 100 separate systems and continues to become more cyber-dependent as NextGen systems are brought into the operational environment. The Critical Infrastructure Cybersecurity program focuses on NAS Enterprise-level security initiatives that are in direct support of ATC operations and which address GAO Audit Report, GAO-15-221 - FAA Needs to Address Weaknesses in Air Traffic Control Systems. The report found that the responsibility for NAS information security was distributed across different entities and programs causing challenges with managing information security activities within the NAS environment.

Program initiatives are defined through the National Institute of Standards and Technology (NIST) Cybersecurity Framework (CSF) and Risk Management Framework (RMF). The NIST, CSF, and RMF provide:

- A structured approach to assess the critical infrastructure security posture and identify and prioritize NAS Enterprise-level security gaps
- Guidance for Information Security Continuous Monitoring as required by the Office of Management and Budget

Critical Infrastructure Cybersecurity program initiatives are captured in the NAS Enterprise Architecture Information System Security Roadmap. Major initiatives include:

- **Evolving Threats:** Continued development of system and enterprise NAS risk mitigation solutions as new cyber threats and mandates evolve;
- **Plans Of Actions and Milestones Remediation:** Supports mitigation solutions to address weaknesses in NAS systems;
- **Enterprise Security Services:** Includes assessment and acquisition activities to implement services and NAS system integration to utilize the services.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Critical Infrastructure Cybersecurity program supports the operational availability metric by providing a key capability of the NAS Coordination and Oversight Tier as described in the "Technical Operations Services Concept of Operations (ConOps) – 2015 Edition." The Cybersecurity program collects, processes, and develops action plans for relevant threat and vulnerability information to minimize impacts on NAS service availability. The Cybersecurity program is a key component of operational resiliency to ensure that the NAS continues to operate under a range of cyber conditions. The program provides cybersecurity protection, monitoring, detection, and response services for the reportable facilities that support the core airports to minimize the impact of cybersecurity events and incidents and sustain adjusted operational availability at 99.7%.

Program Plans FY 2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete installation and testing of security patch management servers in the Cyber Test Facility (CyTF) for Research and Development (R&D) Testing of NAS software protection capabilities.
- Complete installation of NAS Network Data Flow Sensor equipment at 15 sites (50 of 50, 100%) to support NAS cybersecurity monitoring.

Program Plans FY 2020 – Performance Output Goals

- Install NAS asset security inventory management equipment into the CyTF for R&D Testing.
- Complete technology refresh of NAS security event collection equipment at 4 of 4 operational sites (100%).

Program Plans FY 2021 – Performance Output Goals

- Complete R&D testing of the NAS asset security inventory management equipment in the CyTF.
- Install NAS security event collection equipment in the FTI National Test Bed (FNTB) to validate NAS site event collection capabilities.
- Install security patch management servers in the FNTB to validate NAS software protection capabilities.

Program Plans FY 2022 – Performance Output Goals

- Complete installation of security patch management servers at 1 site (1 of 4, 25%).
- Install NAS asset security inventory management equipment in the FNTB to validate NAS automated inventory management capabilities.
- Complete installation of NAS security event collection equipment at 10 sites (10 of 50, 20%).

3A06, SYSTEM APPROACH FOR SAFETY OVERSIGHT (SASO)

FY 2018 Request \$25.8M

**System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1a, A25.02-02 / X,
System Approach for Safety Oversight (SASO) – Phase 2b, Segment 1b, A25.02-03**

Program Description

The SASO Program improves, automates, and standardizes the FAA’s Flight Standards Service (AFS) safety oversight and inspection processes by implementing the International Civil Aviation Organization (ICAO) Safety Management System (SMS). Within AFS, SMS consists of four primary components: Safety Assurance (SA), Safety Risk Management (SRM), Safety Policy (SPO) and Safety Promotion (SPR).

Safety Assurance (SA): The primary product SASO is developing and deploying is the Flight Standards Safety Assurance System (SAS), which supports the SA component of SMS by introducing a new proactive systems safety approach that will significantly improve FAA’s ability to identify and address hazards and safety risks before they result in accidents. Obsolete or redundant systems and data will be consolidated or removed and replaced with an integrated suite of databases and analysis tools that provide both more accurate and critical information needed to make timely safety decisions. The program will exchange information from these systems with national and international government and industry organizations throughout the aviation community to increase awareness of systemic safety risks and maximize levels of safety. The SAS will provide easier and quicker access to safety information for FAA employees that certify and monitor the aviation industry.

Safety Risk Management (SRM): SASO SRM activities include specific enhancements to the SAS toolset to support SRM, particularly with respect to the development and assessment of risk controls and the implementation of functional and data interfaces. These interfaces will interconnect the AFS SRM functions with SRM functions of other FAA Office of Aviation Safety (AVS) services and offices, most notably the Aircraft Certification Service (AIR). This will be done in conjunction with updating internal AFS policy and procedures in accordance with SMS constructs and requirements.

Safety Policy (SPO): SASO Safety Policy improvements will focus on integrating safety planning, organizational structure and responsibilities, and operational procedures and controls. SASO will put in place processes for the establishment of acceptable levels of safety for both individual certificate holders and applicable aviation industry segments viewed as a whole. SASO will develop a methodology for establishing an acceptable level of risk for particular industry segments and types of operations, and procedures to continuously monitor and aggregate industry level risk. Finally, references and process controls will be updated to support integration into the overall AVS SMS.

Safety Promotion (SPR): SASO Safety Promotion initiatives include five primary activities:

- Developing a positive safety culture between AVS, AFS and certificated and non-certificated entities;
- Communicating ongoing SMS efforts and outputs to all employees;
- Establishing personnel competency requirements and training for SMS activities;
- Building knowledge of safety issues and incorporating it into the aerospace system; and
- Updating product/service provider SMS requirements.

SASO is divided into three phases. SASO Phase 1 (FY 2006 – FY 2009) consisted of a planning and engineering effort designed to develop and test the SAS concept, i.e. using automation to guide and support the FAA’s safety oversight and inspection process. It also demonstrated the benefits of system safety to AFS and the aviation community. SASO Phase 2 is further developing and implementing the SAS concept for other Code of Federal Regulations (CFR) Parts pertaining to aviation. SASO Phase 2 is divided into two phases: Alpha and Beta. The SASO Phase 2 Alpha (FY 2010 – FY 2016) Acquisition Program Baseline was completed in FY 2016. In this phase, the SAS was developed and deployed for oversight of air carriers, commuter and on demand operators, and repair stations (Title 14 Parts 121, 135, and 145) representing approximately 7,000 certificate holders.

SASO Phase 2 Beta will address additional requirements of FAA Order VS 8000.367A, Aviation Safety (AVS) Safety Management System Requirements, and includes SAS essential IT upgrades. It includes the effort to enhance the basic SAS framework developed and deployed in Phase 2 Alpha to accommodate additional Title 14 CFR Parts. These include, but are not limited to, other air operators, Pilot Schools and Training Centers, Aviation Maintenance Technical Schools, and other operations such as helicopter external load, and agriculture/crop dusting. SASO Phase 2 Beta also includes the development and implementation of the three remaining components of the SMS: Safety Risk Management, Safety Policy, and Safety Promotion. SASO Phase 2 Beta will be developed in segments.

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1a (A25.02-02):

The Segment 1a program from FY 2015 to 2023 will expand SAS functionality to oversight of an additional 6,500 certificate holders for a total of over 13,500 certificates across the NAS. It will focus on the highest AFS priorities, which will include SAS development for Title 14 CFR Parts 141 (Pilot Training), 142 (Training Centers), 147 (Aviation Maintenance Technical Schools) and an interface to 183 (Designee Management System). SAS functionality will be enhanced in the areas of activity recording, office workload list, risk profile, and the Certification Services Oversight Process. This segment will also include efficiencies in the oversight of repair stations and develop and promote SMS for the general aviation industry. Segment 1a includes a planning effort to prepare for additional segments, which includes an analysis of AFS business processes, systems, data management, and developing a business case. The Phase 2 Beta, Segment 1a Final Investment Decision (FID) was approved in February, 2016 and the planned Final Operational Capability is 2023.

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1b (A25.02-03):

The Segment 1b program from FY 2020 to FY 2027 will continue the development and expansion of SAS functionality by incorporating additional Title 14 CFR parts into its SMS-based oversight list. Work on the remaining SMS components that began in Segment 1a, will continue to expand and enhance risk profiling models; extend the Certification Services Oversight Process to further certificate holders; expand avenues for outreach to the general aviation community; and extend safety policy to bring SMS to the full range of AFS oversight activities. If further segments are determined to be needed, planning for those segments will be included in Segment 1b. The Phase 2B, Segment 1b FID is planned for FY 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

SASO supports the performance metric for reducing the air carrier fatal accident rate by implementing a SMS that will assist aviation safety inspectors with their statutory oversight of the aviation industry. SASO Phase 2 Alpha implemented an automation system that fulfills the first of four SMS components, Safety Assurance. SASO Phase 2 Beta implements the remaining three SMS components, Safety Promotion, Policy and Risk Management. After completion of both phases, the aviation safety inspector workforce will be better informed and prepared to improve enforcement of safety regulations and continue to protect the flying public.

Program Plans FY 2018 – Performance Output Goals

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1a (A25.02-02):

- Complete Critical Design Review (CDR) for SAS. (APB milestone)
- Complete Development Test 1 for SAS. (APB milestone)

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1b (A25.02-03):

- None.

Program Plans FY 2019 – Performance Output Goals

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1a (A25.02-02):

- Complete Development Test 2 for SAS. (APB milestone)
- Complete Beta Testing for SAS. (APB milestone)

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1b (A25.02-03):

- None.

Program Plans FY 2020 – Performance Output Goals

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1a (A25.02-02):

- Complete User Acceptance Testing (UAT). (APB milestone)
- Achieve Key Site Initial Operational Capability (IOC). (APB milestone)

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1b (A25.02-03):

- Complete Final Investment Decision (FID).

Program Plans FY 2021 – Performance Output Goals

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1a (A25.02-02):

- Achieve First Production Site Initial Operational Capability (IOC). (APB milestone)

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1b (A25.02-03):

- Pending JRC approval:
 - Complete Business Process Reengineering (BPR).

Program Plans FY 2022 – Performance Output Goals

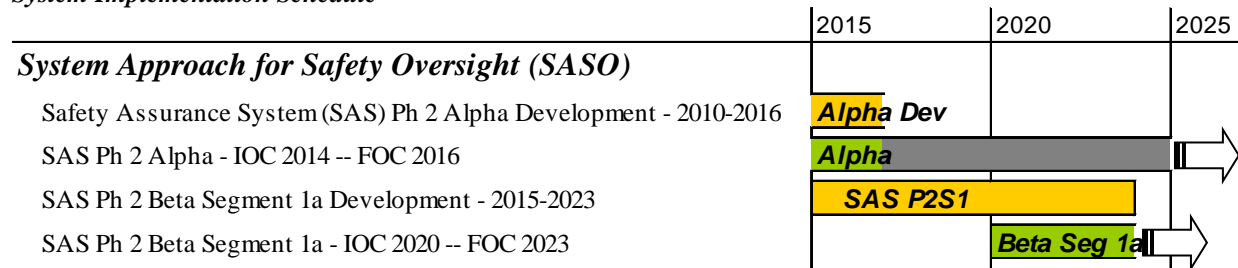
System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1a (A25.02-02):

- Achieve Last Production Site Initial Operational Capability (IOC). (APB milestone)

System Approach for Safety Oversight (SASO) – Phase 2B, Segment 1b (A25.02-03):

- Pending JRC approval:
 - Complete Critical Design Review for Safety Assurance System.

System Implementation Schedule



3A07, AVIATION SAFETY KNOWLEDGE MANAGEMENT ENVIRONMENT (ASKME)

FY 2018 Request \$4.0M

Aviation Safety Knowledge Management Environment (ASKME) – Segment 2, A26.01-01 / X, Aviation Safety Knowledge Management Environment (ASKME) – Segment 3, A26.01-02

Program Description

The ASKME program 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. The program provides a comprehensive automation environment for critical safety business processes for Aviation Safety (AVS) through the deployment of integrated business solutions. ASKME – Segment 1, was approved by the Joint Resources Council (JRC) in 2007 for project work from FY 2008 – 2012.

ASKME – Segment 2 (A26.01-01):

The JRC approved ASKME – Segment 2 in September 2011 to continue development and deployment of the business solutions through FY 2017. Due to a number of technical issues Segment 2 development was halted and consequently delayed. The JRC approved a Baseline Change Decision (BCD) for Segment 2 on June 21, 2017. The program will complete post-BCD actions including Implementation Strategy and Planning Document, final Program Requirements Document, Program Management Plan, and Test Evaluation Master Plan. Segment 2 applications will be operational in 2019.

ASKME 2 projects will provide digital storage and retrieval of FAA safety data and information from FAA technical documentation, including lessons learned from previous certifications that involved aircraft design and manufacturing safety issues, so that they can be accessed quickly and shared more efficiently. ASKME will provide a comprehensive automated system and a suite of electronic tools for capturing key safety related data resulting from rulemaking and policy development, airworthiness directives, engineering design certification, production/ manufacturing certification, airworthiness certification, and compliance and enforcement.

Additional ASKME capabilities will help inspectors with approving new operating certificates, and ensuring that design or modification of aircraft meets aircraft safety regulations. These capabilities will also aid in designee management, compliance and evaluation of certification activities, responses to external inquiries, support for necessary compliance and enforcement actions, continued operational safety management, and international coordination.

ASKME Segment 2 will complete the iterative design, development, testing, and release of the ASKME Segment 2 Integrated System; deliverables include:

- Airworthiness Directives Development (ADD);
- Airworthiness Certifications (AWC); and
- Compliance and Enforcement Actions (CEA).

ASKME – Segment 3 (A26.01-02):

ASKME – Segment 3 will include a Business Process Re-engineering effort to document, update, and streamline business processes, following the planned re-organization of the AIR; enhancements to Segment 1 and Segment 2 applications, including updates to the underlying technology, integration with non-ASKME systems that will deploy after FY 2019, and end-user-generated requests; new automation of business functions within the purview of the AIR (e.g., Continued Operational Safety) that were not included in ASKME Segment 1, Segment 2, or other investments.

ASKME as a whole provides a comprehensive automated system and a suite of electronic tools for capturing key safety-related data resulting from rulemaking and policy development, airworthiness directives, engineering and design certification, production/ manufacturing certification, airworthiness certification, and compliance and enforcement.

Additional ASKME capabilities help inspectors with approving new operating certificates, and ensuring that design or modification of aircraft meets aircraft safety regulations. These capabilities will also aid in designee management, compliance and evaluation of certification activities, responses to external inquiries, support for necessary compliance and enforcement actions, continued operational safety management, and international coordination.

ASKME Segment 3 will include:

- Conduct Business Process Re-Engineering to document, update, and streamline business processes following a re-organization of AIR;
- Develop, test, and deploy 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;
- Develop new systems to replace legacy AIR systems; and
- Develop new automation of functions that are within the purview of the AIR but were not included in ASKME Segment 1, Segment 2, or other investments.

A Final Investment Decision (FID) for ASKME Segment 3 is planned for FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Aircraft Certification Service is responsible for ensuring that civil aircraft are designed and manufactured to operate safely within the NAS. ASKME will provide the automated systems to conduct safety data analysis and data gathering as well as lessons learned as they apply to AIR's safety-related responsibilities (i.e., aircraft certification and certificate management, regulatory development, designee supervision and oversight, and operational safety). ASKME will provide AIR with a comprehensive mechanism aimed at the early identification and resolution of accident precursors; the promotion of systematic and structured risk assessment/risk management practices; and the proactive management of safety issues throughout the lifecycle of an aircraft and its components. The projected benefit from FY 2013 to FY 2023 is estimated at 77.26 avoided fatalities.

Program Plans FY 2018 – Performance Output Goals

ASKME – Segment 2 (A26.01-01):

- Complete Compliance and Enforcement (CEA) User Acceptance Test (UAT). (APB milestone)

ASKME – Segment 3 (A26.01-02):

- None.

Program Plans FY 2019 – Performance Output Goals

ASKME – Segment 2 (A26.01-01):

- Complete user in service training classes.
- Complete Compliance and Enforcement (CEA) Initial Operational Capability (IOC). (APB milestone)
- Achieve Compliance and Enforcement Actions (CEA) In-Service Decision (ISD). (APB milestone)
- Complete Airworthiness Directives Development (ADD) User Acceptance Test (UAT). (APB milestone)
- Complete Airworthiness Directives Development (ADD) Initial Operational Capability (IOC). (APB milestone)
- Achieve Airworthiness Directive Development (ADD) In-Service Decision (ISD). (APB milestone)
- Complete Airworthiness Certification (AWC) User Acceptance Test (UAT). (APB milestone)
- Complete Airworthiness Certification (AWC) Initial Operational Capability (IOC). (APB milestone)
- Achieve Airworthiness Certification (AWC) In-Service Decision (ISD). (APB milestone)
- Complete ASKME Segment 2 Full Operational Capability (FOC). (APB milestone)

ASKME – Segment 3 (A26.01-02):

- Complete System Requirements Review for new systems that will replace legacy AIR systems
- Develop the following products in support of the FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID for ASKME – Segment 3.

Program Plans FY 2020 – Performance Output Goals

ASKME – Segment 2 (A26.01-01):

- Complete transition of ASKME Segment 2 systems to In-Service Management.

ASKME – Segment 3 (A26.01-02):

- Pending FID:
 - Complete development of National Automated Conformity Inspection Process (NACIP) and Certification Project Notification (CPN)
 - Complete design of Flight Test Database

Program Plans FY 2021 – Performance Output Goals

ASKME – Segment 2 (A26.01-01):

- None.

ASKME – Segment 3 (A26.01-02):

- Pending FID:
 - Complete Business Process Re-Engineering
 - Complete implementation of NACIP/CPN

Program Plans FY 2022 – Performance Output Goals

ASKME – Segment 2 (A26.01-01):

- None.

ASKME – Segment 3 (A26.01-02):

- Pending FID:
 - Complete Solution Implementation and transition of ASKME Segment 3 systems to In-Service Management

3A08, AEROSPACE MEDICAL EQUIPMENT NEEDS (AMEN)

FY 2018 Request \$7.0M

- A, Aerospace Medical Equipment Needs (AMEN) – Phase 2, M53.01-02
- B, Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Wind & Wave Evacuation Survival Facility (WIWAVES), M53.02-01

A, Aerospace Medical Equipment Needs (AMEN) – Phase 2, M53.01-02

Program Description

The Civil Aerospace Medical Institute (CAMI), located at the FAA Mike Monroney Aeronautical Center (MMAC) in Oklahoma City, Oklahoma, is the medical certification, education, research, and occupational medicine wing of the Office of Aerospace Medicine (AAM) within the FAA's Aviation Safety Organization (AVS). CAMI research personnel discover methods and recommend strategies to enhance the safety, security, health, and performance of the most important aspect of the NAS, the human operators and the public they serve. CAMI's personnel, working in sophisticated research laboratories and testing facilities require modern scientific, engineering, simulation, and medical systems. Much of the current laboratory equipment being used by CAMI's scientists, physicians, and engineers is becoming obsolete. Obsolete laboratory equipment places several accreditations at risk and does not allow the FAA to keep up with scientific and technological advances.

AMEN Phase 2 includes the replacement of twelve critical and highly technical pieces of specialized laboratory equipment used by in-house aeromedical and human factors research personnel at CAMI that must be replaced due to advanced age, lack of support, diminished technology capability, and limited strategic resource optimization. All of this equipment will be replaced with Commercial-Off-The-Shelf (COTS) or modified COTS products. The equipment to be replaced includes five computer-based flight operations and Air Traffic Control (ATC) simulators, two biochemistry/forensic toxicology testing systems, two specialized cameras, one anthropometric test dummy, one engineering calibration device, and a data acquisition and processing system. In October 2015, the AMEN Phase 2 program achieved a Final Investment Decision for the replacement of this equipment.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Modern equipment supports human safety and performance research areas that are associated with reducing aviation accidents and fatalities. Examples of how the equipment will be utilized to perform research are:

- Development of procedures to detect aeromedically unsafe conditions and trends (biochemistry equipment);
- Assessment of crash environments to determine restraint performance and safety device effectiveness (crash survival equipment);
- Evaluations of Human Factors concerns associated with advanced multifunction displays and controls used in general aviation and air traffic control including General Air Traffic and Technical Operations Research Laboratory (GATTOR), Air Traffic Control Advanced Research Simulator (ATCARS), Technically Advanced General Aviation Research Simulator (TAGARS), Advanced Unmanned Aircraft System (AURS) Research Simulator, and Advanced Rotorcraft Simulator (ARS);
- Evaluation of NextGen technologies and procedures including Human-In-The-Loop (HITL) simulation studies concerning the usability of proposed automation concepts and the effects of those concepts on ATC workload, situational awareness, and performance (GATTOR, ATCARS, and TAGARS); and
- Development and assessment of performance measures for ATC and technical operations specialists (GATTOR, ATCARS, and TAGARS).

Program Plans FY 2018 – Performance Output Goals

- Complete documentation for acquisition of the following items:
 - GATTOR
 - ARS
- Make available for operational use (In-Service) the following:
 - Anthropometric Test Device (ATD)
 - Miniature Data Acquisition System (mDAS)
 - Biochemistry testing system Ultraviolet and Visible absorption spectroscopy (UV/VIS)
 - Biochemistry testing system Micro Gas Chromatograph (mGC)

Program Plans FY 2019 – Performance Output Goals

- Make available for operational use (In Service): ATCARS) (Prior year funds)

Program Plans FY 2020 – Performance Output Goals

- Make available for operational use (In Service): TAGARS (Prior year funds)

Program Plans FY 2021 – Performance Output Goals

- Make available for operational use (In Service): (Prior year obligations)
 - GATTOR
 - ARS)
 - AURS

B, Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Wind & Wave Evacuation Survival Facility (WIWAVES), M53.02-01

Program Description

The Civil Aerospace Medical Institute (CAMI), located at the FAA Mike Monroney Aeronautical Center (MMAC) in Oklahoma City, OK, is the medical certification, education, research, and occupational medicine wing of the Office of Aerospace Medicine (AAM) within the FAA's Aviation Safety Organization (AVS). CAMI's personnel work in sophisticated research laboratories and testing facilities and require modern scientific, engineering, simulation, and medical systems. Much of the laboratory equipment used by CAMI's scientists and engineers is becoming obsolete. This aging equipment places several accreditations at risk and does not allow the FAA to keep up with science and technological advances currently available in the market.

Aerospace Medical Equipment & Infrastructure Needs (AMEIN) - Wind & Wave Evacuation and Survival (WiWAVES) program will provide for the technology refresh of CAMI's aging Water Survival Research Facility (WSRF), an Aerospace Medical Division laboratory asset, originally installed in 1967 and last renovated in 1983. The WSRF failed structurally in 2012 and was unavailable for several months pending repair. This resulted in the suspension of all WSRF research and safety analysis activities during that period. The continuing deterioration of the WSRF presents a high risk of catastrophic structural failure that will result in the WSRF tank becoming completely unusable in the near future.

CAMI plans to construct a new WiWAVES facility housed in an approximately 50,000 sq. ft. building. The WiWAVES facility will consist of a water survival tank surrounded by the structural and mechanical apparatus required 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 the wave generating capability necessary to challenge the design and function of water safety and survival equipment, and procedures.

The Investment Analysis Readiness Decision was approved in March 2017. A Final Investment Decision is planned in FY 2018.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

Modern equipment supports human safety and performance research areas that are associated with reducing aviation accidents and fatalities. WiWAVES facility will replace the old and obsolete WSRF to fully restore capabilities necessary for evaluation and development of equipment, systems, and procedures used for the protection and survival of aircrews, cabin crews, and the flying public. Architectural and functional enhancements beyond the design elements of the legacy WSRF will bring state-of-the-art functionality to address existing and advanced cabin safety requirements in a relevant virtual environment.

Program Plans FY 2018 – Performance Output Goals

- Achieve FID for WiWAVES.
- Pending FID approval:
 - Award architecture and engineering design contract for WiWAVES facility.
 - Complete Engineering and Ground Studies.
 - Complete Environmental Studies.

Program Plans FY 2019 – Performance Output Goals

- Pending FID approval:
 - Complete architecture and engineering design for WiWAVES facility.
 - Complete acceptance of Type B Architectural Drawings.
 - Award construction contract for Phase 1a of WiWAVES facility to include site preparation and relocation of utilities.

Program Plans FY 2020 – Performance Output Goals

- Pending FID approval:
 - Award construction contract for Phase 1b of WiWAVES facility to include construction of survival tank and wind testing area.
 - Acquire and complete installation of Wave Generation equipment.

Program Plans FY 2021 – Performance Output Goals

- Pending FID approval:
 - Award construction contract for Phase 2 (of 2) of WiWAVES facility to include construction of briefing room and support spaces (e.g., locker rooms, support equipment, control room, etc.).

Program Plans FY 2022 – Performance Output Goals

- Pending FID approval:
 - Complete facility construction.
 - Perform and complete all final inspections.
 - Obtain certificate of occupancy.
 - Final acceptance of the facility by the FAA contracting officer.
 - WiWAVES facility In-Service.

3A09, NEXTGEN – SYSTEM SAFETY MANAGEMENT PORTFOLIO

FY 2018 Request \$16.2M

- A, Aviation Safety Information Analysis and Sharing (ASIAS), G07A.02-01
- B, Systems Safety Management Transformation (SSMT), G07M.02-01

A, Aviation Safety Information Analysis and Sharing (ASIAS), G07A.02-01

Program Description

The ASIAS program is an information safety analysis and data sharing collaboration involving industry and government to proactively analyze broad and extensive data to advance aviation safety. The primary objective of ASIAS is to provide a national resource for use in discovering common, systemic safety problems that span multiple airlines, fleets and regions of the global air transportation system. ASIAS uses internal FAA datasets, airline proprietary safety data, publicly available data, and manufacturers' data and other data. ASIAS links together these data sources 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.

The ASIAS information analysis and sharing mission directly supports the FAA's Risk-Based Decision Making, safety promotion, and safety assurance initiatives providing analytical results such as baseline information and trends; and indirectly supports safety risk management through issue identification, information, and tools for analysis of hazards. System wide analysis and modeling support risk assessment and management by identifying potential systemic risks associated with NAS operations for both new NextGen and legacy systems. To fully realize the benefits of the Safety Management System (SMS) approach to safety and reach the level of safety demanded by the public, it will be necessary to:

- Replace inadequate, informal communication with comprehensive and timely exchange of aviation safety information;
- Coordinate and share the resources required to promote effective tool development and issue analysis; and
- Establish a collaborative approach to identifying and mitigating system safety issues posing the highest risk.

ASIAS supports these objectives by aggregating and sharing data among ASIAS participants to more clearly understand the precursors that may lead to accidents. ASIAS fuses and aggregates multiple sources of aviation safety data in a central repository, increasing its potential value for analysis-based insight and providing some insights that are only discoverable through shared data. ASIAS advances safety analytical capabilities and performs analyses that would not otherwise be available to participants performing similar analyses on their own data.

ASIAS has initiated the process of proactively analyzing, identifying and monitoring the data for potential high risk safety issues sooner, rather than reactively uncovering issues later in post-incident investigations. New automated processes and data fusion techniques will facilitate advanced analysis of comprehensive data, providing new insights about potential safety risks in the NAS today as well as the NextGen enabled NAS of the future.

The activities in the program include:

- Research to develop ASIAS capabilities that build upon and extend existing capabilities for managing and processing aviation safety and performance data;
- The development of tools that convert both unstructured textual and digital data into information; and
- The creation of visualization capabilities that aid causal/contributing factor analyses and risk assessment.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter.*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

ASIAS is a vital component needed to support FAA's Strategic Priority to Make Aviation Safer and Smarter. Safety insights from the ASIAS analyses are communicated to ASIAS participants and, as authorized by the ASIAS Executive Board to others in the aviation community. Participants will leverage insights from ASIAS to identify risk-reducing alternatives or changes to operations or processes to improve NAS safety. Safety insights from ASIAS will be applicable to a broad range of aviation communities including commercial, general aviation (GA), helicopters,

UAS, and civilian agencies involved with aviation operations such as airport operators, airport authorities, and specifically to the FAA as it develops and implements NextGen. As a FAA-industry partnership and data-driven safety program, ASIAs supports promotion and expansion of safety information efforts to identify, prioritize and address risks and/or vulnerabilities before they lead to accidents.

Program Plans FY 2018 – Performance Output Goals

- Incorporate available Unmanned Aircraft Systems (UAS)/Remotely Piloted Aircraft data into the ASIAs data set to characterize UAS operations in the NAS.
- Complete transition of non-protected ASIAs data to a FAA enterprise architecture for improved data storage and analytical capabilities, and for enhancing data sharing and access to other ASIAs stakeholders.
- Develop investigative tools to detect and explore trend anomalies for additional undesired aircraft states to provide automated alerting of anomalies on NAS-wide hot spots, and to detect new safety risk areas for previously unknown trends.
- Complete transition of existing Commercial Aviation Safety Team (CAST) metrics and dashboards utilizing fused data sources and new ASIAs communities.

Program Plans FY 2019 – Performance Output Goals

- Integrate ATC voice data into ASIAs fusion-based safety analytical capabilities to improve identification of causal risk and contributing factors.
- Establish a limited helicopter data analysis capability for rotorcraft participants.
- Transfer operational management and production of Threaded Track data service to the FAA.
- Deploy ASIAs safety models and metrics to assess human factors issues related to accident risk.

Program Plans FY 2020 – Performance Output Goals

- Develop adaptive analytics (updatable models) to support automated identification of safety risks through continuous exploration of available ASIAs data resources.
- Deploy interactive and advanced visualization (e.g., geospatial, 3-D) tools for improved safety analysis.
- Deploy text-mining capability enhancements to enable automatic alerting and supplement analytical models using fused ASIAs data sources to improve the efficiency and effectiveness of ASIAs safety analyses.
- Conduct Directed Studies using tailored analytical techniques using available ASIAs data in support of NextGen system changes (e.g., Air Traffic Management procedures, airspace redesign) and community changes (e.g., fleet changes, avionics upgrades) in support of the FAA's Risk-Based Decision Making initiatives.

Program Plans FY 2021 – Performance Output Goals

- Establish participation of local government aviation and airport authorities in the sharing of safety information with ASIAs and the receiving of applicable metrics and studies.
- Conduct ASIAs studies and analyses, and develop metrics in support of the Commercial Aviation Safety Team (CAST), the GA-Joint Steering Committee, and rotorcraft and UAS communities safety risk mitigation activities.
- Establish within ASIAs a program to analyze and monitor risks associated with Unmanned Aircraft System (UAS) operations that intersect with civilian NAS operations.
- Complete Directed Study, as requested by the ASIAs Executive Board, supporting the small fixed wing GA community.

Program Plans FY 2022 – Performance Output Goals

- Expand ASIAs participation to DHS and other Federal Government Agencies that operate aircraft and ensure they are sharing applicable data with ASIAs and receiving results from ASIAs safety metrics and studies.
- In collaboration with Commercial Space organizations, complete development of safety measures and metrics applicable to the integration of Commercial Space operations into the NAS.
- Deploy automated alerting capabilities based on fusion data and expand ASIAs text mining capabilities for enhancing predictive analytic capabilities.
- Deploy a Flight Operations Quality Assurance processing platform for world-class safety and risk analysis, spanning the commercial, military, cargo, business jet, rotorcraft, UAS and small GA segments of the aviation industry.

B, Systems Safety Management Transformation (SSMT), G07M.02-01

Program Description

The Systems Safety Management Transformation program is developing a comprehensive and proactive approach to aviation safety; especially as it relates to the implementation of NextGen. This work enables safety assessments of proposed NextGen concepts, algorithms, and technologies that address the economic, implementation, operational and performance impacts of NextGen system alternatives. This program supports the development and implementation of integrated safety management systems across the air transportation system to ensure that the safety risk throughout the NAS is managed to meet FAA's safety goals. The program will develop a working prototype of a National Level Safety Assessment within the Integrated Safety Assessment Model (ISAM), linking the Airport Surface Anomaly Investigation Capability (ASAI) anomaly detection and accident DNA from National Transportation Safety Board (NTSB) reports, to proactively identify emerging risks associated with NextGen capability definition and implementation. Hazard identification and tracking systems developed within the FAA will be linked to the Integrated Safety Assessment Model (ISAM) to support operational safety analyses. Mechanisms to define and support integrated risk-based approaches to safety and safety oversight will be prototyped to monitor operational safety and to determine the safety implications to the air transportation system of operational changes primarily driven by NextGen.

The Systems Safety Management Transformation program includes activities to support the ISAM Baseline and Forecast for the NAS. Software programs to establish an integrated system risk analysis baseline with standardized baseline safety metrics for all aspects of the NAS will be developed, validated and implemented. Integrated Safety Assessment Forecast will develop, validate and implement system risk analysis forecasting software and periodic metrics reporting of the potential impact of both planned and implemented NextGen initiatives on current and future safety baselines for all aspects of the NAS. Terminal Area, En Route and Oceanic risk baseline and risk forecasts will be periodically calculated and reported through the development, validation and implementation of software for surface operations and terminal areas at all major airports. The ISAM model will also be extended to cover worldwide accident rates and incident data through coordination with the European Organization for the Safety of Air Navigation (EUROCONTROL) to support research conducted by the Single European Sky Air Traffic Management Research program.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

The planned growth and complexity in the air transportation system requires a fundamental change in the way the air transportation community manages safety. System safety management research provides a shared, proactive approach to identifying, assessing, and mitigating risk to make all stakeholders more effective in their approach to managing safety. Processes will be reengineered, safety cultures will change, and new technologies that prevent and mitigate incidents and accidents will be deployed within the air transportation system.

The Systems Safety Management Transformation program delivers prototype systems, functioning models, safety tools, information sharing environments and safety management analyses. Capabilities will be integrated using multiple data sources and shared across the aviation community through the deployment of local system safety risk baseline tools, risk prediction tools, and integrated forecasts. Ultimately, NAS stakeholders will use the tools to identify precursors and contributing factors to accidents, allowing interventions to be developed and implemented before system safety issues manifest as accidents.

Program Plans FY 2018 – Performance Output Goals

- Through a joint project plan with EUROCONTROL, develop integrated world-wide risk analysis capability within ISAM through integration with EUROCONTROL's Integrated Risk Platform.
- Demonstrate capability to prototype a dynamic performance dashboard to model safety data requirements of multiple stakeholders.
- Enhance NAS-wide risk metrics and reporting of system baselines and operational impacts of NextGen changes with most recent data (such as monthly metrics).
- Complete prototype of auto-quantification algorithms to link publicly available aviation accident data from the NTSB and ASIAs to ISAM data.

Program Plans FY 2019 – Performance Output Goals

- None.

Program Plans FY 2020 – Performance Output Goals

- Develop the initial ISAM system to incorporate objective data collected via the ASAIC viewer and other data feeds provided by the FAA to develop baseline capability to represent today's risks, including airport surface, terminal and en route risks with and wake encounter and weather related risks.
- Expand the initial ISAM system to include commercial, general aviation and Unmanned Aircraft Systems (UAS) operations in revised monthly NAS-wide risk metrics and report including system baselines and trends.
- Develop the initial ISAM system to include the capability to produce revised monthly commercial operations report for Air Traffic Organization (ATO) and contract tower operations.
- Develop the initial ISAM system to include the capability to produce revised monthly NAS-wide risk forecasts, trend modeling and reporting.

Program Plans FY 2021 – Performance Output Goals

- Expand the initial ISAM system to include the capability to produce weekly analysis reports.
- Expand the initial ISAM system to include the capability to produce revised weekly commercial operations report for ATO and contract tower operations.
- Develop the capability to incorporate system baselines and trends, reflecting commercial, general aviation and UAS operations into weekly analysis reports.
- Develop the capability to incorporate airport surface, terminal and en route risks and wake encounter and weather related risks into ISAM's weekly NAS-wide risk metrics reports.
- Develop the algorithms to produce revised weekly NAS-wide risk forecasts, trend modeling and reporting.

Program Plans FY 2022 – Performance Output Goals

- Produce validated monthly end-to-end estimate of complete flight track risk baselines, airport, terminal, and en route, linked to threaded track data using SWIM data feed.
- Produce applied forecast case analysis for one complete flight track demonstration based upon SWIM data feed.
- Produce a monthly update process between ASIAs and ISAM.
- Integrate ASIAs data into ISAM monthly forecast.

3A10, NATIONAL TEST EQUIPMENT PROGRAM

FY 2018 Request \$4.0M

National Test Equipment Program, M17.01-01

Program Description

The National Test Equipment Program (NTEP) manages the modernization, distribution, and maintenance of test, measurement, and diagnostic equipment required to perform preventive and corrective maintenance in support of NAS systems. Test equipment allows technicians to safely evaluate the condition of NAS systems, identify and isolate defects, and correct and return systems to full operational capacity. Having modern and reliable test equipment is crucial to communication, automation, surveillance, power, navigation, and weather platforms that must be maintained

within specific tolerances. Failure to achieve and maintain certification of critical NAS systems could result in flight delays.

A Final Investment Decision for NTEP was approved in June 2013. The program will update and replace aging and obsolete test equipment used at approximately 27,000 facilities throughout the NAS. Results of the analysis conducted as part of that FID decision, indicates that between 19% and 25% of the 77,000 pieces of test equipment require replacement, with an estimated cost of approximately \$320 million. Some existing test equipment requiring replacement is more than 30 years old and spare parts are no longer available. There is a critical need for communication test sets, telephone test sets, radio test sets, signal generators, and oscilloscopes. In addition, some analog test equipment must be replaced with digital test equipment to be compatible with new digital technology now being deployed to support NextGen initiatives and other FAA programs.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

Inadequate access to modern test equipment may increase the mean-time-to-repair and restore a system back to operation following an outage. NTEP identifies, acquires, and deploys the test equipment required to maintain the systems critical to the operational availability of the NAS.

Program Plans FY 2018 – Performance Output Goals

- Procure and deliver 40 communication test sets.
- Procure and deliver 80 telephone test sets.
- Procure and deliver 60 cable and antenna analyzers.
- Procure and deliver 12 signal generators.
- Procure and deliver 50 multimeters.

Program Plans FY 2019 – Performance Output Goals

- Procure and deliver 60 communication test sets.
- Procure and deliver 80 handheld vector network analyzers.
- Procure and deliver 12 signal generators.
- Procure and deliver 50 multimeters.

Program Plans FY 2020 – Performance Output Goals

- Procure and deliver 50 communication test sets.
- Procure and deliver 50 universal data test sets.
- Procure and deliver 158 oscilloscopes.
- Procure and deliver 50 cable and antenna analyzers.
- Procure and deliver 12 signal generators.
- Procure and deliver 50 multimeters.

Program Plans FY 2021 – Performance Output Goals

- Procure and deliver 100 telephone test sets.
- Procure and deliver 200 communication test set.
- Procure and deliver 50 cable and antenna analyzers.

Program Plans FY 2022 – Performance Output Goals

- Procure and deliver 50 telephone test sets.
- Procure and deliver 100 communication test sets.
- Procure and deliver 12 signal generators.
- Procure and deliver 50 multimeters.

3A11, MOBILE ASSETS MANAGEMENT PROGRAM

FY 2018 Request \$3.6M

Mobile Asset Management Program, F31.01-01

Program Description

The Mobile Asset Management Program (MAMP) provides transportable NAS equipment to restore certain operations during periods of extended equipment outages and to ensure continuity of NAS operations. Mobile NAS equipment provides for the continuity or restoral of air traffic control when an Air Traffic Control Tower (ATCT) or other NAS system is out of service due to a disaster or an extensive repair/modernization/upgrade. Mobile NAS equipment may also be required to augment air traffic control functions at some locations during major public events to ensure safe operations. The MAMP provides mobile assets that function as ATCTs, Terminal Radar Approach Control (TRACON) facilities, Remote Transmitter/Receiver sites, Remote Communications Air/Ground sites, and other 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. The assets are often incapable of providing their intended service without first undergoing significant maintenance or repair before they can be deployed. The inventory consists of approximately 82 assets, of which 52 are directly involved with controlling air traffic. The assets range from 30-kilowatt Mobile Engine Generators to four-position, modular Deployable Air Traffic Control Facility (DATCF) and Mobile ATCT (MATCT). The near-term priorities are to replace old, large four-position MATCT which may not be cost effective to repair and to 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 several must be replaced. With an increase in the frequency of ATCT modernization projects, requirements for the use of a MATCT and/or a Mobile TRACON have also increased. MAMP is preparing to acquire a second version of the DATCF, which will incorporate the lessons learned on the fielding of the first DATCF. This second version of the DATCF will provide more space in the cab and the equipment room compared to the first version of the DATCF. Long range plans include acquiring and maintaining an inventory of nine large MATCTs and a minimum of three DATCFs. The quantity and mix of these assets may change as the FAA's terminal modernization projects increase. The development of a lifecycle management program for mobile assets is ongoing but not fully operational and the agency continues to experience difficulty in providing functional mobile assets due to an emergency. MAMP will provide the mobile assets and the means to manage those assets. This program is included in the ATC Facilities Sustainment Strategic Plan.

A National Mobile Asset Deployment Center 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 and construction of their Mobile Asset Staging Areas (MASAs) in FY 2017. The Systems Support Centers (SSC) affiliated with respective storage areas will serve as property custodians of the mobile assets. Sheltered storage is mandatory to ensure the readiness and the availability of the assets. The storage areas will coordinate the transportation of the mobile assets to and from the event location, and verify inventory/assess condition with the receiving custodian. The MAMP office will maintain a website schedule of the mobile asset deployments using the Mobile Asset eXchange tool. The mobile assets will be maintained by SSC personnel supporting the MAMP storage area in advance of a deployment.

Efforts are continuing on the development of requirements for all mobile assets. These requirements will be the basis for building an inventory of mobile assets that will enable the FAA to respond to both planned and unplanned outages in the NAS.

The MAMP is not dependent upon other Capital Investment Plan (CIP) programs. The mobile assets acquired are provisioned with NAS systems provided by other program offices. The MAMP office coordinates its system requirements with the appropriate program offices to ensure that the program is on the acquisition waterfall of the NAS program offices.

The Joint Resources Council (JRC) approved the Final Investment Decision for MAMP on June 5, 2013.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The MAMP program supports NAS operational availability by providing augmentation, continuity, or restoral service for ATCTs, small TRACONS, radars, and communications systems. Hurricane Katrina and the Haiti earthquake revealed that the FAA had limited capability to provide rapid, onsite restoral of NAS service for disaster response. Each year there are between 10-15 ATCT modernization efforts in progress, many of which require mobile assets to maintain operations. Assets are not always available, requiring the development and use of “work around” procedures that extend the duration of the projects. Additionally, the majority of the 264 FAA-owned permanent ATCTs are over 50 years old, resulting in an increasing number of both modernization projects and unforeseen outages requiring mobile assets to maintain uninterrupted NAS operations.

Program Plans FY 2018 – Performance Output Goals

- Acquire contract for DATCF Version 2.
- Upgrade / modernize two MATCTs.
- Construct two MASAs.

Program Plans FY 2019 – Performance Output Goals

- Acquire two medium self-contained MATCTs.

Program Plans FY 2020 – Performance Output Goals

- Install NAS systems in two medium self-contained MATCTs.
- Acquire three medium self-contained MATCTs.

Program Plans FY 2021 – Performance Output Goals

- Install NAS systems in three medium self-contained MATCTs.
- Acquire three medium self-contained MATCTs.

Program Plans FY 2022 – Performance Output Goals

- Install NAS systems in three medium self-contained MATCTs.

3A12, AEROSPACE MEDICINE SAFETY INFORMATION SYSTEM (AMSIS)

FY 2018 Request \$14.0M

Aerospace Medicine Safety Information System (AMSIS) – Segment 1, A35.01-01

Program Description

The AMSIS program will develop a new information system for tracking and analyzing medical information associated with pilots, air traffic controllers, and other aviation related personnel.

The Office of Aerospace Medicine (AAM) is responsible for maintaining information relating to the following responsibilities:

- Medical Certification of Airmen;
- Medical Clearance of Air Traffic Control Specialists (ATCS);
- Oversight of the Aviation Industry's Drug and Alcohol Testing Programs;
- Designation, Training, Oversight and Surveillance of Aviation Medical Examiners;
- FAA Employee Substance Abuse Testing;
- Airmen Aviation Physiology and Survival Training and Education;
- FAA Employee Health Awareness; and
- Aerospace Medicine and Human Factors Research.

AAM processes approximately 450,000 medical applications from pilots and ATCSs each year and maintains millions of medical records as part of AAM's role in the oversight of 600,000 pilots and approximately 15,000 ATCSs. AAM has designed, developed and implemented information systems to efficiently process and manage safety, health and research information collected by FAA's regulatory programs.

The information systems currently in use today were developed in the 1990's. The technology and architecture of these systems are becoming unsupportable and will soon be obsolete. The AMSIS program will design, develop, procure, and deploy the next generation information system. The information technology must be aligned with OMB/DOT/FAA information systems architecture and security standards. 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, the private sector, and voluntary standards organizations including the International Organization for Standardization (ISO). The systems must successfully and securely interface with approximately 3,100 health care providers designated by the FAA, known as Aviation Medical Examiners, who perform pilot and ATCS medical examinations.

Based upon review of the AAM Business Process Reengineering effort and coordination with key stakeholders, the AMSIS program determined additional analysis is required to fully mature all program requirements. As a result, the AMSIS program will use a segmented implementation approach. Mature requirements will be included in Segment 1; requirements that require additional analysis will be included in Segment 2.

AMSIG Segmentation Scope:

Segment 1 (Mature Requirements)

- Common Functionality (such as user management and support) Module
- Medical Certification (Airman) & Medical Clearance (ATCS) Module
- Industry Substance Abuse Module
- Workflow Management Module
- Reporting & Data Services Module

Segment 2 (Additional Analysis Required)

- Internal Substance Abuse Module
- Aerospace Medical Analysis Module
- Budget Module

The AMSIS program received JRC approval on both the segmentation strategy and the Initial Investment Decision (IID) on December 17, 2014. The AMSIS program's preferred alternative for final investment analysis was approved by the JRC on September 16, 2015. The Segment 1 Final Investment Decision (FID) is planned for 4th quarter FY 2017; the Segment 2 FID is planned for 1st quarter FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

AMSIS will provide improved data accessibility and a greater ability to analyze medical information and denial data to identify safety trends that could impact system safety.

Specifically, AMSIS will reduce accidents and improve safety by:

- Reducing falsification of health records and preventing pilots or ATCSs from operating in the NAS when they have medical conditions that do not meet aviation safety requirements;
- Improving the ability to analyze medical data and identify and mitigate hazards related to specific and/or systemic airmen and ATCS health issues;
- Providing the ability to match airmen and ATCS medical records with the electronic health records of other government agencies and departments;
- Ensuring the accuracy and integrity of airmen and ATCS medical data;
- Improving the surveillance and oversight of designees and aviation industry substance abuse programs;
- Improving the ability to conduct more inspections of industry substance abuse programs per year, and prioritize inspections of high-risk entities; and
- Improving the traceability of discovered substance abuse infractions and investigation of offenders.

Program Plans FY 2018 – Performance Output Goals

- Pending JRC approval:
Complete Contract Award (Segment 1).

Program Plans FY 2019 – Performance Output Goals

- Achieve FID (Segment 2).
- Pending JRC approval:
 - Complete System Development (Segment 1).
 - Complete System Design (Segment 2).

Program Plans FY 2020 – Performance Output Goals

- Pending JRC approval:
 - Complete Integration and Testing (Segment 1).
 - Achieve Initial Operational Capability (IOC) (Segment 1).

Program Plans FY 2021 – Performance Output Goals

- Pending JRC approval:
 - Achieve Full Operational Capability (FOC) (Segment 1).
 - Complete System Development (Segment 2).
 - Complete Integration and Testing (Segment 2).
 - Achieve IOC (Segment 2).

Program Plans FY 2022 – Performance Output Goals

- Pending JRC approval:
 - Achieve FOC (Segment 2). (Prior year funding)

3A13, TOWER SIMULATION SYSTEM (TSS) TECHNOLOGY REFRESH

FY 2018 Request \$5.0M

National Airspace System (NAS) Training - Equipment Modernization – Training Simulators – Tower Simulation System, M20.01-04

Program Description

The Tower Simulation System (TSS) modernization program will update obsolete tower simulation equipment and analyze the potential for adding new airport locations and satellite facilities. There are 36 TSSs currently deployed at 38 sites supporting 177 tower facilities. There are also 17 TSS at the FAA's Mike Monroney Aeronautical Center

(MMAC) and 3 at the William J. Hughes Technical Center (WJHTC). The TSS supports controller qualification and skill enhancement training at each site.

The TSS is a full-scale tower simulator providing an interactive, highly realistic environment for controller training. The TSS supports up to four simultaneous trainee positions including local, ground, flight data/clearance delivery, and coordinator. Trainees achieve initial proficiency in the simulator; when training is complete they begin work in an operational facility as a “developmental” in preparation for certification. The simulator provides synthetic voice response and voice recognition to allow the student to interact with the simulator. The voice recognition system interprets the student's commands and translates them into actual aircraft movement depicted visually on the screen. A recorded playback feature allows instructors to review and evaluate performance and provide feedback to the student after the training session.

The TSS is also used in non-training applications. It aids 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 or departure procedures in an accurate and safe simulated environment.

The current system is over nine years old and is becoming more expensive to operate and maintain. The projection system needs to be updated with new visual technology and video processors to increase fidelity, processing power, and reduce maintenance costs. The program will upgrade 56 TSSs and procure 23 new mobile platforms to provide training capability at locations that do not require a permanent system.

The Investment Analysis Readiness Decision was completed and approved 1st quarter FY 2016. Final Investment Decision (FID) is planned for 4th quarter FY 2017.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The current TSS may become inoperable due to equipment failures which would increase the cost of operation, maintenance, and training. A TSS technology update will reduce operational, maintenance, and training costs by providing newer and more reliable equipment. A 12% average reduction in training times has been experienced to date at airport locations using TSS.

Program Plans FY 2018 – Performance Output Goals

- Pending FID:
 - Procure and install 29 updated TSSs.

Program Plans FY 2019 – Performance Output Goals

- Pending FID:
 - Procure and install 27 updated TSSs.

Program Plans FY 2020 – Performance Output Goals

- Pending FID:
 - Procure 23 Mobile Systems and 6 Suitcase Systems.

Program Plans FY 2021-2022 – Performance Output Goals

- None.

3A14X, LOGISTICS SUPPORT SYSTEM AND FACILITIES (LSSF)

FY 2018 Request \$0.0M

X, Logistics Center Support System (LCSS) – Sustainment Technology Refresh, M21.04-02

Program Description

The FAA Logistics Center (FAALC) at the FAA Mike Monroney Aeronautical Center (MMAC) in Oklahoma City manages the central NAS inventory warehouses and distribution facilities for the FAA. It provides logistics support for more than 48,000 systems nationwide providing parts, services, supplies and emergency restoration services. The FAALC tracks and accounts for over 62,000 national stock numbers with a total value of \$900 million. It provides routine and emergency logistics products and services to 8,091 FAA customers at facilities nationwide, as well as additional customers in the Department of Defense (Air Force, Navy, and Army), state agencies, and foreign countries.

The FAA Logistics Center utilizes the Logistics Center Support System (LCSS); a mission support IT system that has re-engineered and automated the Logistics Center's management processes. The IT infrastructure of LCSS is a modern, Commercial Off-the-Shelf (COTS) Enterprise Resource Planning system, utilizing object-oriented software design, service-oriented architecture, relational databases, and a web-based user interface. The LCSS Sustainment program will refresh the COTS product between FY 2021 and FY 2024. In addition, enhancements will be incorporated in FY 2019-2022 to address business process inefficiencies and to integrate an inventory warehouse module.

A Final Investment Decision (FID) for the LCSS Sustainment program is planned in FY 2022.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 1 – Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the core airports.*

Relationship to Performance Metric

The LCSS program supports the metric to sustain adjusted operational availability by enhancing the capability to accurately manage NAS spares and repair requirements using a centralized and automated process. This enables the agency to meet customer expectations by providing rapid delivery of the correct NAS components and parts with low error and/or defect rates.

Program Plans FY 2018-2020 – Performance Output Goals

- None.

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of the Investment Analysis Readiness Decision (IARD):
 - Functional Analysis;
 - Solution CONOPS;
 - Shortfall Analysis;
 - Enterprise Architecture Products;
 - Acquisition Program Baseline (Execution Plan); and
 - Investment Analysis Plan.
- Achieve IARD.

Program Plans FY 2022 – Performance Output Goals

- Develop the following products in support of the FID:
 - Final Program Requirements Document;
 - Enterprise Architecture Products;
 - Business Case documentation;
 - Final Implementation Strategy and Planning Document; and
 - Acquisition Program Baseline (Execution Plan).
- Achieve FID.

B: Training, Equipment, and Facilities

3B01, AERONAUTICAL CENTER INFRASTRUCTURE MODERNIZATION

FY 2018 Request \$14.0M

Aeronautical Center Infrastructure Modernization, F18.00-00

Program Description

The Aeronautical Center Infrastructure Modernization program funds renovation and restoration of critical leased and owned facilities at the Aeronautical Center in Oklahoma City to ensure they remain viable for the mission of present and future FAA employees, students, and contractors. Funding from this program allows renovation of facility space used by Air Operations, Engineering, Training (Radar /Navigational Aids), NAS Logistics, airmen/aircraft registration, safety, and Business Services. Program funding will be used for facility renovations, building systems replacement, and telecommunications infrastructure upgrades.

The Aeronautical Center is the FAA’s centralized location that supports the NAS and comprises 1,100 acres of leased land with approximately 3.4 million square feet of space and infrastructure needed to support the work of 7,100 FAA employees, students, and contractors; approximately 11,000 visitors annually; and is the largest concentration of FAA personnel outside of Washington D.C. Many of the buildings at the Aeronautical Center are nearly 50 years old and require structural renovation and replacement of aging building systems (e.g. Heating, Ventilation Air Conditioning (HVAC), plumbing, electrical, roofs, etc.).

Some NAS support functions are conducted in outdated structures and in buildings that do not meet current building codes. Delays to renovation and replacement of building systems have consequences that include leaking roofs, deteriorating plumbing, malfunctioning HVAC, and non-compliance with life safety codes that can disrupt work, cause NAS automation and technology failures, risk occupant health and safety, require emergency repairs, and result in a loss of productivity.

Aging infrastructure, in combination with ongoing growth and improvements to the NAS and business services, affects the work environment of Aeronautical Center personnel and the requirements for the facilities in which they work. This program will extend the useful life of facilities at the Aeronautical Center for the next 25 to 30 years providing a safe and modern infrastructure for current and future generations of the FAA work force.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The Aeronautical Center Infrastructure Modernization program sustains a cost effective workplace for Air Operations, Engineering, and Training that contribute to the FAA's Performance Metric to implement cost efficiency initiatives. This program reduces the cost of Air Traffic Organization (ATO) operations by providing facilities that are lower in

cost as compared to Oklahoma City General Services Administration (GSA) metropolitan leased facilities and GSA national averages for leased facilities.

This program enhances financial discipline by providing Technical Operations and Air Traffic training through updated training facilities for both on-site resident and computer-based distance learning and development. In addition, Aeronautical Center space provides business service facilities for the DOT/DELPHI/Prism/Castle Data Center Operations, consolidated Accounting Operations services, Acquisition, ATO Data Center Operations, and Aviation Safety (AVS/ Civil Aerospace Medical Institute (CAMI)).

Program Plans FY 2018 – Performance Output Goals

- Complete renovation construction of the Environmental System Support building, (Bldg 152) to replace mechanical systems, upgrade electrical wiring, plumbing, and provide energy efficiencies in lighting and insulation.
- Award renovation construction contracts for deferred sustainment; to replace roofs, mechanical, electrical, plumbing, and energy systems (lighting, insulation).
- Award Phase 1 (of 2) renovation construction contract for Multi-Purpose Building #24 to add seismic and wind bracing to the building to mitigate earthquake and high wind damage, add fire detection/suppression systems, replace electrical distribution, windows, elevators, add insulation that complies with industry standards, provide energy efficient lighting, replace plumbing, and HVAC. The building is the workplace for approximately 500 FAA employees and contractors.
- Award contracts for Phase 1 (of 6) telecom network design, test, reconfigure network for redundancy, reliability, security in 1 of 74 buildings. Includes security upgrades, disaster recovery testing and installation of fiber/copper cable for central campus network diversity and availability.
- Complete network design, test, reconfiguration, security upgrades, disaster preparedness testing, and installation of communication duct banks/fiber cable for approximately one quarter of the campus.

Program Plans FY 2019 – Performance Output Goals

- Complete Phase 1 (of 2) Multi-Purpose Building #24 renovation to add seismic and wind bracing to the building to mitigate earthquake and high wind damage, add fire detection/suppression systems, replace electrical distribution, windows, elevators, add insulation that complies with industry standards, provide energy efficient lighting, replace plumbing, and HVAC.
- Award Phase 2 (of 2) renovation construction contract for Multi-Purpose Building #24 to add fire detection/suppression systems, replace electrical distribution, windows, elevators, add insulation that complies with industry standards, provide energy efficient lighting, replace plumbing, and HVAC.
- Award contracts for Phase 2 (of 6) telecom network design, test, reconfigure network for redundancy, reliability, and security in 13 of 74 buildings. Includes security, upgrades, and disaster recovery testing and fiber/copper cable for northwest campus network diversity and availability.
- Complete network design, test, reconfiguration, security upgrades, disaster preparedness testing, and installation of communication duct banks/fiber cable for approximately one quarter of the campus.

Program Plans FY 2020 – Performance Output Goals

- Award renovation construction contract for deferred sustainment, to replace roofs, mechanical, electrical, plumbing, and energy systems (lighting, insulation).
- Award contracts for Phase 3 (of 6) telecom network design, test, reconfigure network for redundancy, reliability, and security in 10 of 74 buildings. Includes security upgrades, and disaster recovery testing and fiber/copper cable for east campus network redundancy and availability.
- Complete network design, test, reconfiguration, security upgrades, disaster preparedness testing, and communication duct banks/fiber installation for approximately one quarter of the campus.

Program Plans FY 2021 – Performance Output Goals

- Complete Phase 2 (of 2) of Multi-Purpose Building #24 renovation construction to add seismic and wind bracing to the building to mitigate earthquake and high wind damage, add fire detection/suppression systems, replace electrical distribution, windows, elevators, add insulation that complies with industry standards, provide energy efficient lighting, replace plumbing, and HVAC.
- Award contracts for Phase 4 (of 6) telecom network design, test, reconfigure network for redundancy reliability, and security in 11 of 74 buildings. Includes security upgrades, and disaster recovery testing and fiber/copper cable for west campus network redundancy and availability.
- Complete network design, test, reconfiguration, security upgrades, disaster preparedness testing, and communication duct banks/fiber installation for approximately one quarter of the campus.

Program Plans FY 2022 – Performance Output Goals

- Award renovation construction contracts to replace roofs, mechanical, electrical, plumbing, and energy systems (lighting, insulation) among 134 buildings (3.6M sq ft) whose systems and infrastructure will be analyzed in 2021 engineering studies to determine those requiring replacement.
- Award construction contract to relocate classrooms and laboratories for the Air Surveillance Radar (ASR-9/Secondary surveillance and communication system (Mode S)), to the west side of the campus.
- Award contracts for Phase 5 (of 6) telecom network design, test, reconfigure network for redundancy, reliability, and security in 17 of 74 buildings. Includes security upgrades, and disaster recovery testing and fiber/copper cable for west campus network redundancy and availability.
- Complete network design, test, reconfiguration, security upgrades, disaster preparedness testing, and communication duct banks/fiber installation for approximately one quarter of the campus.

3B02, DISTANCE LEARNING

FY 2018 Request \$1.0M

Distance Learning, M10.00-00

Program Description

The Distance Learning program will provide for technology refresh of Distance Learning Platforms (DLP) (previously Computer-Based Instruction Platforms) located at all DLP learning centers to increase connectivity and upgrade network multimedia support and services. The system consists of approximately 1,100 learning centers located at virtually every FAA facility around the world consisting of 2,275 DLPs at 610 Air Traffic Sites (includes 235 Federal Contract Towers) and 490 Technical Operations Sites. The FAA is providing the technology refresh of the DLPs to support high-performance media and simulations required in many lessons; and because replacement parts for current platforms are becoming obsolete and increasingly difficult to obtain. The technology refresh is accomplished in a phased, multi-year approach.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The major cost savings benefit of distance learning are a substantial reduction in student time away from work, and reduced travel and per diem costs associated with resident-based training. Distance learning delivery methods also increase training effectiveness and opportunities for all FAA employees and provide additional flexibility in managing training schedules. The FAA DLP system and the Aviation Training Network (ATN) must deliver initial operator, transition, and maintenance training for many NAS programs. By providing a standard training delivery and equipment simulation platform across all NAS programs, the need for such equipment and space to house it is reduced. All of these factors contribute to a reduction in the unit cost of service for en route, terminal, and flight service.

Program Plans FY 2018 – Performance Output Goals

- Award contract for technology refresh of initial 180 DLPs (180 of 2275, 8%) at En Route Air Traffic Facilities (ARTCC, TRACONS) and FCT DLP Learning Centers by Sept-2018.
- Provide updates to courseware and application via network and/or DVD's to 2275 DLPs by Sept-2018.

Program Plans FY 2019 – Performance Output Goals

- Award contract for technology refresh of additional 180 DLPs (360 of 2275, 16%) at Air Traffic Facilities (ARTCC, Terminal) and FCT DLP Learning Centers by Sept-2019.
- Provide updates to courseware and application via network and/or DVD's to 2275 DLPs by Sept-2019.

Program Plans FY 2020 – Performance Output Goals

- Award contract for technology refresh of additional 180 DLPs (540 of 2275, 24%) DLPs at Air Traffic Facilities (ARTCC, Terminal) and FCT DLP Learning Centers by Sept-2020.
- Provide updates to courseware and application via network and/or DVD's to 2275 DLPs by Sept-2020.

Program Plans FY 2021 – Performance Output Goals

- Award contract for technology refresh of additional 180 DLPs (720 of 2275, 32%) at Air Traffic Facilities (ARTCC, Terminal), Technical Operations Facilities, and FCT DLP Learning Centers by Sept-2021.
- Provide updates to courseware and application via network and/or DVD's to 2275 DLPs by Sept-2021.

Program Plans FY 2022 – Performance Output Goals

- Award contract for technology refresh of additional 180 DLPs (900 of 2275, 40%) at Air Traffic Facilities (ARTCC, Terminal), Technical Operations Facilities, and FCT DLP Learning Centers by Sept-2022.
- Provide updates to courseware and application via network and/or DVD's to 2275 DLPs by Sept-2022.

System Implementation Schedule



ACTIVITY 4: FACILITIES AND EQUIPMENT MISSION SUPPORT

4A01, SYSTEM ENGINEERING AND DEVELOPMENT SUPPORT

FY 2018 Request \$35.7M

- A, CIP Systems Engineering & Development Support – System Engineering Contract, M03.03-01
- B, Provide Air Navigation Facilities (ANF)/Air Traffic Control (ATC) Support (Quick Response), M08.01-00

A, CIP Systems Engineering & Development Support – System Engineering Contract, M03.03-01

Program Description

The System Engineering and Development Support program manages a portfolio of contracts providing technical support services for research, analysis, systems engineering and integration for both NextGen and non-NextGen initiatives. It provides access to research, technical, engineering and programmatic resources that support the FAA's NextGen transformational programs and further improves the legacy systems in the NAS. The portfolio of contracts was awarded in two major categories: Research and Mission Analysis; and Systems Engineering.

Research and Mission Analysis: Supports the full range of NextGen Research & Mission Analysis services in one or more functional task areas related to NextGen and the required activities to achieve a Concept and Requirements Definition Readiness Decision (CRDRD) in the Acquisition Management System (AMS) Lifecycle. Research and Mission Analysis includes the following service support activities:

- Concept and Requirements Definition Planning
- Early Life Cycle Concepts and Prototyping
- Early Life Cycle Human Factors Research
- Early Life Cycle Concepts of Operations Research
- Early Life Cycle Human Performance Analysis
- Proof of Concept Research
- Pre-Operational Concept Demonstration Trials
- Cost Benefit Analysis
- Operational Demonstration Trials
- Concept Integration
- Rapid Prototyping/Fast-Time Modeling
- Real-Time Simulations
- Real-Time Human In-the-Loop Simulations
- Full-Scale Concept Demonstrations
- Cognitive Task Analysis Methods
- Conceptual Operations Verification and Validation

Systems Engineering: Supports systems engineering activities that occur throughout the AMS Lifecycle for both NextGen and non-NextGen programs in support of AMS decisions. Systems engineering supports the following activities:

- Final Requirements Documents
- Enterprise Architectural Products
- Safety and Regulatory Evaluations
- Business Continuity Planning

- Portfolio Analyses
- Maintenance, Operation and Enhancements of Financial Systems
- Investment Planning & Analysis
- Acquisition Support
- Schedules
- Human Factors
- Concepts of Operations
- Human Performance Analysis
- Proof of Concept Validation
- Pre-Operational Trials and Operational Trials
- System Integration
- Rapid Prototyping/Fast-Time Modeling
- Pre-Development Real-Time Simulations
- Real-Time Human In-the-Loop Simulations
- Full-Scale Prototype Demonstrations
- Verification and Validation
- Engineering Analysis
- Cyber Security Research, Development, and Implementation
- NextGen Business Case Development
- NextGen Enterprise Risk Management
- NAS Software Assurance
- JRC Investment Decisions

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

This program contributes to FAA's Strategic Priority to Deliver Benefits through Technology and Infrastructure. The program supports the metric for cost efficiency by providing support for designing and managing NAS modernization and in particular the NextGen activities. With contractor assistance, the FAA is able to plan, analyze and manage NAS system improvements more efficiently and effectively.

Program Plans FY 2018-2022 – Performance Output Goals

Contract:

- Conduct Monthly meetings with SE2020/SE2025 vendors.
- Conduct Quarterly Vendor Program Management Reviews.
- Conduct Chief Financial Officer Quarterly Reviews.
- Develop Contract and Financial Status Report (monthly basis).
- Develop SE2020/SE2025 Update to FAA NextGen Executive Team (monthly basis).
- Conduct Monthly briefings for NextGen Directorates with SE2020/SE2025 task orders.
- Exercise Second Option Period for SE2020 Full and Open prime vendors.
- Issue new full and open contract awards.
- Develop and provide multiple performance databases used in tracking the effects of NextGen projects that improve flight trajectories.
- Develop modeling tools used for setting capacity targets and the system effects of FAA initiatives such as Metroplex.
- Develop tools under SE2020/SE2025 to support and/or validate components of the NextGen Performance Snapshots (NPS) website.
- Conduct Post Implementation Reviews via the Joint Resources Council (JRC).

- Improve Quality Management including verification and validation of documents, standard operating procedures and other products.
- Provide NAS Software Assurance upon delivery and implementation.
- Conduct and enhance Cyber Security Research, Development, and Implementation.

Program Evaluation:

- Conduct cost and benefits analysis on all FAA NAS and NextGen Investments. This includes benefits estimating, cost estimating, operations research, risk and schedule analysis, market surveys, and business case development.
- Conduct Engineering Analysis on NextGen systems.

Computer Services:

- Design, develop, maintain, train, and report on all aspects of Simplified Program Information Reporting and Evaluation, FAA Acquisition System Toolset, Financial Management System, and other management tools.

Air Traffic Control (ATC) / Aviation Financial (AFN) Systems Support:

- Enhance financial management and oversight of F&E and R, E&D appropriations. This includes business management, technical management, budget formulation, systems engineering, cost accounting, labor distribution, budget execution, acquisition management.

B, Provide Air Navigation Facilities (ANF)/Air Traffic Control (ATC) Support (Quick Response), M08.01-00

Program Description

This program provides quick response support for Air Traffic Organization organizations to solve unforeseen issues that arise. These issues may be related to immediate needs such as a corrective action for communications or information technology (e.g., installing a communications link for a new facility or service) or to accommodate changes to a financial management system to meet new requirements for a cost accounting report. It also provides emergency response capability for unforeseen regional problems such as relocating an antenna for a remote communications facility. The projects addressed are unexpected and require quick response to maintain efficient services and operations.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

This project supports cost efficiency initiatives by providing the ability to respond quickly to unforeseen needs, issues or situations that, if left unresolved, could result in higher operating or future replacement costs.

Program Plans FY 2018-2022 – Performance Output Goals

- Identify, approve, and implement quick response projects to address emergent requirements in the budget year.

4A02, PROGRAM SUPPORT LEASES

FY 2018 Request \$47.0M

Program Support Leases, M08.06-00

Program Description

The Program Support Leases office is responsible for managing over 2,800 leases needed in support of air traffic operations. The FAA leases land and commercial space necessary for the operation of communication, surveillance and navigation systems (this includes obtaining air rights restrictions around the facilities), for Air Traffic Control Towers (ATCT), for system support, and for other mission related activities. This program is responsible for funding program management and execution of existing and new leases, surveys, appraisals and the purchase of land when necessary for required sites. New leases are required when Air Traffic Control (ATC) facilities are relocated; when airspace redesign requires new sites for the installation of additional navigation and communications equipment within the NAS; and when ATCTs or service area technical facilities are built to meet new mission requirements. The program offices are responsible to fund leases for new facilities for the first two years after which Program Support Leases provides the lease funds.

Lease terms are typically negotiated for 5 to 20 years and should be renegotiated prior to expiration. However; on average, approximately 500 leases expire each year. It is not uncommon for leases to enter holdover status, a situation in which the FAA continues to occupy the space or land without the execution of a renewed lease; sometimes due to resistance by lessors to negotiate fair and reasonable terms. Existing leases are examined prior to expiration to validate a continuing FAA need and to ensure that the lease provisions are both cost effective and equitable to both the lessor and the FAA. Lease arrangements can sometimes be complex requiring negotiations with multiple owners regarding cost, arrangements for personnel and equipment relocation and stringent site specific requirements related to operational needs. Lease costs normally escalate because the market value of land continues to increase. When land lease costs increase substantially the program determines if it is more cost effective to purchase a property or to continue the lease agreement. A business case assessment, supplemented by a market analysis of real estate values in the area, will determine whether it is more advantageous to lease or buy a property. If the decision is made to purchase, the program provides the funds to the service area to negotiate the purchase of the land. The number of purchases continues to increase and 10% of our budget is allocated to purchases. The agency currently has about 200 lease agreements in a holdover status due to an impasse with the lessor over the terms of the contract. Causes for holdovers may encompass a variety of reasons such as changes in ownership or market value.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

In support of the FAA Performance Metric for implementing cost efficiency initiatives, this program is improving management of the FAA's real property assets and contributing to the cost effectiveness of air navigation infrastructure. Real property costs are being effectively controlled through:

- Implementing cost effective alternatives such as downsizing and colocation as leases expire,
- Converting leases to ownership where feasible, and
- Terminating leases that are not needed for future operations.

Program Plans FY 2018-2022 – Performance Output Goals

- Conduct six or more site surveys of available facilities within an area to identify cost effective alternatives to pursue regarding expiring leases.
- Conduct quarterly teleconference meetings with service areas on Facilities & Equipment portfolio issues.
- Complete reviews of funding requests to conduct property surveys and provide a decision within 48 hours.

4A03, LOGISTICS AND ACQUISITION SUPPORT SERVICES

FY 2018 Request \$11.0M

NAS Regional/Center Logistics Support Services, M05.00-00

Program Description

The Logistics Support Services (LSS) program procures contract support services for the three FAA Service Areas, the William J. Hughes Technical Center, and the FAA Headquarters offices that provide technical assistance with contracting, real estate, and materiel management tasks. The contract is managed by the FAA's Aviation Logistics Division and provides direct support to Capital Investment Plan (CIP) projects, accounting system capitalization, and property control-related activities.

The LSS program supplements the FAA workforce for acquisition, real estate, and materiel management in the three Logistics Service Areas and at the Technical Center. The LSS program is responsible for providing logistics support in the planning, documentation and oversight required for establishing new or upgraded facilities, including Air Traffic Control Towers (ATCTs) and Terminal Radar Approach Control Facilities (TRACONs) throughout the NAS. LSS resources will also continue to be used for asset tracking and documentation efforts to obtain and maintain a clean audit opinion.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 4 – Empower and Innovate with the FAA's People*
- *FAA Performance Metric 2 – Achieve a 90% success rate in the areas of financial management and human resources management: Receive annual Unqualified Audits with no material weaknesses. Maintain the competitive status of all FAA employees within the federal personnel system. Improve the "effective leadership" index score on OPM Employee Viewpoint survey by 8 percent. Improve the "talent management" index score on the OPM Employee viewpoint survey by 8 percent. (FAA Business Planning Metric)*

Relationship to Performance Metric

The program will support FAA objectives by improving financial management while delivering quality customer service. Specifically, the LSS program provides required support functions that enable the FAA to manage real property assets, maintain a clean audit opinion, and plan the execution of critical acquisition activities supporting the NAS. These functions are performed throughout the three Logistics Service Areas and the FAA Technical Center.

Related project management goals include:

- Complete 80% of the annual real property Office of Management and Budget (OMB) inventory validation effort.
- Designate 75% of the disposed real property assets as "retired" within 30 days of the date the disposal forms are received.
- Capitalize 92% of all personal and real property capital assets within 65 days of date placed in service.
- Award at least 90% of all formal contracts within 180 calendar days; award 90 % purchase orders within 45 calendar days and 80% of Task Orders/Delivery orders within 60 calendar days, from the time a purchase request is received from the requiring organization.

Program Plans FY 2018 – Performance Output Goals

- Complete 93% of the work assignments in support of:
 - The annual real property OMB inventory validation effort;
 - The "retired" real property disposal effort; and
 - Capitalization efforts for both real and personal property assets.
- Complete Option Year acquisition activities to fully fund the program-funded task orders on the LSS contract.
- Begin acquisition actions for a follow-on LSS contract to be awarded in FY 2019.
- Contract actions are awarded within time to award metric.

Program Plans FY 2019 – Performance Output Goals

- Complete 94% of the work assignments in support of:
 - The annual real property OMB inventory validation effort;
 - The "retired" real property disposal effort; and
 - Capitalization efforts for both real and personal property assets.
- Complete 100% of acquisition activities and award a follow-on LSS contract.
- Contract actions are awarded within time to award metric.

Program Plans FY 2020 – Performance Output Goals

- Complete 95% of the work assignments in support of:
 - The annual real property OMB inventory validation effort;
 - The "retired" real property disposal effort; and
 - Capitalization efforts for both real and personal property assets.
- Complete Option Year acquisition activities to fully fund the program-funded task orders on the LSS contract.
- Contract actions are awarded within time to award metric.

Program Plans FY 2021 – Performance Output Goals

- Complete 95% of the work assignments in support of:
 - The annual real property OMB inventory validation effort;
 - The "retired" real property disposal effort; and
 - Capitalization efforts for both real and personal property assets.
- Complete Option Year acquisition activities to fully fund the program-funded task orders on the LSS contract.
- Contract actions are awarded within time to award metric.

Program Plans FY 2022 – Performance Output Goals

- Complete 95% of the work assignments in support of:
 - The annual real property OMB inventory validation effort;
 - The "retired" real property disposal effort; and
 - Capitalization efforts for both real and personal property assets.
- Complete Option Year acquisition activities to fully fund the program-funded task orders on the LSS contract.
- Contract actions are awarded within time to award metric.

4A04, MIKE MONRONEY AERONAUTICAL CENTER LEASES

FY 2018 Request \$19.7M

Aeronautical Center Lease, F19.00-00

Program Description

The Aeronautical Center lease program pays the annual rent for leased land and approximately 80 percent of the Mike Monroney Aeronautical Center (MMAC) space, which encompasses 2.8M square feet of leased space and 1,100 acres of land, having a replacement value of \$696M. The MMAC lease consists of a master lease for land, buildings, sustainment and insurance; the Thomas Road warehouse lease; and tower space for Terminal Doppler Weather Radar target generators. The MMAC, located in Oklahoma City, provides facilities supporting FAA air operations/flight checks fleet of aircraft, engineering, system testing, air traffic and system specialist training in radar/navigation Aids, NAS logistics, aviation regulation, registration, certification, aviation and transportation safety research, and business services. MMAC has the largest concentration of FAA personnel outside of Washington D.C. at facilities that support the work of 7,100 employees, students, and contractors on a daily basis, and accommodate approximately 11,000 visitors annually.

The MMAC 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 high level security site (Level IV) based on numbers of employees, facility square footage, sensitivity of records, volume of

public contact, and mission-essential facilities whose loss, damage, or destruction may have serious or catastrophic impact on the NAS. The current lease agreement expires in 2028.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The Aeronautical Center Lease sustains a cost effective workplace for Air Operations, Engineering, and Training. Eighty percent (80%) of Aeronautical Center space is used for direct support of the Air Traffic Organization (ATO) by Engineering Organizations, Aviation System Standards (AVN) operations and flight check, the Logistics Center, Air Traffic Control training, ATO Technical Operations Training and Certification, and system testing of Radar and Nav aids. An additional 13% of MMAC space provides business service facilities for the DOT/FAA DELPHI/Prism/Castle Data Center Operations, consolidated accounting operations services, acquisition, ATO Data Center Operations, and Aviation Safety (AVS/Civil Aeromedical Institute (CAMI)). The current lease is cost efficient when compared to the General Services Administration rate for leased facilities in Oklahoma City. Leasing is more cost effective than replacing the \$696M leased facility.

Program Plans FY 2018 – Performance Output Goals

- Complete monthly lease payments on time.
- Award contracts for energy management improvement that includes renovation design for solar panels to conform to Executive Order to improve efficiency in federal facilities.
- Award contracts for water metering construction, energy conservation in leased buildings, Logistics Support Facility energy projects.
- Replace Air Navigation Facility, Flight Services Building, and Airman Records Building air handlers and direct digital controls.

Program Plans FY 2019 – Performance Output Goals

- Complete monthly lease payments on time.
- Award contracts for energy conservation replacement systems in leased buildings.
- Award renovation construction contract for Systems Training Building annex.
- Award construction of solar panels (Phase 1 of 2).

Program Plans FY 2020 – Performance Output Goals

- Complete monthly lease payments on time.
- Award renovation design of the Radar Training Facility to remove the exterior facade, install insulation/vapor barrier, and replace panels for energy efficiency.
- Award contracts for energy conservation replacement systems in leased buildings.
- Award renovation construction contract for the Radar Training Facility building.
- Award construction of solar panels (Phase 2 of 2).

Program Plans FY 2021 – Performance Output Goals

- Complete monthly lease payments on time.
- Award contracts for lease holder improvements that include replacement of windows, HVAC, electrical systems, and lighting. Award renovation design of the Radar Training Facility to remove the exterior facade, install insulation/vapor barrier, and replace panels for energy efficiency.

Program Plans FY 2022 – Performance Output Goals

- Complete monthly lease payments on time.
- Award contracts for energy management improvement that includes renovation design to conform to Executive Order to improve efficiency in federal facilities.

4A05, TRANSITION ENGINEERING SUPPORT

FY 2018 Request \$19.9M

- A, NAS Integration Support Contract (NISC), M22.00-00
- B, Configuration Management Automation (CMA), M03.01-02

A, NAS Integration Support Contract (NISC), M22.00-00

Program Description

NISC provides technical expertise to assist the FAA in deploying, implementing, and integrating many different components and equipment critical to the safety and efficiency of the NAS. NISC also provides expertise and technical support to maintain agency compliance with laws, regulations and Congressional directives during transition, implementation, and integration activities. Examples of the work products include: equipment installation schedules for power systems, weather cameras, etc.; engineering site preparation packages and site implementation plans for installation of new towers, repair of unstaffed infrastructure (fences, remote site roads, power back-up systems, etc.); analysis and assessment of environmental impacts; test procedures for validating components and equipment placed into the NAS meet rigorous safety requirements; site test monitoring to ensure compliance with various rules and regulations; FAA employee Occupational Safety and Health Administration (OSHA) compliance; and corporate work planning to track and report on capital investment programs.

NISC also supports FAA's Aviation Safety line-of-business (AVS) by installing Information Technology systems such as automation of the safety rulemaking process and automation of the collection and storage of safety data used by inspectors to develop recommendations that may result in safer aircraft and better trained air personnel. NISC also provides technical support to automated systems that generate and track commercial and general aviation licenses for pilots; systems that enable engineers and inspectors to certify commercial aircraft to transport passengers and cargo; and systems that enable automation of records management. To provide these services the NISC program requires over 1,000 Full Time Equivalent (FTE) technical support personnel annually.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The NISC program has contributed to numerous innovations that have provided cost savings to the FAA and to industry. For example, the NISC program provides Aeronautical Information Analyst support to the Aeronautical Information Services Group (AJV-5) to review and update Terminal and En route instrument flight procedures, which support the Very High Frequency Omnidirectional Range (VOR) – Minimal Operational Network (MON) initiative. This initiative will reduce operational costs by over \$12M by reducing the number of VORs in the NAS from 957 to 649 by FY 2020.

The FAA's NISC contract offers experienced and affordable personnel at a current average cost of \$79 per hour (fully-burdened). This cost effective rate supports the Air Traffic Organization service centers, headquarters offices and AVS with the planning and coordination of various programs. The NISC program has also implemented an affordability methodology across all Task Orders which involves workforce alignment, infrastructure resizing, competitive bidding and process improvements which have resulted in both cost savings and cost avoidance.

Program Plans FY 2018-2022 – Performance Output Goals

- Two award fee performance ratings per year, which measure FAA satisfaction with Contractor performance with regard to products and services, task order management, initiative/continuous improvement, contract management, and contract cost management. Periodically adjust performance metrics to promote excellent contractor performance based on customer feedback.

B, Configuration Management Automation (CMA), M03.01-02

Program Description

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 program will provide:

- An automated and integrated enterprise solution to support CM of FAA assets and investments;
- Functionality and data previously provided by legacy CM tools;
 - WebCM provides an automated system for reviewers to view proposed changes
 - Replacement Documentation and Configuration Identification System (RepCON) collects NAS configuration data and associated status to maintain the as-is NAS configuration
- A single point of access with insight and traceability to configuration baselines reflected in the FAA NAS Enterprise Architecture (NAS EA);
- Seamless interfacing with other related CM information; and
- 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.

The CMA program will use a commercial-off-the-shelf (COTS) industry standard tool designed to support both NAS and Non-NAS FAA assets, as mandated by FAA order 1800.66, Configuration Management Policy. CMA establishes systems and processes that support the five tenets of CM:

- CM planning and management,
- Configuration identification,
- Configuration control,
- Configuration status accounting, and
- Configuration audits.

In addition, the program will host the CMA servers, provide training for users, and supply maintenance to the system. CMA will be implemented in two Segments as follows:

Segment 1 replaces the legacy WebCM and will deliver a FAA owned functional User Interface (UI). It will automate the change management workflows and business rules to manage the change process; including the longer and more involved must-evaluation process. The UI will also provide the FAA a platform to connect to Industrial and Financial Systems (IFS) in Segment 2.

Segment 2 replaces the legacy RepCON with a Logistics Center Support System/IFS module that will:

- Automate CM Tenets
- Develop system hierarchy in an IFS module
- Configure CMA UI change management workflows and business rules within IFS
- Establish system interfaces needed to provide the NCP closed-loop data
- Additional UI functionality enabled, such as document management and custom reporting
- System interfaces and workflows necessary to support CM in Non-NAS
- "Line of Sight" Configuration identification of NAS systems to LRU level.

Final Investment Decision is planned for Segment 1 in FY 2018 and Segment 2 in FY 2020.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

As NextGen equipment is installed, the decommissioning of legacy NAS systems requires accurate records of the configuration of the current systems. Knowing the configuration of the current systems and the changes needed to install new systems will result in cost savings to FAA in both the short and long term. CMA is the Enterprise tool that supports the planning required for both the decommissioning and removal of expiring equipment, hardware and software, and fielding of new systems.

CMA will move the FAA from a process that relies heavily on a CM practitioners' institutional knowledge to providing the enterprise solution for a scalable, network-centric architecture. The existing lack of a closed-loop CM system requires multiple manual processes to retrieve information related to the proposed change, which can lead to time-consuming duplication of effort and a high risk of inaccurate results. CMA will create the closed-loop enterprise infrastructure necessary to leverage process-to-process integration, minimize redundancy, and cluster processes around a single integration point.

CMA maps to the Performance Metric of implementing cost efficiency initiatives by:

- Reducing costs associated with delay risks during the implementation of new systems and technology by providing the ability to identify configuration problems early in the development process;
- Reducing equipment maintenance costs through a coordinated systems approach that identifies maintenance issues early in the procurement process; and
- Standardizing CM processes which will result in a more efficient and effective management of the change process.

Program Plans FY 2018 – Performance Output Goals

- Prepare for Single Source evaluation process to conduct Competitive Award for small businesses.
- Develop and receive approval for all JRC Artifacts for Segment 1 FID.

Program Plans FY 2019 – Performance Output Goals

- Develop and complete a user interface resulting in fully functioning change management workflows and business rules necessary to manage the FAA change process.

Program Plans FY 2020 – Performance Output Goals

- Achieve Segment 2 FID.

Program Plans FY 2021-2022 – Performance Output Goals

- Achieve Full Operational Capability with fully defined NAS system hierarchy in IFS depicting an accurate top-down structure for FAA configuration items. (Prior year funding)

4A06, TECHNICAL SUPPORT SERVICES CONTRACT (TSSC)

FY 2018 Request \$23.0M

Technical Support Services Contract (TSSC), M02.00-00

Program Description

The TSSC program provides a contract vehicle to augment FAA's workforce with professional engineering, technical, and construction services to assist FAA project implementation. TSSC performs site surveys and selection,

engineering; environmental, fire/life safety, equipment installation, and removal of asbestos and obsolete equipment. Other services include testing; drafting; staging, warehousing and distribution; and contract surveillance and oversight. The TSSC program helps the FAA ensure timely completion of projects for NAS modernization. TSSC provides approximately 500 Full Time Equivalent (FTE) of technical employee workforce capability and monitors approximately \$35M in non-labor costs for projects such as fixed price subcontracts for site preparation construction. The number of FTEs provided by TSSC will vary depending upon the amount of industrial funding received from other CIP programs that utilize TSSC support. Program funds applied to the TSSC contract are used to support specific projects and tasks for which the program funds were appropriated. In a typical year, more than 3,700 separate projects are completed by FAA using the TSSC Program.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

The TSSC program contributes to cost control by helping the FAA install new equipment on a timely basis. This avoids added costs for holding and storing equipment and allows the FAA and the aviation industry to receive equipment and system modernization benefits on schedule. The TSSC Program Office collaborates with the NAS Integration Support Contract (NISC) Program Office to share development of a contract tracking programs and program office support contracts to reduce management costs.

Additional cost savings by the TSSC program may also result by moving TSSC regional management counterparts into unused FAA space when available. This can save FAA tens of thousands of dollars in lease agreements that would have otherwise been paid through the contract vehicle. This cost effective strategy has been implemented at several offices within all three FAA Service Area organizations.

Program Plans FY 2018-2022 – Performance Output Goals

- Two award fee performance ratings per year, which measure FAA satisfaction with Contractor performance with regard to cost, schedule and quality. Periodically adjust performance metrics to promote excellent contractor performance based on customer feedback.

4A07, RESOURCE TRACKING PROGRAM (RTP)

FY 2018 Request \$6.0M

Resource Tracking Program (RTP), M08.14-00

Program Description

The RTP/Corporate Work Plan (CWP) is a computer management system (including hardware, software, development, training, and support) used by the FAA Service Units, Service Centers, the Technical Center, and the Aeronautical Center for identifying requirements, internal budget preparation, implementation planning, resource estimating, project tracking, and project performance measurement. The CWP allows users to share and coordinate FAA project data during the various stages of implementation (i.e., planning, scheduling, budgeting, execution, and closeout). The CWP system and its supporting data are used to report project metrics to program offices, project managers, responsible engineers, and various other customers.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 8 – 90% of major baselined acquisition programs must be maintained within 10% of their current acquisition cost, schedule and technical performance baseline as of the end of fiscal year 2017. (FAA Business Planning Metric)*

Relationship to Performance Metric

The RTP/CWP contributes to FAA performance metric to maintain 90% of major system investments within a 10% variance of their acquisition program baselines by providing an enterprise level project management system that allows field and headquarters' office to use consistent data for managing capital programs.

Program Plans FY 2018-2022 – Performance Output Goals

- Deliver quarterly software upgrades to optimize project/program management.
- Provide monthly project management reports.

4A08, CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT (CAASD)

FY 2018 Request \$57.0M

CIP Systems Engineering & Technical Assistance – MITRE, M03.02-00

Program Description

The Center for Advanced Aviation System Development (CAASD) is an FAA-sponsored Federally Funded Research and Development Center (FFRDC) operated under a contract and Sponsoring Agreement with the MITRE Corporation. CAASD high quality research, systems engineering, and analytical capabilities help FAA meet the technically complex challenges in the 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, develop the NAS Enterprise Architecture, and support the National Aviation Research Plan (NARP).

From 2018-2020, the CAASD program, is supported under its existing CAASD FFRDC contract with the MITRE Corporation. A full "Comprehensive Review" (CR) of the FAA's FFRDC requirements beyond 2020 is planned in 2019. A new FFRDC contract and Sponsoring Agreement will be defined by this CR and awarded in 2020 to provide coverage from 2021 through 2025.

The CAASD *Product-Based Work Plan* defines an outcome-based program of technically complex research, development, and system engineering activities. The scope and breadth of CAASD work are detailed in the *CAASD Long Range Plan* for each program outcome. Individual CAASD deliverables provide FAA stakeholders with important data and recommendations that improve FAA decision-making and matures the NAS Architecture.

The Work Plan is categorized in the following areas.

NAS Concept of Operations, Architecture and Integration: Develop the NAS Concept of Operations. Integrate Next Generation Air Transport System (NextGen) enhancements into the NAS Architecture. Anticipate the impact of planned improvements on future capacity based on demand at airports and for use of airspace. Develop and integrate the NextGen Enterprise Architecture (EA), operational concepts, capability action plans, and roadmaps to ensure an integrated evolution that aligns with the agencies enterprise architectures.

Air Traffic Management (ATM) Operational Evolution: Provide analysis of the NAS mission needs, system requirements and proposed system design to identify critical enhancement needs and ensure that system enhancements will meet operational needs in a cost-effective manner. Provide an understanding of the benefits associated with capability enhancements. Provide assessments of concept maturity, operational feasibility and implementation risks, including identification of cross-domain dependencies. Advance the maturity of emerging ATM improvement concepts, and conduct Human-in-the-Loop (HITL) evaluations. Develop and validate cross domain operational evolution plans.

Airspace and Performance-Based Navigation: Take advantage of the precision, reliability, predictably, and efficiencies of improved navigation and procedures through Area Navigation (RNAV). Conduct research on new concepts for achieving a performance-based NAS. Model and simulate operational improvements and impacts to

address mid-term and far-term Performance-Based Navigation (PBN) requirements. Perform system-wide optimization analyses of airspace and procedures for NextGen. Design and execute technical analyses on airspace security incidents on the NAS. Perform airspace concept development for mitigating airspace security incidents.

Safety and Training: Develop safety assurance processes as an integral part of normal operations. Perform technical analyses of NAS-wide accident and runway incursion risks to identify airports or specific types of operations with the highest risk. Develop metrics and processes that allow FAA to proactively identify potential safety issues. Identify and assess the feasibility of new or advanced capabilities and standards that mitigate safety issues in the NAS. Enhance the quality and efficiency of Terminal Radar Approach Control (TRACON) and En Route controller training.

Communications, Navigation, Surveillance (CNS), and Cyber-Security Infrastructure: Develop and evaluate advanced NAS CNS system concepts and requirements, and assess alternative technological approaches to meeting requirements. Perform research, modeling, simulation, and demonstration of prototypes of technical and operational enhancements to the NAS CNS and cyber security systems.

Unmanned Aircraft Systems: Provide technical analyses supporting strategic solutions for managing UAS integration into the NAS and NextGen. Implement standards for safe operation of UASs without compromising the safety or efficiency of the NAS.

Special Studies, Laboratory and Data Enhancements: Provide an integrated research environment that ensures individual research activities, prototypes, and capabilities can be brought together with the appropriate mixture of fidelity and flexibility to facilitate integrated investigations, compressed spiraling of operational concepts and procedure development. Develop and sustain the Aviation Integrated Demonstration & Experimentation for Aeronautics laboratory infrastructure. Provide a data repository system that allows efficient access to aviation data and associated tools.

Mission-Oriented Investigation and Experimentation: Identify opportunities for innovative solutions to NAS problems and enhancements to NAS capabilities and procedures. Explore new approaches including complexity theory, agent-based modeling, and productivity modeling.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 3 – Achieve a NAS on-time arrival rate of 88 percent at core airports and maintain through FY 2018.*

Relationship to Performance Metric

CAASD provides independent advanced research and development required by the FAA to develop operational concepts, technical analyses, prototypes, procedures, and systems requirements needed to fulfill the vision for the NAS Enterprise Architecture and ensure that the FAA's mission of positioning the NAS for the future by building an Air Traffic Management System capable of efficiently meeting future demand while ensuring the NAS current safety record is sustained. FAA adoption of the new systems and procedures in the NAS improves on-time performance and provides a more efficient global air transportation system.

Program Plans FY 2018-2022 – Performance Output Goals

- Achieve a 90% on-time completion rate of the activities identified in the Product-Based Work Plan for the year.
- Release annually, an updated Long Range Plan.
- Conduct Quarterly Performance Reviews of CAASD.
- Obtain semi-annual FFRDC Executive Board approval(s) of Annual Work Plans and policy changes.

4A09, NEXTGEN – AERONAUTICAL INFORMATION MANAGEMENT PROGRAM

FY 2018 Request \$4.7M

**Aeronautical Information Management (AIM) Modernization Segment 2, G05A.02-05 / X,
Aeronautical Information Management (AIM) Modernization Segment 3, G05A.02-06**

Program Description

The AIM Modernization program will provide aviation users with digital aeronautical information that conforms to international standards and supports NextGen objectives. Digital aeronautical data enables near real-time processing of data to improve access to, and the quality of static and planned NAS constraint data including Notice to Airmen (NOTAM), airport status, Special Activity Airspace (SAA), and other relevant Aeronautical Information such as Standard Operating Procedure Letter of Agreement constraints, procedures, and obstacles data. This constraint information will be provided through enterprise support services and will support better decision-making by NAS operators.

AIM Modernization Segment 2 (G05A.02-05):

AIM Modernization Segment 2 will build on pre-implementation efforts that were performed in the NextGen Common Status and Structure Data program (G05A.02-01), part of the Collaborative ATM portfolio, to baseline and implement suitably mature AIM technologies and tools for Aeronautical Information exchange. Aeronautical Common Services (ACS) will:

- Provide a foundational enterprise level infrastructure platform leveraging SWIM, internationally recognized exchange standards, and web services to deliver aeronautical information across the NAS with native functionality to process, transform, filter, and publish tailored aeronautical information as services to end use applications;
- Improve distribution of SAA relevant information among stakeholders. Digital management of SAAs will also facilitate calculation of airspace usage and availability metrics in support of efficiency of air traffic management, analysis of SAA usage, integration with industrial partners, and scheduling automation;
- Provide access to Airports Geographic Information System (GIS) data for critical information about airports including airport mapping and status; and
- Fully leverage the SWIM Common Support Services infrastructure to deliver quality aeronautical information using common standards and services.

AIMM S2 will be done in three releases:

- Release 1 establishes the ACS infrastructure and provides portal and data orchestration for the NAVLean program (Navigation Procedures Project published September 2010);
- Release 2 provides the capabilities associated with SAA; and
- Release 3 provides the capabilities associated with the Federal NOTAM System (FNS), other types of aeronautical information including obstacles, and finalizes remaining capabilities.

Final Investment Decision (FID) for AIM Modernization Segment 2 was approved August 20, 2014.

AIM Modernization Segment 3 (G05A.02-06):

AIM Modernization Segment 3 (S3) will modernize and expand on the ACS enterprise service and initial SAA and GIS capabilities developed by AIM Modernization Segment 2 by adding performance capability, increased level of integration with NAS automation to integrate or fuse the static aeronautical information with operational data feeds for updates on the activation status of SAA, and active runway/airport configuration data from the authoritative source. AIMM S3 will provide value added services using aeronautical status information such as fused airspace, NOTAMs, and airport reference data in a common data model for improved flight planning and briefing services. Examples of value added services include Aeronautical Information visualization/mapping and relational filtering such as airspace affected by a given NOTAM, Standard Operating Procedures or Letter of Agreement constraints affecting a given geographic location, and airspace affected by SAA schedule and status. Additional capabilities will include the processing of static airspace constraints and business intelligence services to provide fused and integrated data products on demand to end use applications. This will be done via SWIM through web services which, when fully implemented, will provide improved access and increased functionality embedded in the information services with

respect to filtering and data fusion (visualization of airspace, relational delivery and display of features and maps, geospatially referenced NOTAM data, etc.) so that end user applications and decision support tools may take advantage of these services to provide a significantly enhanced user experience.

The Common Status and Structure Data program (G05A.02-01) will prepare the acquisition management products to support the investment decisions for the AIMM S3 program. The schedule for AIMM S3 is:

- The Investment Analysis Readiness Decision is scheduled for FY 2017;
- The Initial Investment Decision is scheduled for FY 2018; and
- The FID is scheduled for FY 2019.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 1 – Make Aviation Safer and Smarter*
- *FAA Performance Metric 1 – Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.*

Relationship to Performance Metric

AIM Modernization Segments 2 and 3 will improve and expand AIM services. The program will improve the accuracy and timeliness of information regarding NOTAM, SAA and Airport data. Analyses are underway to quantify legacy systems current delivery performance to establish the baseline and metrics for measuring the benefit provided. NAS safety depends upon the timely and accurate exchange of information between internal and external users.

Program Plans FY 2018 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- Complete Release 3 Operational Test and Evaluation. (APB Milestone)
- Achieve Operational Capability for Release 3. (APB Milestone)
- Complete delivery of FNS information into NAS Automation.

AIM Modernization Segment 3 (G05A.02-06):

- None.

Program Plans FY 2019 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- None.

AIM Modernization Segment 3 (G05A.02-06):

- Complete acquisition activities including:
 - Source selection decision
 - Contract Award
- Complete System Requirements Review that includes the draft System Segment Specification (SSS) and Verification Requirements Traceability Matrix (VRTM).

Program Plans FY 2020 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- None.

AIM Modernization Segment 3 (G05A.02-06):

- Complete Preliminary Design Review (PDR) for Release 1 that includes the final SSS and VRTM, and draft Release 1 Software Requirements Specifications (SRS), Software Design Document (SDD) and Web Service Description Documents (WSDD).
- Complete Critical Design Review (CDR) for Release 1 that includes the final Release 1 SRS, SDD and WSDD.

Program Plans FY 2021 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- None.

AIM Modernization Segment 3 (G05A.02-06):

- Complete PDR for Release 2 that includes draft Release 2 SRS, SDD and WSDD.
- Complete CDR for Release 2 that includes the final Release 2 SRS, SDD, and WSDD.
- Complete Release 2 code development and development of test procedures.
- Achieve Operational Capability for Release 1.

Program Plans FY 2022 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- None.

AIM Modernization Segment 3 (G05A.02-06):

- Complete PDR for Release 3 that includes draft Release 3 SRS, SDD and WSDD.
- Complete CDR for Release 3 that includes the final Release 3 SRS, SDD, and WSDD.
- Complete Release 3 code development and development of test procedures.
- Achieve Operational Capability for Release 2.

4A10, NEXTGEN – CROSS AGENCY NEXTGEN MANAGEMENT

FY 2018 Request \$1.0M

Cross Agency NextGen Management, G08M.04-01

Program Description

The development of NextGen is a priority for the Administration. Modernizing the air transportation system and safely managing forecasted growth in the air traffic system requires the active participation of FAA's NextGen partners; the Department of Commerce, Department Of Homeland Security, National Aeronautics and Space Administration, Department of Defense, the White House office of Science and Technology Policy, and the Office of the Director of National Intelligence. Activities conducted under 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.

Alignment of Program to FAA Strategic Priority and Performance Metric

- *FAA Strategic Priority 2 – Deliver Benefits through Technology and Infrastructure.*
- *FAA Performance Metric 7 – Achieve documented cost savings and cost avoidance of \$42.46 million in FY 2017.*

Relationship to Performance Metric

Upgrading current NAS technology and infrastructure to support NextGen requires collaboration with both industry and partner agencies. Data sharing of NextGen research technology and tools in cybersecurity, weather, and air traffic management among partner agencies is critical to reduce cost. The Cross Agency NextGen Management program will provide timely coordination between all Federal NextGen partners without which the FAA's ability to leverage potentially cost saving research and expertise from other agencies would also be reduced.

Program Plans FY 2018 – Performance Output Goals

Interagency Planning:

- Support Senior Policy Committee (SPC); execute meetings and follow guidance to complete directed initiatives and produce Annual Executive Summary.
- Support NextGen Executive Board (NEB); execute meetings and follow guidance to complete directed initiatives and produce Quarterly Progress Reports.
- Co-chair Interagency Core Cyber Team (ICCT), identify specific cyber gaps and vulnerabilities in the NAS, and propose high-priority R,E&D solutions to mitigate the gaps and vulnerabilities and provide monthly status update report.
- Lead the early collaboration and coordination of key NextGen interagency initiatives for multiagency efforts, including updating and revising the NextGen investments and documenting the budgetary amounts and programs for each partner agency.
- Identify critical gaps, determine potential multi-agency research solutions, prioritize multi-agency weather research projects and provide recommendations to the NextGen Executive Weather Panel (NEWP) for further action; engage and guide partner agencies through the Research Transition Team (RTT) process. Develop: RTT and Research-to-Operations (R2O) progress reports.

Systems Engineering:

- Systems Engineering support for Cross Agency initiatives including development of cost/benefits analyses and engineering studies addressing high-priority cross agency activities (e.g., integration of UAS into the NAS)

Program Plans FY 2019-2022 – Performance Output Goals

Interagency Planning:

- Support SPC; execute meetings and follow guidance to complete directed initiatives and produce Annual Executive Summary.
- Support NEB; execute meetings and follow guidance to complete directed initiatives and produce Quarterly Progress Reports.
- Co-chair ICCT, identify specific cyber gaps and vulnerabilities in the NAS, and propose high-priority R,E&D Solutions to mitigate the gaps and vulnerabilities and provide monthly status updates.
- Lead the early collaboration and coordination of key NextGen interagency initiatives for multiagency efforts, including updating and revising the NextGen investments and documenting the budgetary amounts and programs for each partner agency.
- Develop partner agency vision beyond NextGen to identify future aviation trends to take advantage of emerging technologies; develop Beyond NextGen Vision Report.
- Identify gaps, determine potential R,E&D solutions and prioritize NextGen R,E&D projects including the Research Transition Teams (RTTs); determine potential weather R,E&D solutions and engage partner agencies through the NEWP.
- Develop updates to partner agency vision beyond NextGen to identify future aviation trends to take advantage of emerging technologies. Update Beyond NextGen Vision Report.

Systems Engineering:

- Develop cost/benefit analyses in support of high-priority multi-agency initiatives.