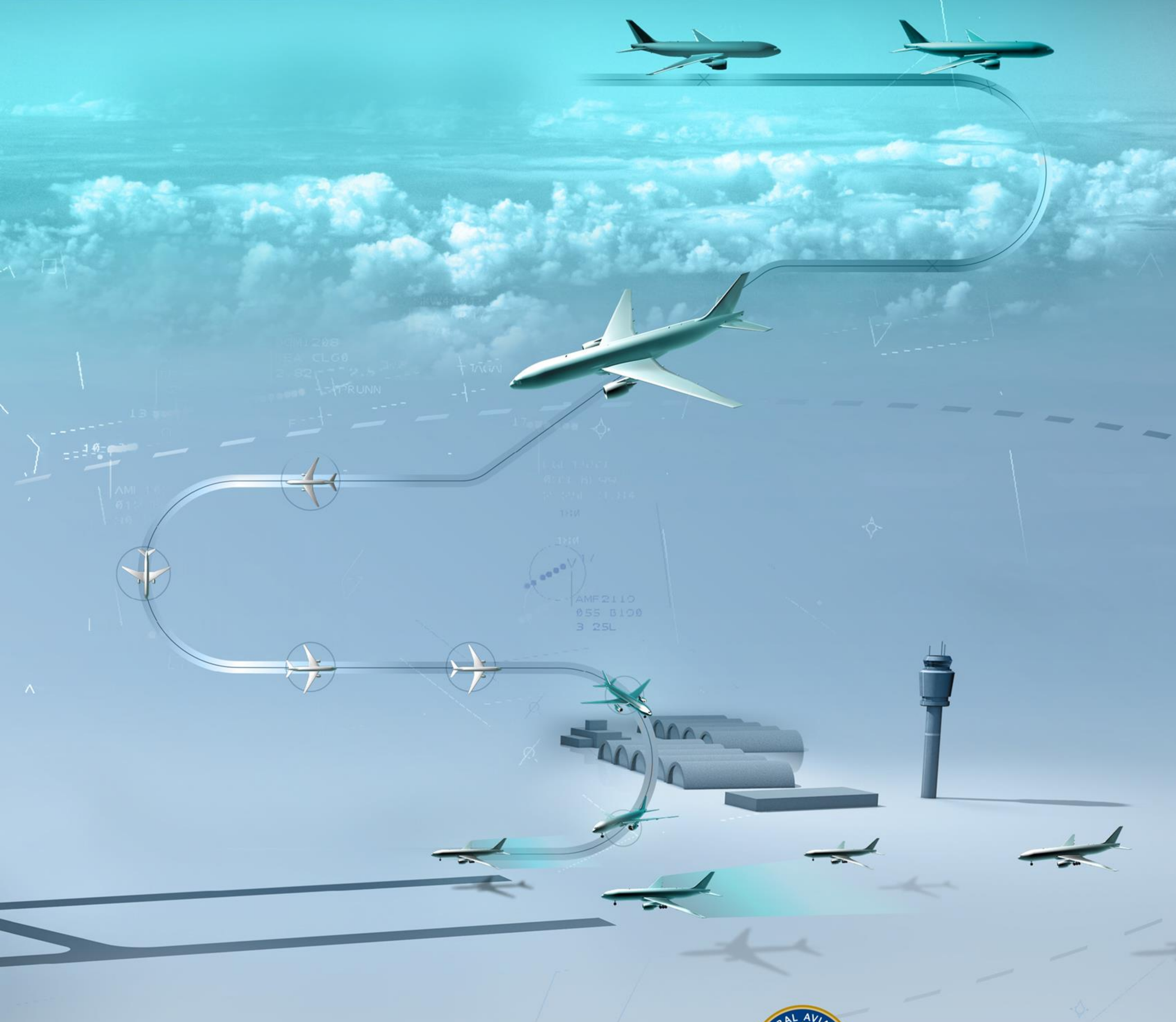
National Airspace System Capital Investment Plan

FY2017–2021



Federal Aviation Administration

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Administrator's Preface:

The National Airspace System (NAS) requires a high degree of reliability, availability, and resiliency to ensure uninterrupted delivery of aviation services while providing the highest level of safety in the world. Our highly trained, certified professional air traffic controllers require state-of-the-art equipment and dependable communication, navigation, and surveillance systems to deliver world-class service to all NAS users. Significant safeguards and redundancies are in place to ensure that NAS infrastructure and systems meet stringent reliability, availability, and safety standards to prevent service disruptions, and to minimize system impact should one occur.

The programs included in the Capital Investment Plan (CIP) are critical to FAA's continued success in achieving and maintaining this high level of safety and service to the public and support the development and implementation of the ongoing transition to the Next Generation Air Transportation System (NextGen). CIP programs also support continued FAA leadership in global aviation and the development of future applications for new technologies such as Automatic Dependent Surveillance – Broadcast (ADS-B).

The CIP provides the agency's latest five-year plan for the F&E programs supporting the development, acquisition, implementation, and sustainment of the systems that provide the infrastructure, the technology, and the capabilities of the NAS. The CIP begins with the F&E programs requesting funding in the most recent President's Budget submission plus the approved programs planned for the next four years. By law, FAA's annual publication of the 5-year CIP must be based upon the Facilities and Equipment (F&E) funding requested in the President's Budget and with the F&E outyear funding targets that are issued and updated annually by the Office of Management and Budget.

Each year, the overall progress made in sustaining and modernizing NAS equipment, systems, and facilities is reviewed. In prioritizing and approving the portfolio of capital programs, the FAA executives on the Joint Resources Council (JRC) strategically balance the programming of these funds between sustaining the services provided the NAS and supporting development and implementation of NextGen capabilities needed to meet projected growth in the demand for aviation services.

I hope this plan provides you with a better understanding of FAA's capital programs; their role in sustaining and modernizing the NAS; and the ongoing transition to NextGen that is now delivering new capabilities and benefits to our customers.

Sincerely,

Michael P. Huerta,
Administrator

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Federal Aviation Administration National Airspace System Capital Investment Plan for Fiscal Years 2017 – 2021

1 Capital Investment Plan Overview

The Federal Aviation Administration (FAA) Capital Investment Plan (CIP) describes the capital investments required to modernize the National Airspace System (NAS); what can be accomplished with the Facilities and Equipment (F&E) appropriation dollars requested in the Fiscal Year (FY) 2017 President's Budget; and with the outyear funding targets issued and updated annually by the Office of Management and Budget (OMB) for the next four years.

Section 1 of the overview describes the statutory requirements for the CIP; the format for this CIP; the senior level decision body for the CIP; the FAA's strategic priorities that drive the objectives of the programs; the economic impact of aviation on the U.S. economy; and information about the other sections that follow.

1.1 CIP Overview Format

The FY 2017-2021 CIP is being published in a format that includes brief descriptions of the NextGen Operational Improvements (OIs) and the systems and programs shown on the NAS Enterprise Architecture Roadmaps for Automation, Communications, Navigation, Surveillance and Weather. Full descriptions of all the CIP programs are referenced by their Budget Line Item (BLI) number and are available in Appendix B. This format results in a more concise document that provides an overview of NAS modernization and supports reader access to full program descriptions for those programs they would like learn more about. The full program descriptions with performance output goals (Appendix B) are available online. http://www.faa.gov/air_traffic/publications/cip/

The overview CIP identifies the F&E programs supporting Aviation Safety, NextGen Development, Facilities and NAS and Mission Support. The CIP also includes FAA's five-year Facilities and Equipment (F&E) profile by BLI and the status of the major F&E programs in sections 8 and 9; respectively. A complete acronym list for this document is included in section 11. Also note that all budget and program information in this CIP is consistent with the "Abbreviated" CIP submitted as a section of the FAA's 2017 President's Budget submission to Congress in February 2016.

1.2 Statutory Requirements

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

1. The Consolidated Appropriations Act, 2016 (Public Law 114-113) states: "*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 2017 through 2021, 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 Public Law 114-113 cited above, an Abbreviated CIP, consisting of a brief introduction, planned funding for each CIP program by BLI for FY 2017-2021, and a current status of the major CIP programs was included in the FAA's FY 2017 President's Budget submission to Congress.

The CIP provides a brief summary of each system and program shown on the NAS Enterprise Architecture Roadmaps that graphically depict a 10, or more year view of each system in compliance with section 44501 of 49 USC as referenced above.

The CIP is an integral part of the FAA's near-term, mid-term, and long-term planning and budgeting process. Current CIP program data is used as the starting point for the F&E budget formulation and justification process for the following fiscal year. By integrating F&E budget formulation with the preparation of the CIP, the accuracy and consistency of program information contained in the F&E budget request with the program descriptions included in the CIP is significantly improved.

The forward looking, multi-year view of the CIP serves as a management resource by identifying planned program lead times for acquisition planning, scheduling, and preparation for milestone presentations to the Joint Resources Council (JRC) for review and approval under FAA's Acquisition Management System (AMS). Examples of typical AMS milestones include Investment Analysis Readiness Decision (IARD), Initial Investment Decision (IID), and Final Investment Decision (FID). This acquisition planning and scheduling information is helpful for other programs that are interdependent with the approval, acquisition, or timely deployment of other systems, equipment, or capabilities into the NAS. The CIP development process also supports the update of the NAS Enterprise Architecture roadmaps to ensure that the program information provided and shown on the roadmaps is consistent with the information in both the Budget Request and the CIP. The NAS Systems Engineering Portal may be accessed at https://sep.faa.gov/.

1.3 The Joint Resources Council (JRC)

In accordance with the Acquisition Management System (AMS), the JRC is FAA's investment decision making body charged with the responsibility for approving and overseeing the management of all FAA investments and allocating resources for their accomplishment. The membership of the JRC consists of senior level representatives from FAA's major lines of business. The JRC plays an important part in the CIP development process as it reviews, approves, and establishes baselines for all AMS documents. This includes program requirements, acquisition program baselines, business case analyses, implementation strategy and planning documents, and production and in-service decisions. In addition, the JRC reviews and approves the overall portfolio of programs included in the CIP, the agency's budget requests, and the FAA NAS Enterprise Architecture (EA) Roadmaps. CIP programs must return to the JRC for review by the investment decision dates shown in the approved NAS EA.

1.4 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 Strategic Priorities guide the FAA in upgrading NAS systems and operating procedures to meet the demands of current operations and future growth. Performance Metrics are a tool the agency uses to track progress towards accomplishment of the Strategic Priorities. The agency depends on capital investments to meet the Performance Metrics.

1.5 Information on other CIP Sections

Section 2, "Key Considerations in Capital Planning", describes the balance that must be maintained to sustain current system performance while transitioning to NextGen. Section 3, "Aviation Safety", provides summary descriptions for programs sponsored by the Aviation Safety (AVS) organization. Section 4, "NextGen Portfolios and Implementations", describes NextGen Portfolios and the planned Operational Improvements (OIs) that support the portfolio objectives. Section 5, "Enterprise Architecture Infrastructure Roadmaps", contains the Infrastructure Roadmaps, which outline the planned modernization of the NAS and describe the programs and systems included in the NAS architecture. Section 6, "Facilities", provides summary descriptions for programs sustaining and modernizing facilities across the NAS. Section 7, "NAS and Mission Support", provides summary descriptions for programs. Section 8, "Estimated Funding by Budget Line Item", contains BLIs included in the FY 2017 President's budget request and estimated outyear funding amounts from FY 2018 through FY 2021 for current and future BLIs. Section 9, "Information for Major Capital Programs", provides current cost and schedule status on major capital investment programs.

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 which may take years to execute and implement. 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 schedule status of ongoing capacity expansion projects at major airports (e.g. new runways), and the level of sustainment needed for mission critical ATC systems, facilities, and other NAS infrastructure. All capital investments must be identified, prioritized, requested, approved, funded, and scheduled in time to meet demand forecasts. This must also include sufficient time for systems to complete testing to demonstrate compliance with NAS reliability and safety standards.

FAA planning of capital investments is balanced to the latest OMB targets for the F&E appropriation. Agency decision makers must allocate capital funds between programs supporting the ongoing development and deployment of NextGen capabilities and those ensuring continued NAS sustainment of ATC systems and infrastructure during the transition. The requirement to sustain current NAS performance and safety is a high priority.

2.1 Economic Considerations

Aviation plays a significant role in promoting economic growth and contributes to over five percent of the U.S. Gross Domestic Product (GDP). NextGen supports economic growth by modernizing the ATC system as it introduces new technologies and advanced decision support tools to make air travel more efficient, safer and environmentally friendly. In a study published by the Air Traffic Organization's Office of Performance Analysis in June of 2014, "The Economic Impact of Civil Aviation on the U.S. Economy," it was estimated that in 2012 aviation accounted for over $1.5 trillion in economic activity contributing to 5.4 percent of total U.S. GDP. The spending on aviation-related activities supported an estimated 11.8 million jobs. In support of commercial activities, air carriers transported over 61.2 billion revenue ton-miles of air cargo. A reliable worldwide aviation network is essential for today's economy. Domestic and international commerce rely on the access to, and the passenger and freight capacity it provides to cities around the world to sustain economic growth.

2.2 Air Travel Demand

Historically, the demand for air travel is heavily influenced by changes in the economy. Figure 1-1 shows that the growth rate in revenue passenger miles (RPM) over the last 30 years has exceeded the growth rate of GDP.

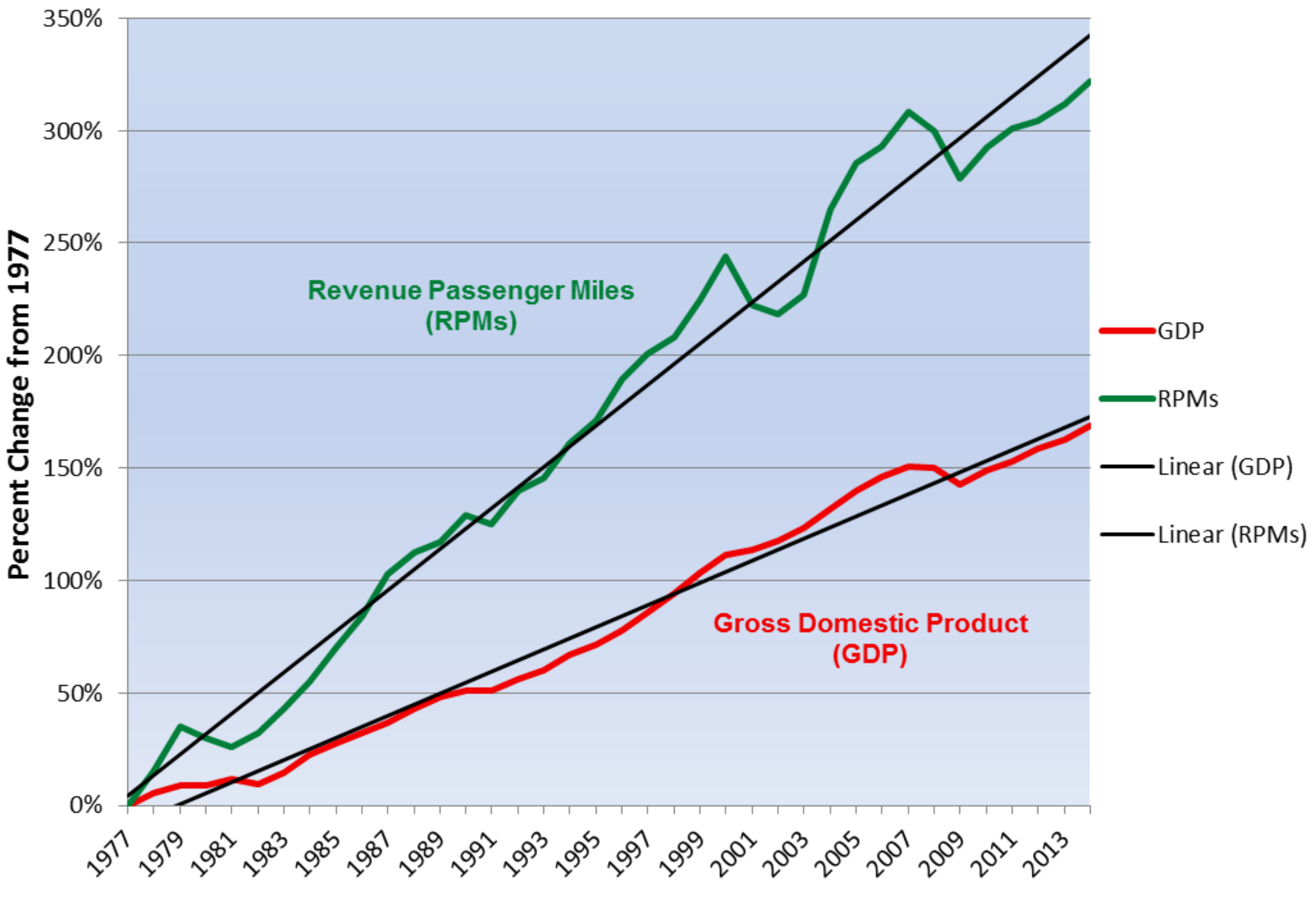

Figure 2-1 Air Travel Demand Growth Compared to Growth in GDP[1]

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

The U.S. inflation-adjusted (real) economic output long-term growth trend supports the continuing increases in air travel. Recent economic data shows that GDP is continuing to grow. The trend lines in figure 2-1 suggest that continuing GDP growth in the economy will support a corresponding growth rate in the demand for air travel. With load factors now at a historic high, larger aircraft have been able to absorb the recent growth in passenger revenue miles which have continued to climb since 2009. With little room for further increase in the domestic load factor, growing demand at core airports will ultimately require more aircraft operations. The availability of advanced NextGen capabilities may help to accommodate this growth and minimize delays.

2.3 Airport Expansion Projects

Ongoing efforts to increase airport capacity with runway infrastructure improvements drive capital investments, especially at large hub airports, where flights are concentrated. In September 2014, Fort Lauderdale/Hollywood International Airport (FLL) completed a 2 year project to expand and elevate runway 9R-27L to an overall length of 8,000 feet to accommodate larger passenger aircraft; upon completion the runway designation was changed to 10R-28L. In October 2015, Chicago O'Hare International Airport opened a new runway, 10R-28L following its October 2013 opening of runway, 28C-10C. Further runway improvements for Chicago O'Hare are proposed for the north airfield. Philadelphia International Airport will be extending 9R-27L, a main east-west runway by an additional 1,500 feet to 12,000 feet as part of a long-term major airport reconfiguration program.

Increasing capacity 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. The 30 large hub airports handle about 72 percent of airline enplanements. The combined total of 63 large and medium hubs supports 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.

When airport authorities in coordination with the FAA build new runways to expand capacity, additional supporting navigation and surveillance equipment is often required. New procedures may also be needed to fully utilize new capacity. New or relocated runways often require that airspace around the airports be reconfigured to accommodate new approach and departure patterns. When new or relocated precision approach guidance systems are installed, approach lights and visibility sensors must be positioned along the runway so that these systems can be used down to the lowest visibility approved for that airport. Some airports may need new surveillance systems to cover expanded departure and approach patterns. Capital investment may also be needed to expand or relocate air traffic control facilities. In cases where significant increases in demand result from the airport improvements, additional controller positions may also be required.

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 separation, the reliable operation of communication, navigation and surveillance systems is 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 difficult to obtain.

The air traffic control infrastructure is a complex system made up of several thousand components. There are 21 Air Route Traffic Control Centers (ARTCC) that house automation equipment used by air traffic controllers to control en route air traffic. There are over 500 Air Traffic Control Towers (ATCT) and 168 Terminal Radar Control (TRACON) facilities that control air traffic approaching, landing and departing from airports. 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 February 2016, the air traffic control infrastructure has a maintenance and repair backlog estimated at $3.9B in unfunded requirements to sustain its facilities. Goals, objectives, strategies, processes, and priorities are being established to address this challenge. Eight systemic issues have been identified across the Air Traffic Organization (ATO) that include Mold Remediation, Fire Life Safety, Fall Protection, Arc Flash, Power Cable, Engine Generators, Fuel Storage Tanks, and ARTCC Chiller replacement. As requested in the FY 2017 President's Budget, the ATC Facilities Sustainment Strategic Plan focuses on the following programs 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 2B06;
- ATCT/ Terminal Radar Approach Control (TRACON) Facilities – Improve, BLI 2B07;
- NAS Facilities Occupational Safety and Health Administration (OSHA) and Environmental Standards Compliance, BLI 2B09;
- 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 (Navaids)), 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 also modernized to a common automation platform to support NextGen and reduce maintenance costs;
- **En route Automation –** The new En Route Automation Modernization (ERAM) platform is operational and 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. Instrument Landing System (ILS) and other Navigation aids (Navaids) systems will be installed as necessary to replace older unreliable and unsupportable systems; and
- **Surveillance/Weather –** Modernization of en route, and terminal primary and secondary surveillance radars will be implemented to upgrade or replace aging unsupportable systems. Weather sensing and processing equipment will also be modernized.

More details on all of 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. A Resiliency Assessment Program has been established to identify and address vulnerabilities that could severely impact NAS operations. Assessing programs critical to ensuring NAS Resiliency will result in the development of specialized programmatic and technical recommendations to target investments to improve the resiliency of critical 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 greater than 24 hours at Core Airports and/or 96 hours for the En Route domain. Funding for NAS Resiliency activities will be requested within the BLIs for the relevant systems, facilities, and infrastructure to be addressed.

2.6 Planning for the Future through NextGen Investments

NextGen is the name given to the overarching program for the ongoing, wide-ranging transformation of the NAS to ensure that future safety, capacity and environmental needs will be met by the FAA. NextGen 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 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 already achieved many of the milestones needed for this transformation, we are starting to realize some of the expected benefits from NextGen. The NextGen Implementation Plan provides more information concerning the vision, benefits and implementation details and can be found 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) – Sector Enhancements and Technology Refresh –** 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);
- **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 2A17);
- **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 2A19);

- **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 2B13); 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 #
2A18	Airborne Collision Avoidance System X (ACAS X) – Segment 1	M54.01-01
3A02	Regulation and Certification Infrastructure for System Safety (RCISS) – Segment 3	A17.01-03
3A06	System Approach for Safety Oversight (SASO) Phase – 2b	A25.02-02
3A07	Aviation Safety Knowledge Management Environment (ASKME) – Segment 2	A26.01-01
3A08	Aerospace Medical Equipment Needs (AMEN) – Phase 2	M53.01-02
3A08	Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Phase 3	M53.01-03
3A12	Aerospace Medicine Safety Information System (AMSIS) – Segment 1	A35.01-01

Table 3-1 Aviation Safety Programs

4 NextGen Portfolios and Implementations

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) listed in the NextGen portfolios shown below and describe specific performance enhancements to be realized through the NextGen investments.

The NextGen concept development and pre-implementation work is now focused on the next useful segments of capabilities that will be deployed once development and implementation of new modern infrastructure is completed. The portfolios describe the engineering and acquisition work needed to achieve additional functionality to the base systems along with complementary development of standards, guidance, operational descriptions, and procedures.

The OIs included in this section are targeted for development and implementation within the FY 2017-2021 timeframe. Each portfolio section and its corresponding OI descriptions are followed by a list of the portfolio programs that support the OIs. For information concerning the implementing systems, please refer to the NAS Enterprise Architecture Infrastructure Roadmaps descriptions in Section 5. To obtain more information on NextGen accomplishments visit the following site: http://www.faa.gov/nextgen/snapshots/

Each OI has a unique six-digit identifier that is included as a reference. The first digit identifies the FAA Service Group such as Air Traffic Management services; the next two digits are service type; the fourth digit is the capability, e.g. ATC Separation Assurance/Surface Separation; and the last two digits are a unique ID. Additional information can be found on the NAS Systems Engineering Portal at https://sep.faa.gov.

4.1 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. Enhancements to separation management are articulated in the following Operational Improvements (OI):

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. Users may also supply trajectory option sets that represent their route preferences in the event of a constraint, such as weather. Trajectory flight data will continue to be updated for changes and made available to subscribers so that tactical and strategic plans are developed with the most up to date 4D flight trajectory.

Initial Conflict Resolution Advisories, OI: 104104

The ANSP automation supports the controller in predicting and resolving conflicts. Automation is enhanced not only to recognize conflicts but also to provide rank-ordered resolution advisories to the ANSP.

Automation Support for Separation Management, OI: 102137

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.

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.

Optimized Oceanic Trajectories via Interactive Planning, OI: 104102

Interactive planning between the 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. 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 to better fit the new conditions.

Reduced Horizontal Separation Standards, En Route - 3 Miles, OI: 102117

By taking advantage of advances in surveillance and surveillance data processing, the ANSP provides reduced separation (down to 3 miles) in greater portions of en route airspace. These reductions will allow procedures with lower separation minima and enable controllers to use more flight efficient clearances to manage conflict resolution.

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 status of SAA are made readily available for operators and ANSPs using automation systems.

Relative Spacing Using Traffic Display, OI: 102143

Enhanced surveillance and new procedures enable the ANSP to initiate relative spacing operations, in which the position of an aircraft in a stream is managed in relation to the position of one or more other aircraft. These operations improve NAS capacity and flight efficiency by allowing flight crews to close to tighter spacing currently only experienced during visual approach and visual separation operations. Relative spacing operations can be realized through flight deck equipment and procedures supported by new ground automation and procedures.

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, and as a result, fewer diversions from the preferred routing.

Improved Parallel Runway Operations with Airborne Applications, OI: 102157

Improved flight deck capabilities allow for increased arrival capacity for parallel runway operations in Instrument Meteorological Conditions. Aircraft collision avoidance systems will be further enhanced for dependent operations by providing algorithms that calculate the blunder protection area followed by the appropriate procedural maneuver to ensure that the protection area is not compromised.

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.

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	Alternative Positioning Navigation and Timing (APNT)	G06N.01-06
1A05	Wake Turbulence Re-Categorization	G06M.02-02
1A05	Oceanic Tactical Trajectory Management	G01A.02-02
1A05	Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development	G01A.01-09
1A05	Reduced Oceanic Separation	G02S.04-01
1A05	Separation Automation System Engineering	G01A.01-06
1A05	Separation Management Concept & Analysis	G01M.02-04
1A05	NextGen Oceanic Capabilities	G01A.01-07
1A05	Conflict Advisories	G01A.02-03

Table 4-1 Separation Management Programs

4.2 Improved Surface/ Terminal Flight Data Manager (TFDM) Portfolio

This portfolio will improve safety, efficiency and flexibility on the airport surface by implementing new traffic management capabilities for pilots and controllers using shared surface movement data. The capabilities in the portfolio address surface movement and the exchange of information between controllers, pilots and air traffic managers that occur for departing aircraft from the gate to departure of the aircraft from the airport; and for landing traffic from exiting the runway to arriving at the terminal gate.

Provide Full Surface Situation Information, OI: 102406

Automated broadcast of aircraft and vehicle position to ground and aircraft sensors/receivers provides a digital display of the airport surface. Aircraft and vehicles are identified and tracked to provide a comprehensive picture of the surface environment to ANSPs, equipped aircraft, and flight operations centers.

Enhanced Separation Services to Small Community Airports, OI: 102138

Improved surveillance and communication capabilities at or near smaller community airports allow for increased capacity in previous non-radar environments providing improvements over non-radar separation guidelines.

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 as well as the ability to save fuel and emissions through the use of virtual departure queues into the movement area.

Remotely Staffed Tower Services, OI: 102155

Non-radar tower services are provided to additional general aviation airports through the certification of remote tower operations. These remote tower services are more economical for the airport owner than the cost to build, staff, and maintain an air traffic control tower. This provides increased access, capacity and safety at airports wanting to provide non-federal tower services by enabling control operations to be conducted with FAA certified controllers located in a remote ground level facility.

Capital investments that support Improved Surface/TFDM are listed below.

BLI #	CIP Title	CIP #
1A06	Surface Tactical Flow	G02A.01-01
1A06	Surface Conformance Monitoring	G02A.01-02
1A06	Enhanced Service Small Communities (ESSC)	G03M.04-02
2B18	Terminal Flight Data Manager (TFDM) – Segment 1	G06A.03-01

Table 4-2 Improved Surface/TFDM Programs

4.3 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 (TFRs), 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).

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. 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.

Improved Management of Special Activity Airspace, 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 status of SAA are made readily available for operators and ANSPs using automation systems.

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.

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

Automation will assist with minimizing the capacity and efficiency impacts to aircraft of space vehicle traffic and ensure that safety is maintained. Traffic managers and controllers will use these tools to tactically manage aircraft flows away from space vehicle launches, and in the event of a catastrophic failure, the debris field.

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.

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

BLI #	CIP Title	CIP #
1A07	Flight Object	G05A.02-03
1A07	Common Status and Structure Data	G05A.02-01
1A07	Flight Object Exchange Services (FOXS)	G05A.02-08
1A07	Dynamic Airspace	G05A.04-01
1A07	Advanced Methods	G05A.02-02
1A07	Airspace Resource Management System (ARMS)	G05A.02-09

Table 4-3 On-Demand NAS Programs

4.4 Improved Multiple Runway Operations Portfolio

The Improved Multiple Runway Operations (IMRO) portfolio enables the FAA to more efficiently use runway capacity through the use of improved technology, updated standards, safety analysis, and air traffic tools and operating procedures to enable more arrival and departure operations. The capabilities in this portfolio will enable the use of simultaneous approaches (two aircraft on the approach path at the same time) during periods of reduced visibility, decrease the required separations between aircraft on dependent approaches (staggered aircraft arrivals on parallel runways), departure procedures, and alleviate the effects of wake turbulence that normally require increased separation between aircraft in terminal airspace.

Improved Parallel Runway Operations, OI: 102141

This improvement will explore concepts to recover lost capacity through reduced separation standards, increased applications of advanced dependent and independent procedures, and enabling operations in lower-visibility conditions.

Improved Parallel Runway Operations with Airborne Applications, OI: 102157

Improved flight deck capabilities allow for increased arrival capacity for parallel runway operations in Instrument Meteorological Conditions. Reduced separation for dependent approaches of closely spaced parallel runways will be enhanced through the use of 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.

Wake Turbulence Mitigation for Arrivals: CSPRs, OI: 102144

Initially, dependent separation between aircraft on parallel approach courses to CSPRs will be procedurally reduced in Instrument Meteorological Conditions in all crosswind conditions to something less than today's wake separation behind heavy or B757 aircraft based on a safety analysis of the airport geometry, local meteorology and other factors at each airport. In persistent crosswind conditions, separation at less than today's wake separation minima for dependent approaches will be permitted for certain aircraft pairs, based on systems that sense and predict wind and indicate to controllers when the upwind approach is safe from wakes generated by aircraft on the downwind approach.

Ground Based Augmentation System (GBAS) Precision Approaches, OI: 107107

Global Positioning System (GPS)/GBAS support precision approaches to Cat I and eventually Cat II/III minima for properly equipped runways and aircraft. GBAS can support approaches at airports which require fewer restrictions to surface movement and offers the potential for curved precision approaches. GBAS may also support high-integrity surface movement requirements.

CSPR Paired Departure Wake Mitigation, OI: 102159

Changes in procedures and 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. (OI: 102159)

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 predictions 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.

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, will be used to monitor crosswind conditions, and air traffic automation systems will be used to indicate to controllers when they can safely reduce wake separation standards, increasing departure capacity.

Capital investments that support Improved Multiple Runway Operations are listed below.

BLI #	CIP Title	CIP #
1A08	Wake Turbulence Mitigation for Arrivals (WTMA)	G06A.01-02
1A08	Closely Spaced Parallel Runway Operations	G06N.01-02
1A08	Ground Based Augmentation System (GBAS)	G06N.01-01

Table 4-4 Improved Multiple Runway Operations Programs

4.5 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, improves the use of weather forecast information in the NAS and evolves 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.

Current Oceanic Separation, OI: 102105

The use of Advanced Technologies and Oceanic Procedures (ATOP) will be expanded into domestic-to-oceanic transition sectors to provide the controllers with integrated rules for setting up transitioning traffic to/from oceanic airspace. Enhancements include modifications needed to handle tactical 5 nautical mile separations.

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.

On-Demand NAS Information, OI: 103305

An integrated set of weather 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.

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.

Surface Traffic Management, OI: 104211

ANSP automated decision support tools integrate surveillance data, weather data, departure queues, aircraft flight plan information, runway configuration, expected departure times, and gate assignments. Local collaboration between ANSP and airport stakeholders improves information flow to decision support as well as the ability for aircraft operators to meet their operational and business objectives. The sharing of electronic flight data increases efficiency by providing a method to convey both the strategic and tactical plan to controllers as well as improved amendment and coordination capabilities.

Capital investments that support NAS Infrastructure are listed below.

BLI #	CIP Title	CIP #
1A09	Weather Observation Improvements	G04W.02-01
1A09	Weather Forecast Improvements – Work Package 1	G04W.03-01
1A09	NextGen Navigation Engineering	G06N.01-03
1A09	New ATM Requirements	G01M.02-02
1A09	Surface/Tower/Terminal Systems Engineering	G06A.02-01
1A09	NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN) Strategy	G01N.01-02
1A09	Information Management	G05M.03-01

Table 4-5 NAS Infrastructure Programs

4.6 NextGen Support Portfolio at WJHTC

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

BLI #	CIP Title	CIP #
1A10	NextGen Laboratories	G03M.02-01

Table 4-6 NextGen Support Portfolio Program

4.7 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.

Resilient PBN Operations, OI: 107120

The ability to conduct PBN operations in the event of 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.

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 RNP criteria. RNAV and RNP will permit the flexibility of point-to-point operations and allow for the development of routes, procedures, and approaches.

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

BLI #	CIP Title	CIP #
1A11	NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV) /Required Navigation Performance (RNP)	G05N.01-01
1A11	NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP) – Future Plans	G05N.01-03
1A11	Concept Development for Integrated NAS Design and Procedure Planning	G05A.02-04

Table 4-7 Performance Based Navigation & Metroplex Programs

4.8 Collaborative Air Traffic Management Portfolio

Collaborative Air Traffic Management (CATM) coordinates flight and flow decision-making by flight planners and FAA traffic managers; this will improve the overall efficiency of the NAS by providing greater flexibility to make best use of available airspace and airport capacity. The objective of CATM services is to accommodate user preferences to the maximum extent possible. Traffic managers impose Traffic Management Initiatives (TMI) to account for congestion, weather, and special activity airspace or other constraints. Tailoring flow management actions to specific flights can reduce the impact of TMIs on user flight plans.

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

Constraint information that impacts the proposed route of flight is incorporated into ANSP automation, and is available to users. A user can adjust the flight plan based on available information.

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.

Interactive Planning Using 4D Trajectory Information in the Oceanic Environment, 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 intended Oceanic trajectory and adjust plans if desired.

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.

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 generation and dissemination of route changes.

Initial Flight Day Evaluation, OI: 105302

Continuous (real-time) constraints are provided to ANSP traffic management decision-support tools and the NAS users which improves system constraint predictions and assessments of proposed mitigation strategies. The FAA, in collaboration with users, develops mitigation strategies that consider the potential constraints.

Capital investments that support Collaborative Air Traffic Management are listed below.

BLI #	CIP Title	CIP #
2A14	Strategic Flow Management Application	G05A.01-01
2A14	Strategic Flow Management Engineering Enhancement (SFMEE)	G05A.01-02
2A14	Collaborative Air Traffic Management (CATMT) – Work Package 4	G05A.05-03
2A14	Collaborative Air Traffic Management (CATMT) – Work Package 5	G05A.05-04

Table 4-8 Collaborative Air Traffic Management Programs

4.9 Time-Based Flow Management (TBFM) Portfolio

TBFM will enhance NAS efficiency by using the capabilities of the Traffic Management Advisor (TMA) decision-support tool; a system that is already deployed at all air route traffic control centers in the contiguous United States. Improvements in TMA's core time-based metering capability and its trajectory modeler, an expansion of TMA and its departure capabilities to additional locations and enhancements to TMA's departure capabilities will enhance efficiency and optimize demand and capacity. Controllers will be able to more accurately deliver aircraft to the TRACON and offer an opportunity to fly optimized descents.

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.

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. Metering automation will manage the flow of aircraft to meter fixes that are the point for aircraft to enter the pattern for runway approaches, thus permitting efficient use of runways and airspace.

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

This OI 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.

Interval Management-Spacing (IM-S), OI: 102118

This OI enables controllers to identify, initiate, and monitor the spacing between aircraft, when they direct flight crews to establish and maintain a given time or distance from a designated aircraft. Controllers will be assisted with ground automation and a new set of voice or data link procedures.

Pair-wise Trajectory Management, OI: 102149

Pair-wise Trajectory Management is intended to increase efficiency during separation-related maneuvers in the cruise phase of flight through the use of ground and airborne pair-wise distance assurance capabilities to save fuel and reduce delays.

Capital investments that support Time-Based Flow Management are listed below. See section 5.1, Automation Roadmap 1.

BLI #	CIP Title	CIP #
2A15	Time Based Flow Management (TBFM) Work Package 3	G02A.01-06
2A15	Time Based Flow Management (TBFM) Technology Refresh	G02A.01-07
2A15	Time Based Flow Management (TBFM) Work Package 4	G02A.01-08

Table 4-9 Time-Based Flow Management Programs

4.10 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.

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.

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.

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

4.11 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.

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 Program

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 are updated annually to reflect the results of studies, demonstration projects, and economic analysis related to programs; the roadmaps are however, reasonably stable from year-to-year. For additional information you can view the Enterprise Architecture and Infrastructure Roadmaps at: https://sep.faa.gov/

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 account. 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 the box 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.

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 2017-2021, a brief summary that describes the purpose of the program are provided as well as the associated BLI number, the CIP title, and CIP number. The BLI number may be used to associate a CIP program shown on the FAA Enterprise Architecture Roadmaps with the funding provided in Section 8, Estimated Funding by BLI. Note that BLIs may include funding for multiple CIP programs.

Figure 5-1 shows and defines the symbols used in the infrastructure roadmaps. The solid red lines indicate the time the 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 final date of operation is indicated with an X. The boxes with names identify programs, functions or systems, which are either described in the text or, when they are not described, their acronyms, are spelled out in the Acronyms and Abbreviations section.

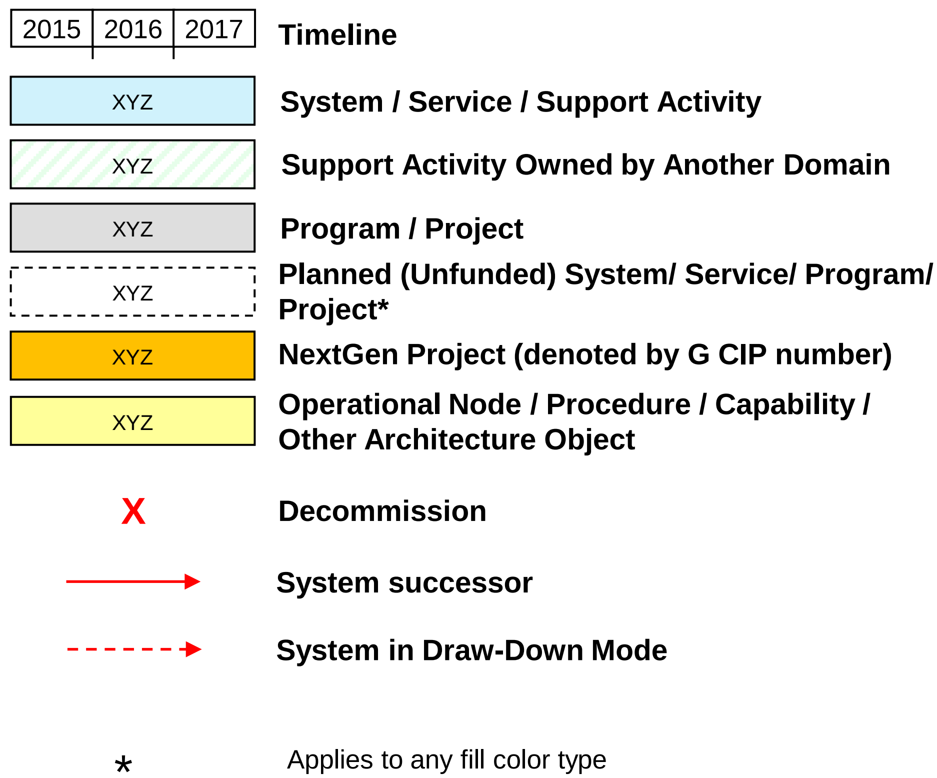

Figure 5-1 Infrastructure Roadmap Legend

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. Automation systems can also show an aircraft's projected track even if there is a temporary loss of surveillance information by calculating an aircraft's ground speed to project its future position based on its last reported direction.

The Traffic Flow Management System (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 (TMU) at all major ATC facilities (80 sites), and flight operators. TFMS remote sites are also located at other FAA and Government offices (39).

Automation systems will host the software improvements needed to support many of the NextGen OIs. NextGen programs will develop the software enhancements which are then installed on existing or upgraded automation systems.

Automation implementation, including the plans to sustain, upgrade, replace or decommission current systems from 2015 through 2029 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 2 (figure 5-4) - Flight Services, Aeronautical and Information Support

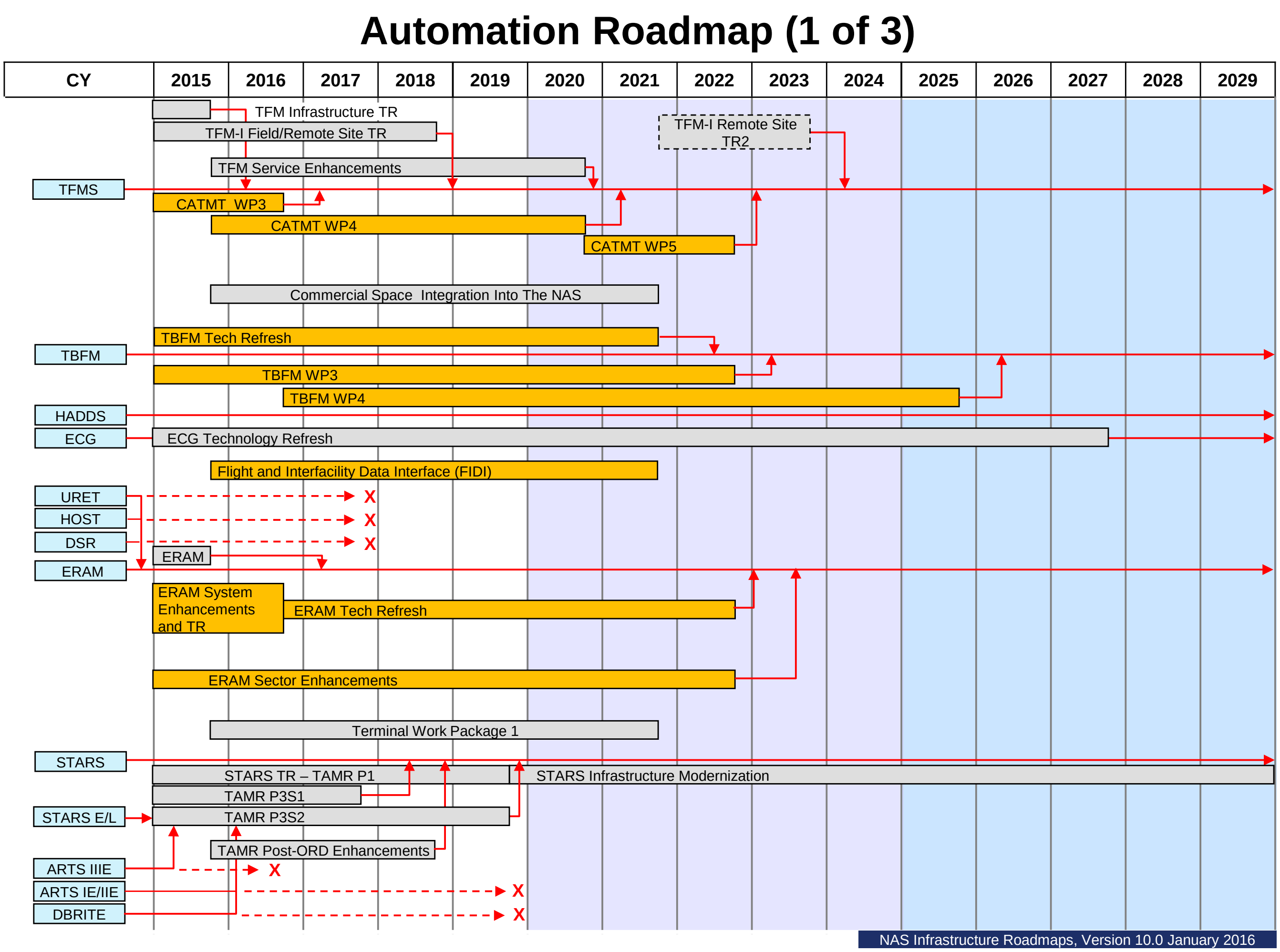

Figure 5-2   Air Traffic Management and Air Traffic Control Roadmap

The first system shown on the top left of the Automation Roadmap 1 (figure 5-2) is the TFMS as described on the previous page. The FAA will continue to implement the TFM Infrastructure and Remote Site Technology Refresh program to upgrade the hardware for existing TFMS components.   The TFM Service Enhancements program will upgrade decision support tools to help traffic managers implement more efficient Traffic Management Initiatives (TMIs). See BLI 2A05 for descriptions on TFM Infrastructure – Field/Remote Site Technology Refresh, A05.01-13, and TFM Infrastructure – TFM Service Enhancements, A05.01-14.

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 descriptions on CATMT – Work Package 4, G05A.05-03, and CATMT – Work Package 5, G05A.05-04.

The number of commercial space operations has increased significantly over the past few years. Commercial Space Transportation Integration into the NAS focuses on safely managing and minimizing the effects of commercial space operations on the capacity and efficiency of the NAS without impeding industry progress. See BLI 2A05 for a full description of Commercial Space Integration Into The NAS, M55.01-01.

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 those centers. 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; expansion of the Integrated Departure /Arrival Capability to additional locations; and making TBFM more flexible to accommodate reroute operations during adverse weather conditions during FY 2015-FY 2022. See BLI 2A15 for more detailed descriptions of TBFM Work Package 3, G02A.01-06.

TBFM Technology Refresh will replace the existing hardware deployed in 2012 and 2013 with new hardware in the FY 2018-2021 time frame. 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. Each of these programs are working towards a Final Investment Decision (FID). See BLI 2A15 for more detailed descriptions of TBFM Technology Refresh, G02A.01-07 and TBFM Work Package 4, G02A.01-08.

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 (2015-2029).

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 (ERAM) and the Enhanced Backup Surveillance System at the Air Route Traffic Control Centers. The ECG Technology Refresh program procures and deploys ECG hardware or software components to maintain the system throughout the roadmap timeframe. See BLI 2A02 for a description on ECG – Technology Refresh, A01.12-02.

The Flight and Interfacility Data Interface (FIDI) will modernize the flight data and interfacility data interfaces between en route, oceanic, and terminal automation systems. In conjunction with the Surveillance Interface Modernization (SIM) program, S13.01-01, (described under on Surveillance Roadmap 3, Figure 5-12), the FIDI program will use Internet protocols requiring only standard FAA Telecommunications Infrastructure to replace the serial interfaces used by ECG. The program is working towards a FID. See BLI 2B22 for a description of the FIDI – Phase 1, Segments 1 & 2, G08A.01-01.

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 Technology Refresh program will sustain the ability for en route controllers at each center to collectively track up to 1,900 aircraft at a time by updating ERAM equipment in critical need of replacement during the FY 2017 through FY 2021 time frame. The ERAM Sector Enhancements program will improve the efficiency and effectiveness of en route sector operations. The improvements will enable implementation of NextGen capabilities which will allow for increased efficiency and capacity benefits. The program is working towards a FID. See BLI 2A01 for more information about ERAM Technology Refresh, G01A.01-10 and ERAM Sector Enhancements, G01A.01-04.

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 IIIE (ARTS IIIE); ARTS 1E/IIE; 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 47 Terminal Radar Approach Control (TRACON) facilities and their associated Air Traffic Control Towers (ATCTs). Current STARS equipment has been in the NAS since 1999 and requires technology refresh. The STARS Infrastructure Modernization Program will continue to update and modernize STARS components that have reached end of life and support infrastructure transition to Internet Protocol. The program is working towards a FID. See BLI 2B03 for details about the STARS – Technology Refresh (TAMR Phase 1) program, A04.01-01 and STARS – Infrastructure Modernization Program, A04.01-03.

The Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 1 program will address infrastructure improvements essential for the adoption of Automatic Dependent Surveillance-Broadcast (ADS-B) at 11 Common Automated Radar Terminal (CARTS) IIIE sites. The Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2 program will replace 97 systems, 91 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. See BLI 2B04 for more information about Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 1, A04.07-01 and TAMR – Phase 3, Segment 2, A04.07-02.

The Terminal Automation Modernization – Replacement (TAMR) – Post Operational Readiness Demonstration (ORD) Enhancements program will address operational needs and capabilities identified by STARS users and FAA stakeholders beyond STARS core functionality. As validated enhancements are identified and prioritized, the TAMR Program Office will develop a detailed implementation plan for the engineering, design, development, testing, integration and delivery of those enhancements. See BLI 2B04 for more information about TAMR – Post ORD Enhancements, A04.07-04.

Terminal Work Package 1 program is the next useful segment for the Standard Terminal Automation Replacement System (STARS) platform and will consolidate terminal automation onto a single platform. It will implement the capabilities necessary to enable trajectory-based operations in the terminal environment. This program will refine proposed concepts and validate them as viable additions to the NAS to support NextGen goals. The program is working towards a FID. See BLI 2B05 for more information about the Terminal Work Package 1 program, A04.08-01.

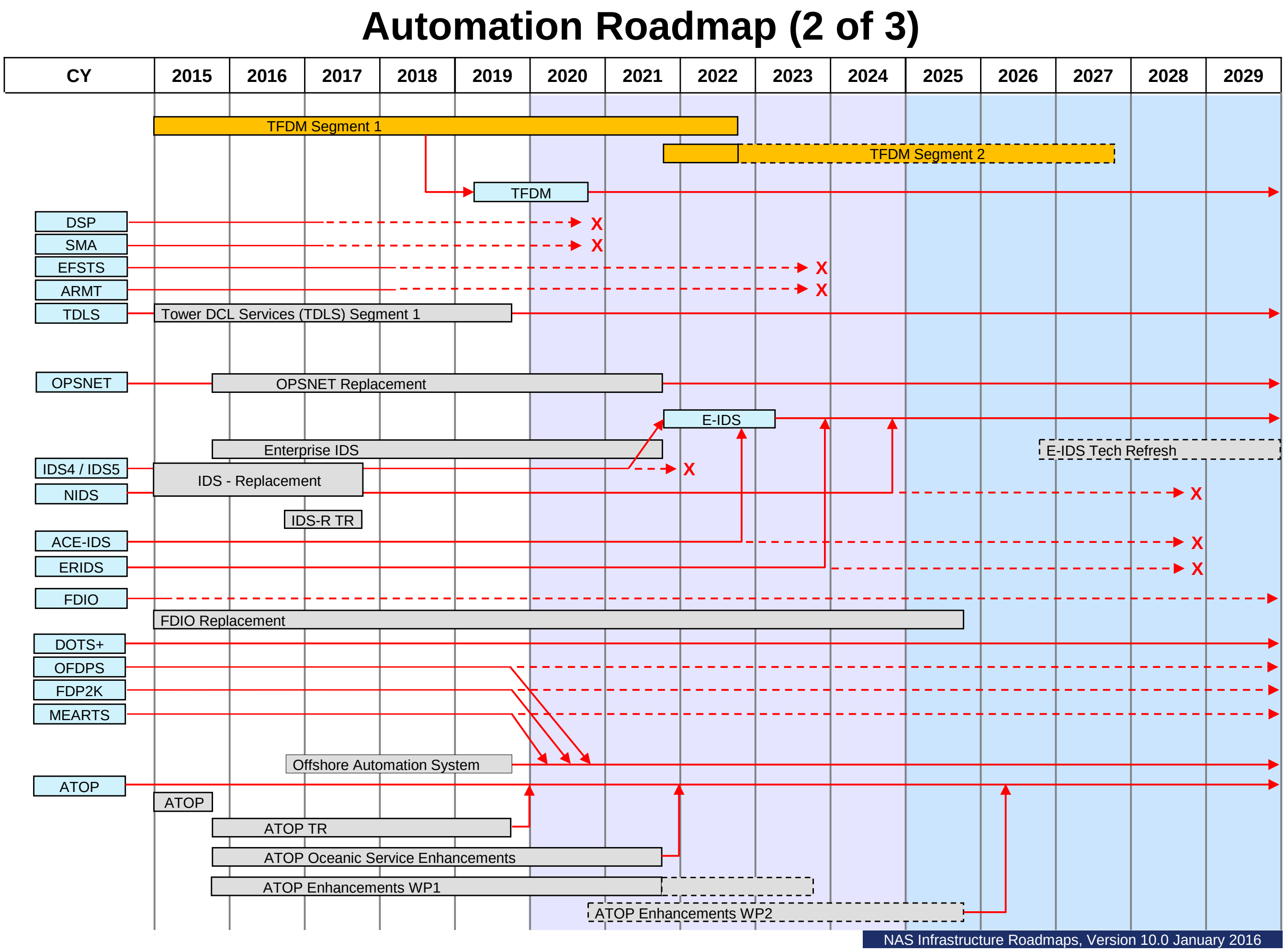

Figure 5-3 Air Traffic Support and Oceanic Air Traffic Control Roadmap

The program at the top of figure 5-3, the Air Traffic Support and Oceanic Air Traffic Control Roadmap, is the Terminal Flight Data Manager (TFDM) – Segment 1. This program 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 notional implementation plan, which includes a future segment 2, is based on a two build approach and deployment of TFDM to approximately 89 airports. The program is working towards a FID. See BLI 1A06 for additional details on Terminal Flight Data Manager (TFDM) – Segment 1, G06A.03-01.

The first system on figure 5-3 is the Departure Spacing Program (DSP) and it is 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 Communication Roadmap 5, section 5.2, for a description of the Data Communications Segment 1 Phase 1 program.

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 will 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 additional information on the OPSNET Replacement program, A37.01-01.

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. To sustain system services, the Integrated Display Systems (IDS) Replacement – Technology Refresh program will perform a system analysis of the replacement COTS components approximately 5 years after they were acquired and identify affected components for technology refresh. See BLI 2B14 for additional information about Integrated Display Systems (IDS) Replacement, A03.05-01 and IDS Replacement – Technology Refresh, A03.05-02.

The Enterprise Information Display System (E–IDS) program will take over the upgrade or replacement of systems included in the IDS replacement program and 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 2B14 for more information about the Enterprise Information Display System (E–IDS), A03.05-03.

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) will begin a transition to E-IDS starting in FY 2024. ERIDS is an information display system that provides access to aeronautical data including weather, airspace charts, ATC procedures, Notice to Airmen (NOTAMS), and pilot reports (PIREPS).

The Flight Data Input/Output (FDIO) system collects data from the ERAM system and provides standardized flight plan data, weather information, safety related data, and other information to air traffic controllers at more than 650 NAS Terminal facilities. The Flight Data Input/Output (FDIO) Replacement 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 2B05 for more information about the Flight Data Input/Output (FDIO) Replacement, A01.11-01.

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 (MEARTS), 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 FAA's four non-standard offshore automation systems. These facilities use the same Radar Data Processor (RDP) and Microprocessor En Route Automated Radar Tracking System (Micro-EARTS) but with a Flight Data Processor (FDP) that varies by facility. Replacing these with NextGen common systems will improve NAS interoperability and reduce cost by standardizing the training, maintenance and development efforts across the platform. The program is working towards a FID. See BLI 2A20 for additional details on the Offshore Automation program, A38.01-01.

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 Technology Refresh program will define the engineering requirements for replacing the hardware, the operating system, and procure and integrate the new hardware and operating system with the baseline ATOP applications. The program is working towards a FID.

The Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Service Enhancements program will improve the flexibility, reliability, and efficiency of oceanic air traffic control by providing a capability to more frequently accommodate user preferred flight trajectories and requests for altitude changes to increase the likelihood of on-time arrivals.

The Advanced Technologies and Oceanic Procedures (ATOP) – 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 is working towards a FID. See BLI 2A09 for additional information on ATOP Technology Refresh, A10.03-01, ATOP Oceanic Service Enhancements, A10.03-03 and the ATOP Enhancements program, A10.03-02.

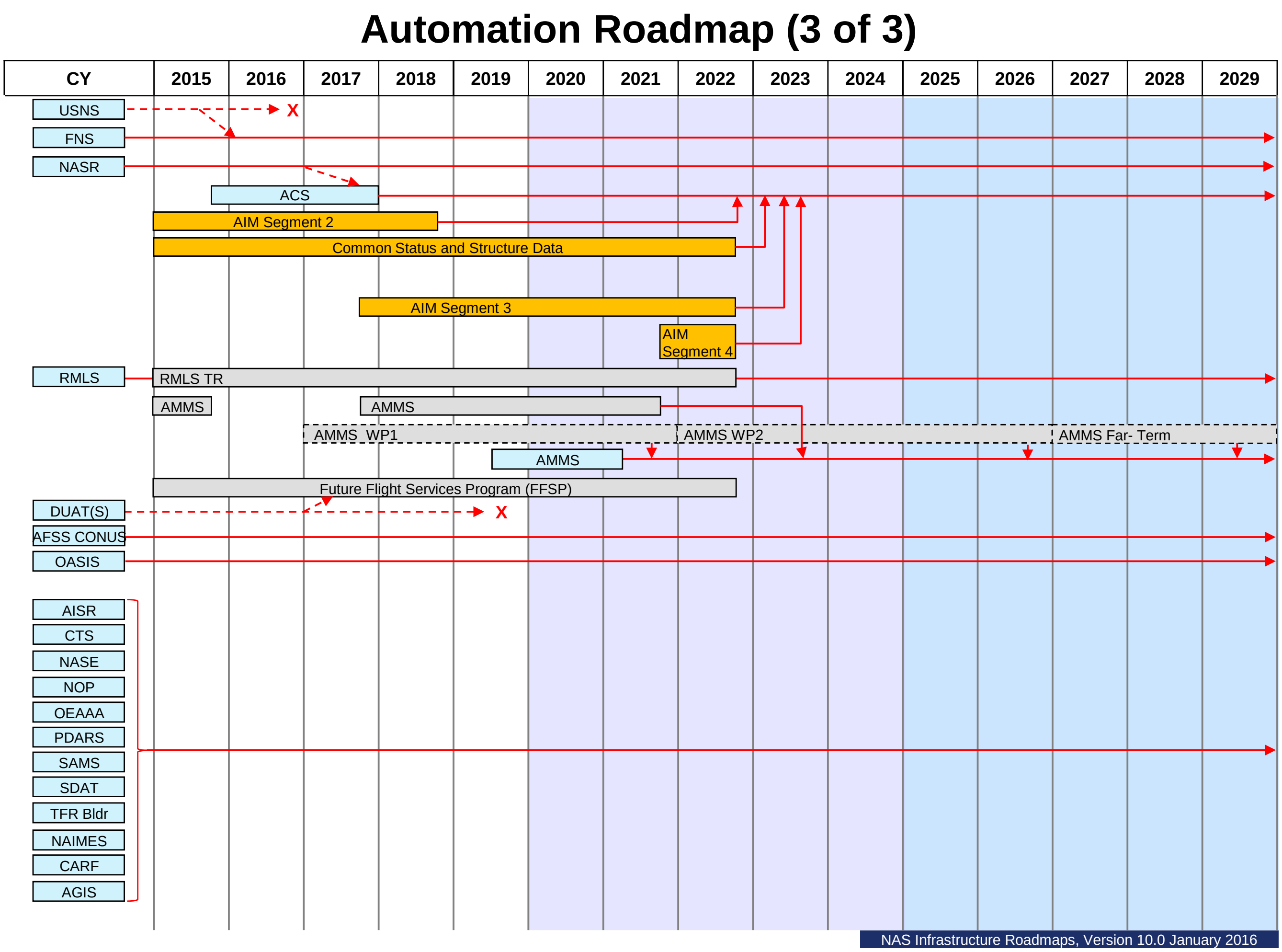

Figure 5-4 Flight Services, Aeronautical and Information Support Roadmap

Figure 5-4 shows 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 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 build 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.

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 by adding performance capability through an increased level of integration with NAS automation to integrate static aeronautical information with operational data feeds providing updates on the activation status of SAA and active runway/airport configuration data. The program is working towards a FID.   See BLI 4A09 for more information about Aeronautical Information Management (AIM) Modernization Segment 2, G05A.02-05 and Aeronautical Information Management (AIM) Modernization Segment 3, G05A.02-06.

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. The 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 Center Radar Approach Control (CERAP) in Hawaii. See BLI 2B15 for more information about RMLS – Technology Refresh, M07.04-02.

The Automated Maintenance Management System (AMMS) will allow for the interfacing of maintenance systems via a Service-Oriented Architecture environment by utilizing the SWIM communications infrastructure that exists today. The ability to efficiently manage the maintenance of FAA’s equipment and systems is critical to the operation of the NAS. AMMS will allow for data sharing between dispersed maintenance systems resulting in improved data integrity and advancements in automation within the maintenance tools. The program is working towards a FID. See BLI 2B15 for more information about the Automated Maintenance Management System (AMMS), M07.05-01.

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 general aviation pilots.

The Future Flight Service Program (FFSP) 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 expand the web portion of flight services and seek 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 Future Flight Service Program (FFSP), A34.01-01.

Figure 5-4 shows twelve systems that continue in operation, with technology refreshes, through the roadmap timeframe. A brief description of each system's capability and impact of providing service 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.

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. PDARS work is included within the System Capacity, Planning and Improvements program, M08.28-00 and is funded by BLI 2E11.

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) stores data on airport configuration and physical location and size of all elements of the airport. It is used to develop airport modernization plans and is necessary for developing new approach and departure procedures.

5.2 Communication Roadmaps

Communication between pilots and controllers is an essential element of air traffic control. Currently the primary method for communication is voice radio. To ensure controllers can stay in contact with pilots remotely located radio sites are used to provide coverage. The controller has electronic links to activate radios at remote sites and ground telecommunication lines from these sites carry the verbal exchange to and from air traffic control facilities. If ground links are not available, satellite communication links can be used, and in the future, data link may be used for most routine communications. Backup systems are essential to ensure the continued ability to maintain communications when the primary systems fail.

NextGen improvements will require improved voice switching and A/G data communications as shown on the diagrams.

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

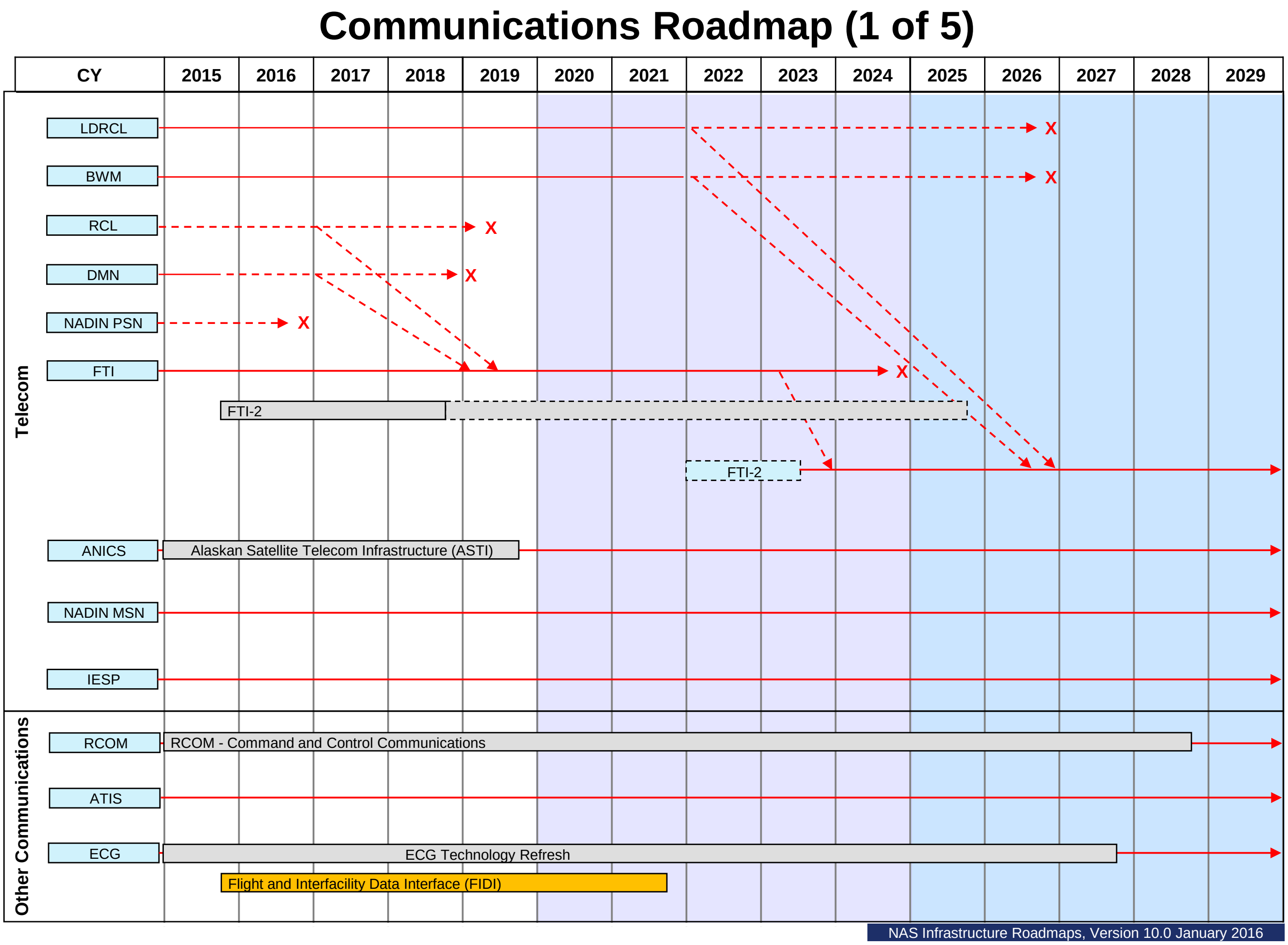

Figure 5-5 Telecom and Other Communications Roadmap

The Low Density Radio Communication Link (LDRCL) and Radio Communication Link (RCL) are microwave systems that were 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. The LDRCL will remain in service for areas with limited commercial services, but their functions will be transitioned to the new FTI contract.

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

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 FAA is transitioning functions of DMN and NADIN PSN to the FTI network.

The FTI contract provides telecommunications services between FAA facilities. The successor program to FTI will be FTI-2 which will provide all of the capabilities available under the existing FTI contract. FTI-2 will also provide the next generation of telecommunications, messaging, and infrastructure services required by FAA programs and address challenges associated with phasing-out of telecommunication services based upon time division multiplexing (TDM). FTI-2 is planned to continue beyond 2029. The program is working towards a FID. See BLI 2E10 for more information about FTI-2, C26.01-02.

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. The ASTI program will acquire and provide Commercial off-the-Shelf (COTS) equipment and with associated support services to upgrade FAA owned and operated communications network to provide Alaska with critical, essential, and routine air traffic control telecommunications using satellite transmission of data. ASTI will improve system availability by minimizing outages for critical and essential communications links between pilots and air traffic controllers. See BLI 2E05 for more information about Alaskan Satellite Telecommunication Infrastructure (ASTI), C17.02-01.

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 (SNMP) system which is capable of providing monitoring services for external NAS systems.

NAS Recovery Communications (RCOM) is the program that 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. 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. The RCOM C3 system supports and modernizes the Washington Operations Center Complex and several other FAA "continuity of operations" sites to ensure that FAA executives have command, control, and communications available at all times. See BLI 3A03 for more information about RCOM, C18.00-00.

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 or BLI 2A02 for more information about En Route Communications Gateway (ECG) – Technology Refresh, A01.12-02.

See Automation Roadmap 1, section 5.1 or BLI 2B22 for more information about Flight and Interfacility Data Interface (FIDI) – Phase 1, Segments 1 & 2, G08A.01-01.

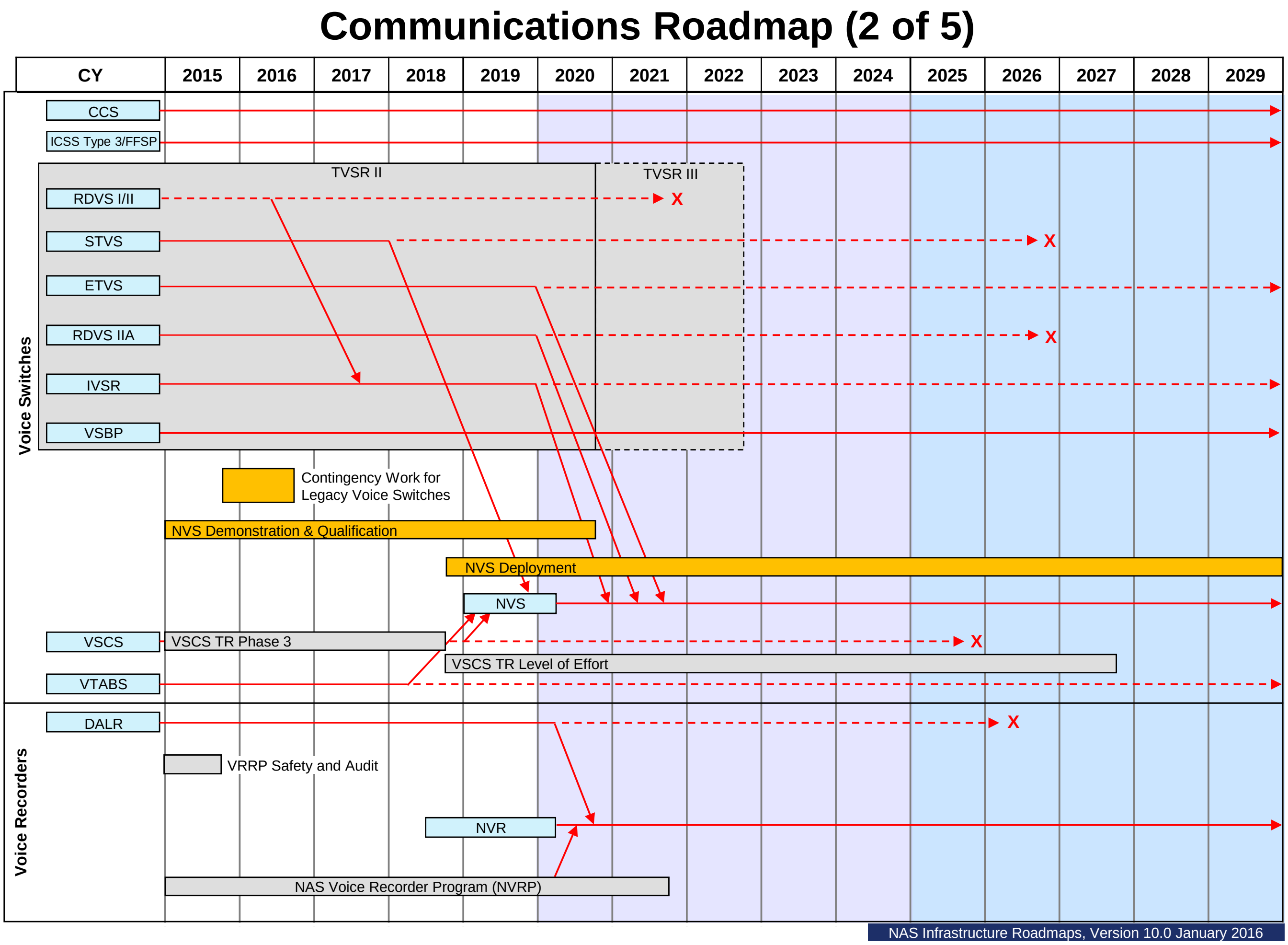

Figure 5-6 Voice Switches and Recorders Roadmap

Figure 5-6 shows the Conference Control Switch (CCS) which is installed at the Air Traffic Control System Command Center (ATCSCC) facility. The CCS allows the FAA specialists to stay in contact with air traffic control facilities and with 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 Type 3/ Future Flight Services Program (ICSS Type 3/FFSP) is installed at flight service stations. Decisions made for the FFSP will determine the future status of this switch. See also the FFSP description in Automation Roadmap 3, section 5.1.

The Terminal Voice Switch Replacement (TVSR) II program box in the top left of figure 5-6 encompasses six voice switches; Rapid Deployment Voice Switch (RDVS) I, II and IIA; Small Tower Voice Switch (STVS); Enhanced Terminal Voice Switch (ETVS); Interim Voice Switch Replacement (IVSR); and Voice Switch By Pass (VSBP). Terminal voice switching systems direct and control voice communications. The controller can communicate with another controller position at his or her own facility, another air traffic control facility, or via radio 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. The TVSR program replaces and sustains aging, obsolete voice switches in ATC Towers and Terminal Radar Approach Controls to ensure controllers continue to have reliable voice communications in the terminal environment. See BLI 2B08 for more information about TVSR II, C05.02-00.

In 2021 the TVSR III program 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 and 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 2017 to request FID approval for NVS funding and deployment in the NAS operational environment including three article test systems and three key site systems. See BLI 2B13 for more information about NVS – Demonstration & Qualification, G03C.01-01 and for NVS – Deployment, G03C.01-02.

The Voice Switching and Control System (VSCS) controls the switching mechanisms that allow controllers to select the communication channel they need to communicate with pilots, other controllers, other air traffic facilities, and commercial telephone contacts. Controllers need to be able to quickly select the proper channel, so they can communicate with pilots, coordinate with other controllers and/or contact emergency services as necessary. The VSCS Technology Refresh program will replace and upgrade hardware and software components for the voice switching systems in all 21 en route air traffic control centers. 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. Based on the analysis, the program will replace or upgrade VSCS components to sustain VSCS and will be a stand-alone effort starting in FY 2019. See BLI 2A08 for more information on VSCS – Technology Refresh – Phase 3, C01.02-04 and VSCS – Technology Refresh – Level of Effort, C01.02-05.

VSCS Training and Backup Switch (VTABS) can maintain critical 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 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 and are used in the investigation of accidents and incidents and 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. 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 voice communications are used in the investigation of accidents and incidents and in the routine evaluation of ATC operations. The program is working towards a FID. See BLI 2B19 for more information about the NAS Voice Recorder Program (NVRP), C23.02-01.

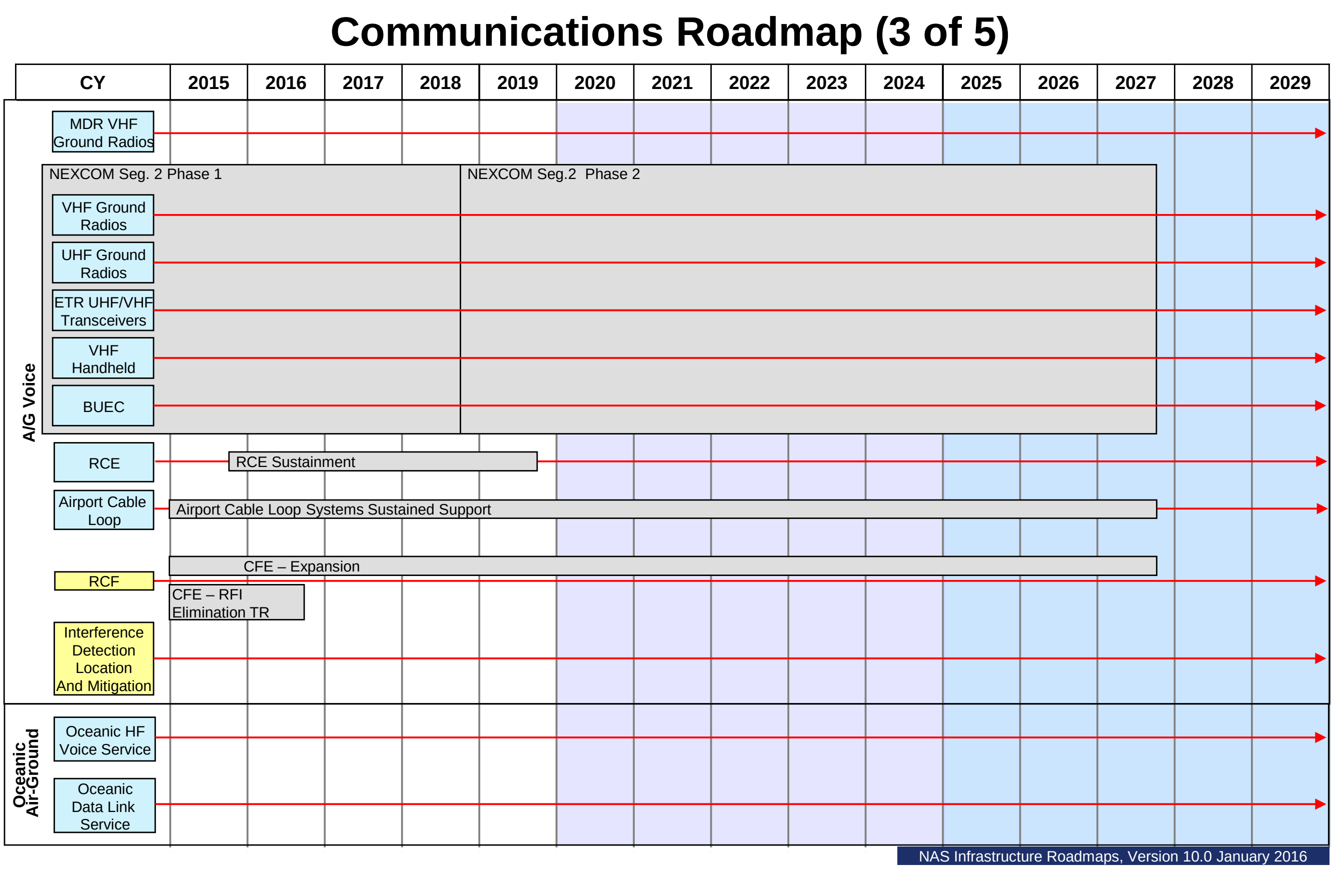

Figure 5-7 Air-to-Ground Voice and Oceanic Communications Roadmap

Figure 5-7 shows the Next Generation VHF and UHF Air/Ground (A/G) Communications (NEXCOM) program is upgrading Very High Frequency (VHF) radios used to communicate with civil aviation and Ultra High Frequency (UHF) radios used by FAA to communicate with military aircraft. Segment 1a of the NEXCOM program finished replacing all 25,000 en route radios with Multimode Digital Radios (MDRs) in FY 2013 which will continue in operation for the duration of this roadmap.

The NEXCOM Segment 2, Phase 1 program will replace a total of 15,000 radios from FY 2009 through FY 2018 with Multimode Digital Radios. The radios will support Voice over Internet Protocol (VoIP) and meets the requirements of the NextGen NVS program. Emergency Transmitter Replacement (ETR) UHF/VHF Transceivers provides emergency and backup service when primary radios are not working. VHF Handheld units are used by maintenance technicians so they can communicate with each other and with ATC tower personnel. The Backup Emergency Communication (BUEC) consists of radios installed at remote sites that backup the primary radios used by ARTCC controllers. The NEXCOM program will also replace emergency transceivers, Hand Held radios and radios at BUEC sites.

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 (FY 2019 to FY 2027). The program is working towards a FID. See BLI 2A10 for more information about NEXCOM – Segment 2 Phase 1, C21.02-01 and NEXCOM – Segment 2 Phase 2, C21.02-02.

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 program replaces obsolete radio signaling and control equipment which controllers use to select a remote radio channel. The RCE program replaces older non-supported tone control equipment and provides more functionality and improves operational performance. 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 Radio Frequency Interference (RFI) Elimination and Technology Refresh program expedites the detection and resolution of radio frequency interference events to minimize delays and congestion, improving air traffic capacity and maximizing the overall throughput of the NAS. See BLI 2A06 for more information about RCE – Sustainment, C04.01-01, and Communications Facilities Enhancement – Expansion, C06.01-00.

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 these cable lines that have deteriorated. Where cost effective, the program will install a fiber-optic cable in a ring configuration to provide redundancy and communications diversity. The Aeronautical Mobile Airport Communications System (AeroMACS), an Internet Protocol (IP) based wireless broadband network, can also be installed at FAA locations for airport surface communications and provides extremely reliable high-density data rates at low cost. See BLI 2E04 for more information on Airport Cable Loop Sustained Support, F10.00-00.

The Interference Detection, Location and Mitigation (IDLM) 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 last two items on the roadmap are communications systems used for oceanic air traffic control. The first one is the high frequency (HF) radio which allows the FAA to stay in touch with aircraft that are out of range of VHF radios. 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.

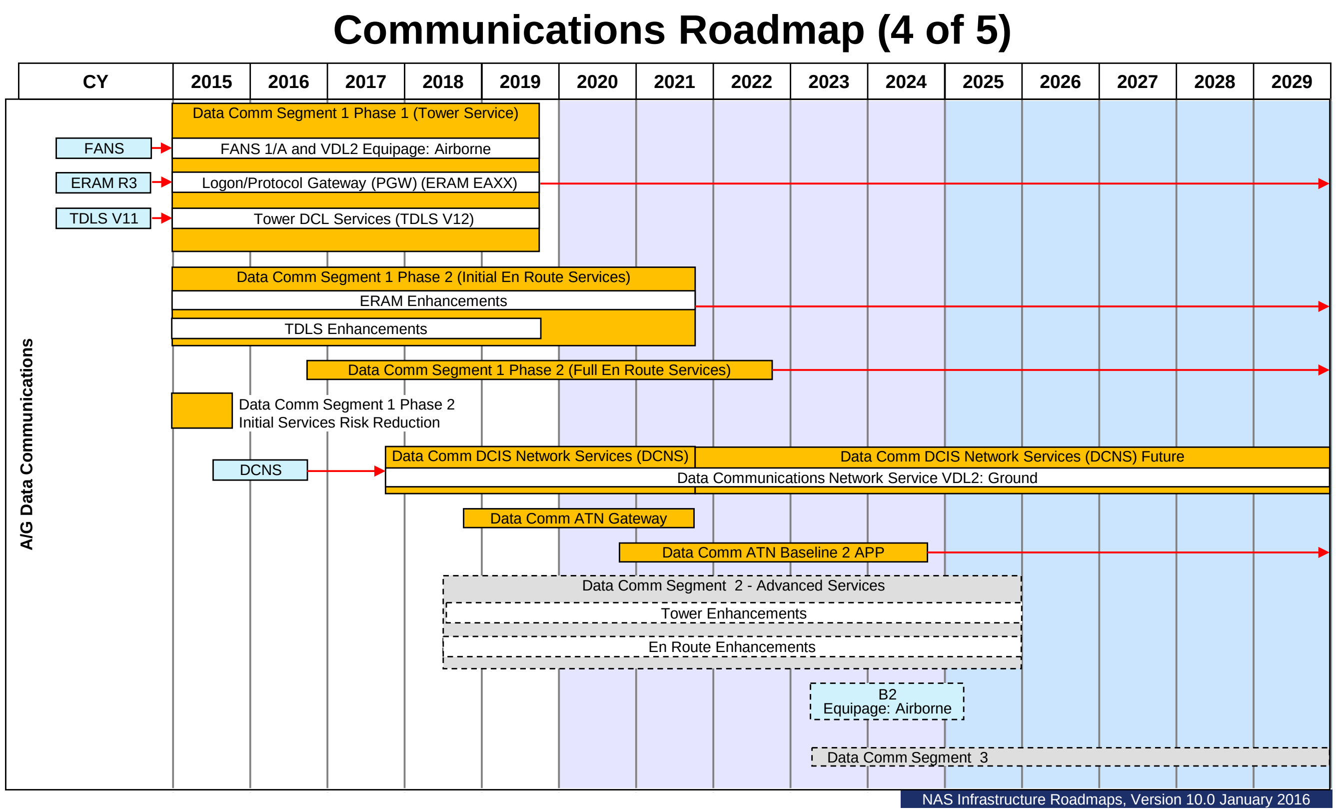

Figure 5-8 Air-to-Ground Data Communications Roadmap

Figure 5-8 shows the planned addition of Data Communications (Data Comm) services.

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

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. Segment 1 Phase 2 (S1P2) will deliver 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.

Segment 2 and Segment 3 will further build upon CPDLC DCL and En Route services by supporting the delivery of services to enable more advanced NextGen operations not possible using voice communications, such as four-dimensional trajectories and advanced flight interval management. 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.

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

See BLI 2A19 for more information about the Data Communications programs: 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 2 Full En Route Services, G01C.01-10; Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services, G01C.01-07; Data Communications – ATN Gateway, G01C.01-08; and Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application, G01C.01-09.

Communications Roadmap (5 of 5)

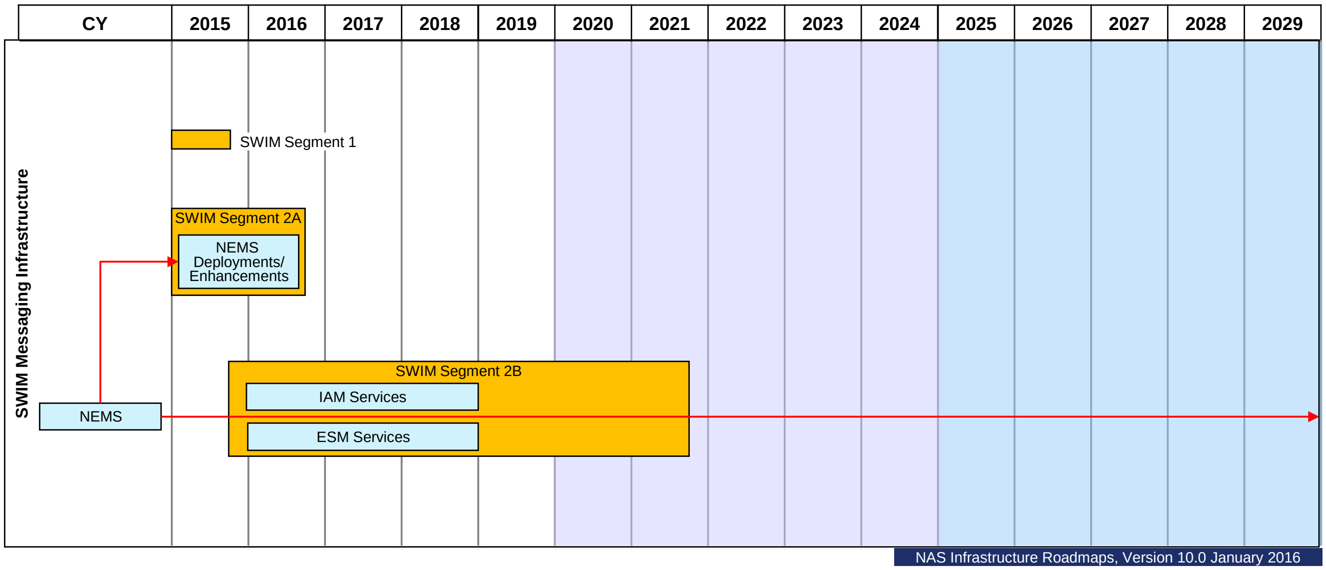

Figure 5-9 Messaging Infrastructure Roadmap

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

The NAS Enterprise Messaging Service (NEMS) is an FTI Service, which provides for an Enterprise Service Oriented Architecture (SOA) messaging infrastructure for the NAS. The NEMS supports two types of standards-based messaging exchange patterns: Publish/Subscribe and Request/ Response. Publish/Subscribe model is used when a Service Provider (Publisher) 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.

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. Plans for SWIM Segment 2B include continued ramping of programs onto the NEMS that provides a reliable messaging infrastructure to be leveraged by SWIM producers and consumers and providing additional NAS enterprise services such as: Identity and Access Management; Enterprise Service Monitoring; SWIM Terminal Data Distribution System Phase 2; and NAS Common Reference. See BLI 2A11 for more information about SWIM – Segment 2B, G05C.01-08.

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; generally 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.

NextGen operational improvements will rely on advanced surveillance capabilities provided by ADS-B and Wide Area Multilateration which will provide more accurate information to controllers and better situational awareness for pilots.
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

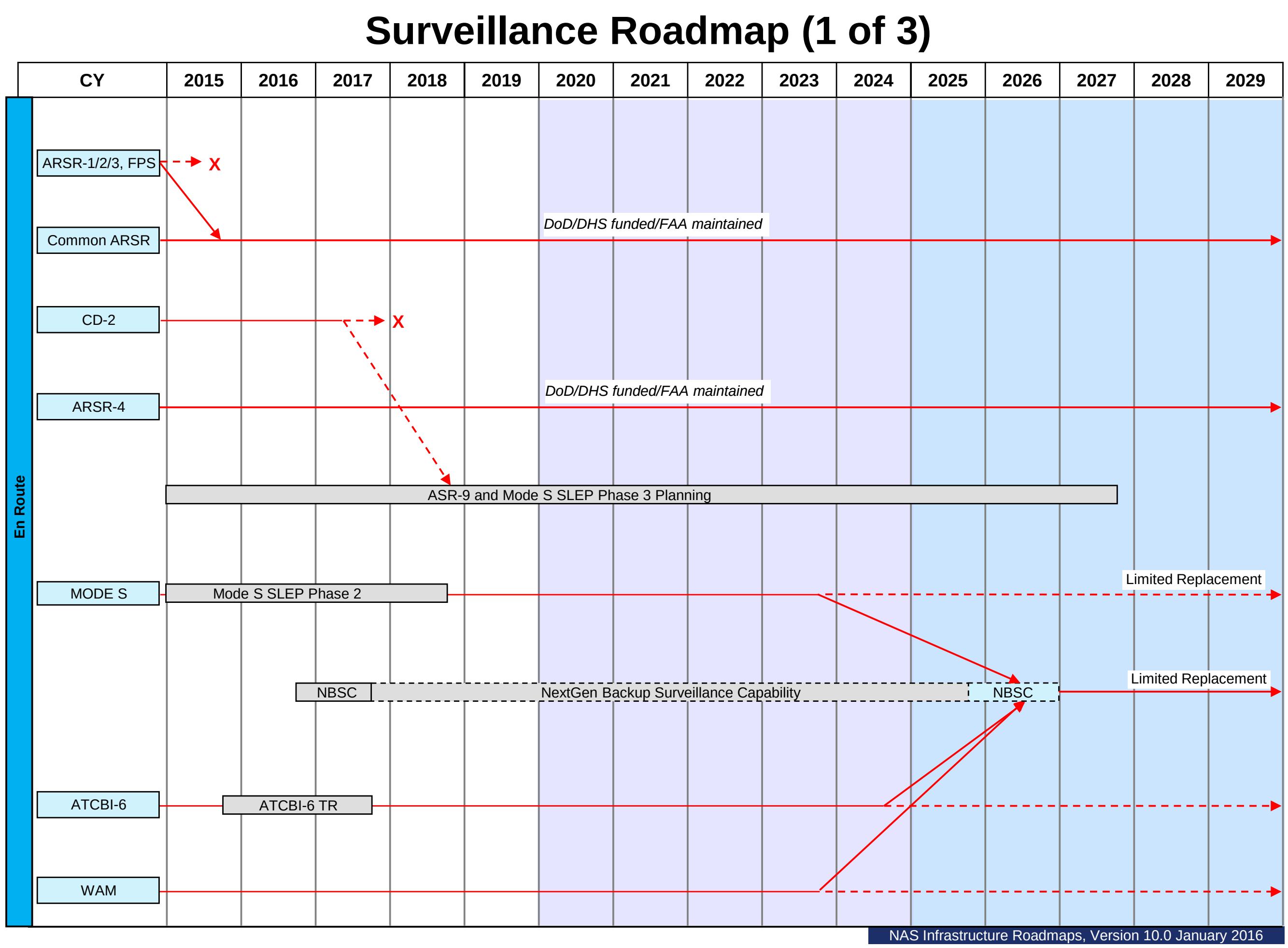

Figure 5-10 En Route Surveillance Roadmap

Existing model Air Route Surveillance Radars (ARSR) 1, 2, 3 and Fixed Position Surveillance (FPS) radar systems are primary radars and are being converted to the Common ARSR (CARSR) configuration.

The Common Digitizers (CD-2), which convert analog radar information to a digital format, will not be needed after programs to convert radar information to internet protocol are completed (See Surveillance Interface Modernization (SIM) in Surveillance Roadmap 3).

The DoD and Department of Homeland Security will fund system upgrades of the ARSR-4 and CARSRs through 2025 due to national security concerns.

The Mode S radar uses selective beacon detection technology to provide target data as digital formatted messages and analog video tailored for automation and display systems. The Mode S is co-located with Airport Surveillance Radar Model 9 (ASR-9) and ASR-8, and CARSR. 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 TRACON and ARTCC facilities, the U.S. DoD, and other users. 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 2025.

The ASR-9 and Mode S Service Life Extension Program (SLEP) Phase 3 program will perform engineering studies to analyze Lowest Replaceable Units (LRUs) identified with major obsolescence issues and continue software development for the Data Communications Equipment (DCE) prototype. The program is working towards a FID. See BLI 2B16 for more information about Mode S SLEP Phase 2, S03.01-08 and ASR-9 and Mode S SLEP Phase 3 Planning, S03.01-11.

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 (MSSR) systems. NBSC will support cooperative target acquisition and maintain continuity of operations if ADS-B outages should occur. The program is working towards a FID. See BLI 2B21 for more information about Next Generation Backup Surveillance Capability (NBSC), S15.01-01.

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.

ATCBI-6 Technology Refresh Program will replace and upgrade obsolete ATCBI-6 original equipment manufacturer peculiar and Commercial Off-The-Shelf (COTS) hardware and software to ensure the continued reliable and cost effective operation of the radar system through its designated lifecycle. The program is working towards a FID. See BLI 2A16 for more information about ATCBI-6 – Technology Refresh, S02.03-03.

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.

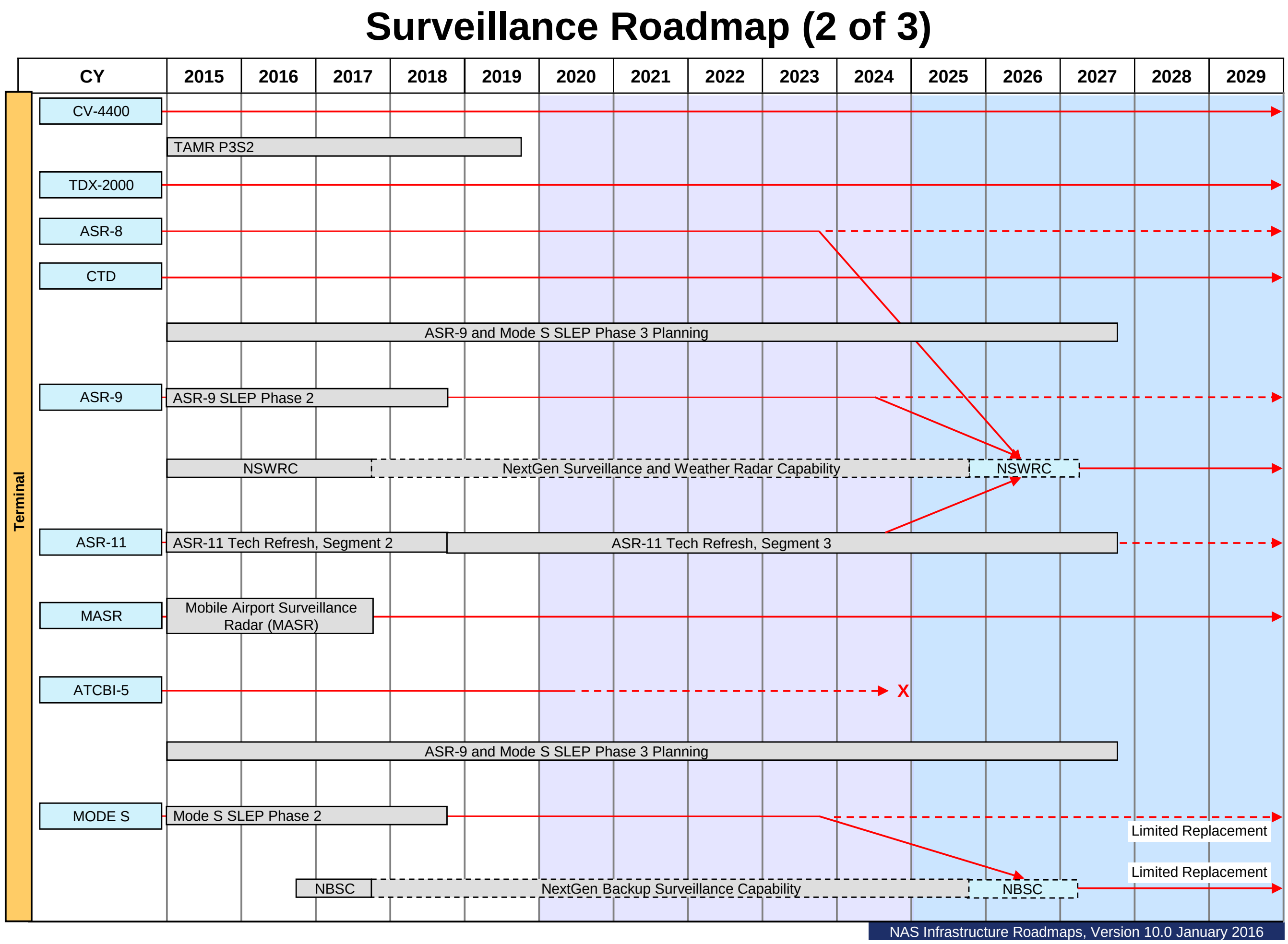

Figure 5-11 Terminal Surveillance Roadmap

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, e.g., using terminal radar to fill gaps in en route radar coverage at selected en route centers.

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

Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2: See Automation Roadmap 1, section 5.1 and BLI 2B04 for information on program, A04.07-02.

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 need to be installed.

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 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 was procured in the mid-1980s, fielded between 1989 and 1994, and is intended to remain operational until replacement begins in 2025. The ASR-9 SLEP Phase 2 program will procure Digital Remote Surveillance Communication Interface Processor Replacement (DRSR) systems, Transmitter Backplanes, and Radar Data Access Point (RDAP), and replenishment of depot inventory of critical components. See BLI 2B10 for more information about ASR-9 SLEP Phase 2, S03.01-09.

There are components of the ASR-9 radar systems and Mode S that are not supportable through 2025 and analyses are needed to determine the extent of re-engineering and system modifications needed. The ASR-9 and Mode S SLEP Phase 3 program will reduce the risk of unscheduled outages by providing in-service support to improve radar performance, provides engineering and planning to correct performance, operational, and reliability issues and resolution of performance issues such as radar interference. The program is working towards a FID. See Surveillance Roadmap 1 and BLI 2B16 for information about ASR-9 and Mode S SLEP Phase 3 Planning, S03.01-11.

NSWRC will provide a cost-effective replacement for several models of Airport Surveillance Radars (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. The program is working towards a FID. See BLI 2B21for more information about Next Generation Surveillance and Weather Radar Capability (NSWRC), S14.01-01.

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 an earlier ASR-9 program. The ASR-11 Technology Refresh Segment 2 is structured to address shortfalls identified in the Segment 2 Shortfall Analysis Report including Site Control Data Interface (SCDI) /Operator Maintenance Terminal (OMT) obsolescence and Uninterruptible Power Supply (UPS) capacitor at end of life expectancy. The objective of the Segment 2 program is to insure continued reliable and cost effective operation of the radar system throughout its designated lifecycle.

ASR-11 Technology Refresh Segment 3 will address parts obsolescence, operational performance deficiencies, or other areas requiring technology refresh. The program is working towards a FID. Future ASR-11 Technology Refreshes are dependent on decisions for NSWRC. See BLI 2B11 for more information about ASR-11 – Technology Refresh Segment 2, S03.02-05 and ASR-11 – Technology Refresh Segment 3, S03.02-07.

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 timeline of the current roadmap. The program is working towards an in-service decision for Mobile ASR-11. See BLI 2B11for more information about ASR-11 – MASR, S03.02-06.

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.

See Surveillance Roadmap 1 and BLI 2B16 for information about Mode S SLEP Phase 2, S03.01-08.

See Surveillance Roadmap 1 and BLI 2B21 for information about NBSC, S15.01-01.

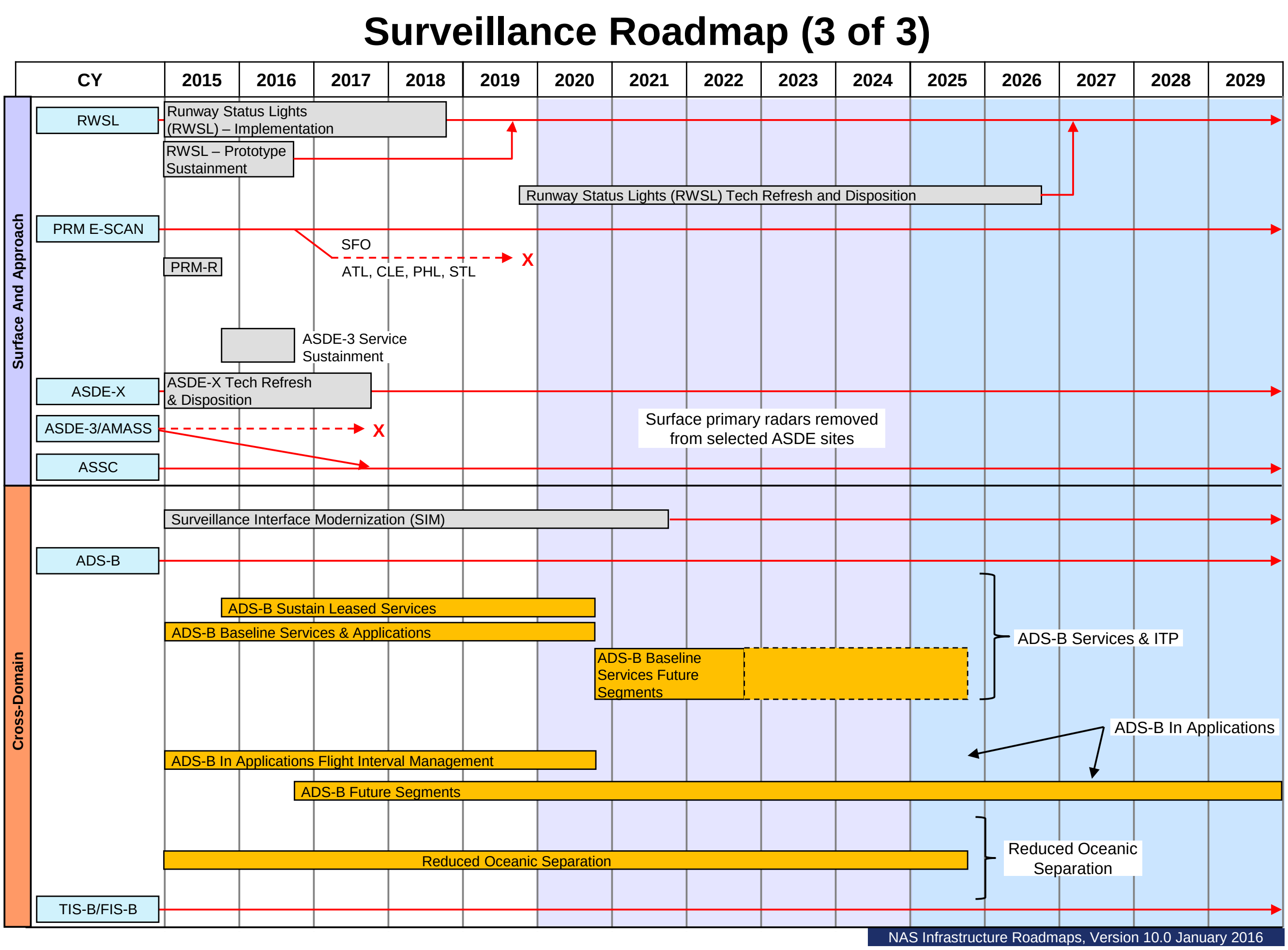

Figure 5-12 Surface, Approach and Cross Domain Surveillance Roadmap

The Runway Status Lights (RWSL) (figure 5-12) 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. RWSLs are currently operational at 12 airports and the FAA plans to have all RWSL systems operational by

2017. The RWSL was procured in late 2008 and fielded between 2009 and 2017. It is intended to remain operational through the duration of this roadmap. The RWSL uses hardware and software architectures that are becoming obsolete and require replacement. The technology refresh will replace the RWSL processor subsystem and part of the field lighting subsystem as necessary to sustain RWSL. The technology refresh program is working towards a FID. See BLI 2B12 for more information about RWSL – Implementation – Phase 1, S11.01-02 and RWSL – Technology Refresh & Disposition, S11.01-04.

The Precision Runway Monitor (PRM) is used to monitor the safety of side-by-side simultaneous approaches to closely spaced parallel runways during Instrument Flight Rules (IFR) conditions. 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 electronic scan (E-SCAN) version of PRM achieves rapid update by moving the beam electronically rather than relying on turning the antenna. 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 ATL PRM system assets and will not be replaced.

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). Airport Movement Area Safety System (AMASS) as 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.

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 ASDE-X Technology Refresh Program will ensure the continued operation of ASDE-X systems through its designated lifecycle. Periodic replacement of Commercial Off-The-Shelf (COTS) system components; e.g., processors, displays, computer operating systems and Commercially Available Software (CAS), will help keep the number of Category A&B runway incursions at the reduced levels attained during ASDE-X system deployment. See BLI 2B01 for more information about ASDE-X – Technology Refresh & Disposition, S09.01-01.

Implemented within the ADS-B NAS Wide Implementation – Baseline Services & Applications program the Airport Surface Surveillance Capability (ASSC) is a surface multilateration system which will receive inputs from multilateration sensors, ADS-B, and Airport Surveillance Radar/Mode Select (ASR/Mode S) terminal radars. Using fused target data, ASSC will enhance 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. Aircraft position 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 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 is focused on the acquisition of ADS-B equipment. It 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. The ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment program is working towards a 2018 FID to re-compete the service contracts and provide additional enhancements in the FY 2020 – FY2025 timeframe. See BLI 2A12 for more information about ADS-B NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01 and ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment, G02S.03-04.

FAA subscription for ADS-B Baseline Services is delivered through contractor owned and operated ADS-B infrastructure in place in the NAS. Performance-based service fees support the operation of the system, any necessary upgrades, and modernization. The program also supports operation of the Colorado Wide Area Multilateration surveillance service to provide aircraft location information to the automation system at Denver ARTCC. See BLI 6A01 for more information about ADS-B – Sustain Leased Services, G02S.03-05.

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 inter-aircraft spacing (e.g., achieve a precise interval between aircraft in a stream of traffic). Interval Management-Spacing (IM-S) Arrivals, Approach, & Cruise (AA&C) supports IM operations for arrival and approach applications for independent runway operations and for cruise operations (i.e., spacing during en route metering and Miles-in-Trail operations). Pre-implementation activities and AMS milestones through FID for ADS-B In IM Applications are funded under this program. See BLI 1A05 for more information about ADS-B In Application - Flight Interval Management, G01S.02-01.

The ADS-B NAS Wide Implementation – Future Segments program will develop Advanced-Interval Management dependent runway, departure and oceanic operations, and other future concepts along with the associated avionics standards will be developed with RTCA and the user community. Pre-implementation activities for these future concepts will be conducted under G01S.02-01. See BLI 2A12 for more information about ADS-B NAS Wide Implementation – Future Segments, G02S.01-02.

The Reduced Oceanic Separation program will address gaps in performance by increasing the use of 30/30nm separation and potentially reduce separation to 15/15nm in Oceanic Flight Information Regions. The program will conduct collision risks and safety efforts with ICAO, separation assurance and safety assessments, develop requirements, and conduct investment analysis activities. The program is working towards a FID. See BLI 1A05 for more information about Reduced Oceanic Separation, G02S.04-01.

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.

The Surveillance Interface Modernization (SIM) program will modernize the interfaces between FAA surveillance radar and automation systems for Terminal, En route, and Oceanic environments. SIM’s improvements are achieved by converting the radar and automation systems from the serial interfaces to flexible Internet Protocol (IP) addressable interfaces, over a secure network. The program is working towards a FID. See BLI 2B17 for more information about Surveillance Interface Modernization (SIM), S13.01-01.

5.4 Navigation Roadmaps

Navigation aids (also called Navaids) 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 Navaids. 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 aids. Visual Navaids are ground-based lighting systems that show pilots the path they need to follow during approach and landing.

Navaids 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, and the pilot must be able to see the runway at that altitude before descending further. Non-precision approaches use Navaids (other than ILS) and usually only provide lateral guidance, not vertical guidance.

Many NextGen OIs rely on improved position information provided by the GPS satellite navigation system.

Navigational aid programs are portrayed in two different roadmaps:

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

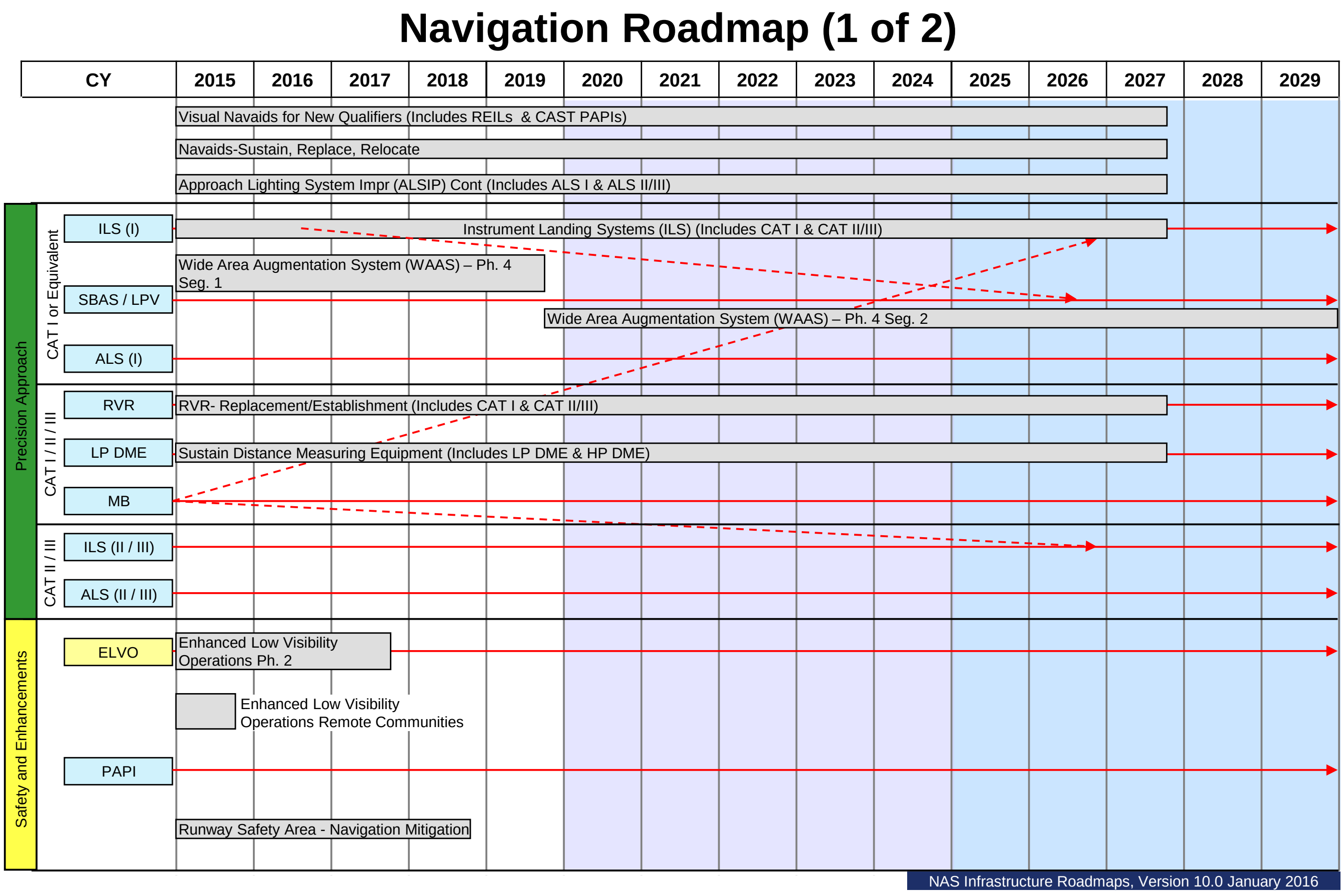

Figure 5-13 Precision Approach, Surface Navigation and Safety & Enhancements Roadmap

At the top of the roadmap, figure 4-13, are 3 programs that support the continued operation of existing systems.

Visual Navaids for New Qualifiers supports the procurement, installation, and commissioning of Precision Approach Path Indicator (PAPI) and Runway End Identification Light (REIL) systems at new qualifying runways. See BLI 2D07 for more information about Visual Navaids for New Qualifiers, N04.01- 00.

Navaids – Sustain, Replace, Relocate sustains and/or replaces Approach Lighting Systems (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 Navaids – Sustain, Replace, Relocate, N04.04-00.

Approach Lighting System Improvement Program (ALSIP) improves the safety of approach lighting systems built before 1975 by replacing rigid structures, and the entire approach lighting system, with lightweight and low-impact structures that collapse or break apart upon impact (frangible). See BLI 2D05 for more information about ALSIP, N04.03-00.

ILSs provide 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. 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, the decision height, and how far away the pilot can see the runway, or 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 ILS, N03.01-00.

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 stations and master and up link stations. Localizer Performance with Vertical guidance (LPV) is a high precision GPS/WAAS instrument approach procedure with a decision height similar to the ILS Cat I. See Navigation Roadmap 2 and BLI 2D03 for more information about WAAS – Phase IV Segment 1, N12.01-07, and WAAS - Phase IV Segment 2, N12.01-08.

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.

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-generation RVR and PC-based RVR which are safer, because the equipment is mounted on frangible structures that break away if accidently 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. The Sustain DME program is replacing DMEs that have exceeded their service life expectancy; establishing new DMEs at qualifying airports; relocating DME facilities; and establishing DMEs in lieu of Instrument Landing System markers. See BLI 2D06 for more information about Sustain DME, N09.00-00.

MB (Marker Beacons) 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 program Phase II provides the equipment and procedures for reduced minimums for landing and takeoff during periods of low visibility at selected airports. At these airports, ELVO is expected to remain in operation beyond the timeline of the current roadmap. See BLI 2D04 for more information about ELVO - Phase II, N08.03-01.

The PAPI system has 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.

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 program corrects FAA-owned NAVAIDs in RSAs by taking action on those navigation systems that are not in compliance with the RSA requirements. See BLI 2D11 for more information about Runway Safety Area – Navigation Mitigation, N17.01-01.

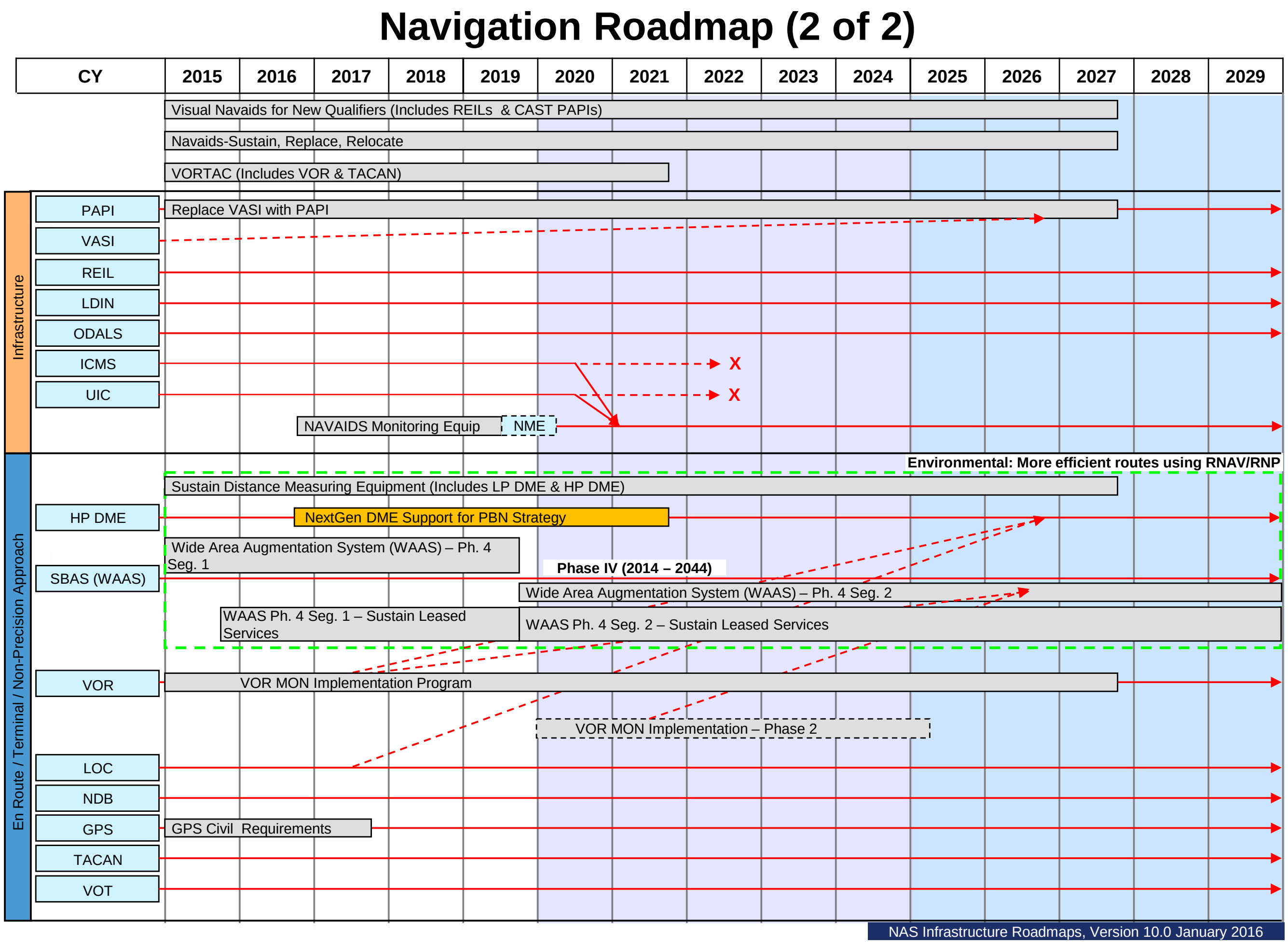

Figure 5-14 Infrastructure and En Route, Terminal and Non-Precision Approach Roadmap

See Navigation Roadmap 1 and BLI 2D07 for more information about Visual Navaids for New Qualifiers, N04.01-00.

See Navigation Roadmap 1 and BLI 2D09 for more information about Navaids – Sustain, Replace, Relocate, N04.04-00.

Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC) is a combination of VOR and Tactical Air Navigation (TACAN) system and provide navigational guidance for civilian and military aircraft in both the en route and terminal areas. VORs and VORTACs are used by pilots as primary navigation aids to determine an aircraft's azimuth and slant range distance from the Navaids. The VORTAC program (figure 5-14) replaces, relocates, or improves VOR and VORTAC facilities. See BLI 2D01 for more information about the VORTAC program, N06.00-00.

In September of 2015, FAA decided to implement the VOR Minimum Operational Network (MON) to serve as a backup to satellite navigation. Some number of VORs will be retained and continue to define VOR routes and procedures for legacy users. VORs must remain in service and may be relocated, technologically refreshed, or replaced for the duration of the roadmap. See the VOR MON program description below.

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 maintain the appropriate descent rate to the runway. The Replace VASI with PAPI program will continue to replace the VASIs beyond the duration of this roadmap. See BLI 2D10 for more information about Replace VASI with PAPI, N04.02-00.

Runway End Identification Lights (REIL) helps pilots to visually align with the runway for both precision and non-precision approaches.

Lead In Light System (LDIN) and Omnidirectional 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 replace both the ICMS and UIC with a single system that provides consolidated monitoring and control of navigational aid equipment. The program is working towards a FID. See BLI 2D13 for more information about NME, M08.41-02.

High Power (HP) DME supports navigation for both en route and terminal operations.

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; establish new DMEs at qualifying airports; relocate DME facilities; and establish DMEs in lieu of Instrument Landing System markers. See BLI 2D06 for more information about Sustain DME, N09.00-00.

The NextGen DME program will expand DME coverage in both en route and terminal airspace to provide a resilient, complimentary navigation service to support Performance Based Navigation (PBN) operations in the event of a disruption to the Global Navigation Satellite Service (GNSS). See BLI 1A09 for more information about NextGen DME Support For Performance Based Navigation (PBN) Strategy, G01N.01-02.

The Satellite-Based Augmentation System (SBAS) also called the Wide Area Augmentation System (WAAS) uses a network of 38 ground reference stations located in North America that monitor the GPS satellite signals. Three master stations collect reference station data; calculate corrections and integrity messages for each GPS satellite, and broadcasts WAAS messages to users via geostationary satellites providing precise navigation position to the aircraft. 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 planned for implementation in Dual Frequency Operations (DFO). 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 WAAS – Phase IV Segment 1, N12.01-07 and WAAS Phase IV Segment 2, N12.01-08.

The WAAS requires a minimum of three commercial geostationary satellites (GEOs) to meet its performance requirements. The WAAS Sustain Lease Services programs funds the required leased services for the 3 WAAS GEOs. See BLI 6A01 for information about WAAS – Phase IV Segment 1 and Segment 2 Sustain Leased Services, N12.01-09 and N12.01-10.

The Very High Frequency Omni-Directional Range (VOR) is used by pilots as a primary navigation aid, and direct lines between VORs are used to define established air routes. The VOR provides the user with bearing and distance (slant-range) to a ground station.

The VOR Minimum Operating Network (MON) Implementation Program will downsize the VOR network to the minimum required as a backup navigation system in the event of an unplanned GPS localized outage to allow aircraft to navigate and land safely. This program supports the NAS transition from the current VOR airways to Performance Based Navigation (PBN) consistent with NextGen goals. At the VOR MON Phase 1 FID the program was approved to discontinue approximately 74 VORs by the end of September 2020. See BLI 2D01 for more information about the VOR – MON Implementation Program, N06.01-01.

A future program, VOR MON Phase 2 will be established to address additional sites to achieve the MON.

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 NDB, because NDBs are still used at some remote areas, where it is not economically justified to install modern navigational equipment.

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.

GPS Civil Requirements program provides system design and development for a network of GPS monitoring stations and processing facilities to monitor the quality of the GPS signal for civil users. Signal monitoring requirements enable GPS operators on the ground to quickly identify a civil signal anomaly and determine if the cause is due to either a satellite or a control segment failure and take corrective action to restore service. See BLI 2D03 for more information about GPS Civil Requirements, N12.03-01.

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.

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

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 weather hazard 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.

NextGen operational improvements will rely on improved access to weather information provided by Common Support Services – Weather (CSS - Wx) and better weather processing and forecasting provided by NextGen Weather Processor (NWP).

Weather sensors include weather radars and surface observation systems that measure atmospheric parameters, such as surface temperature, prevailing wind speed and direction, relative humidity, and cloud bases and tops, as well as 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

Weather Roadmap (1 of 2)

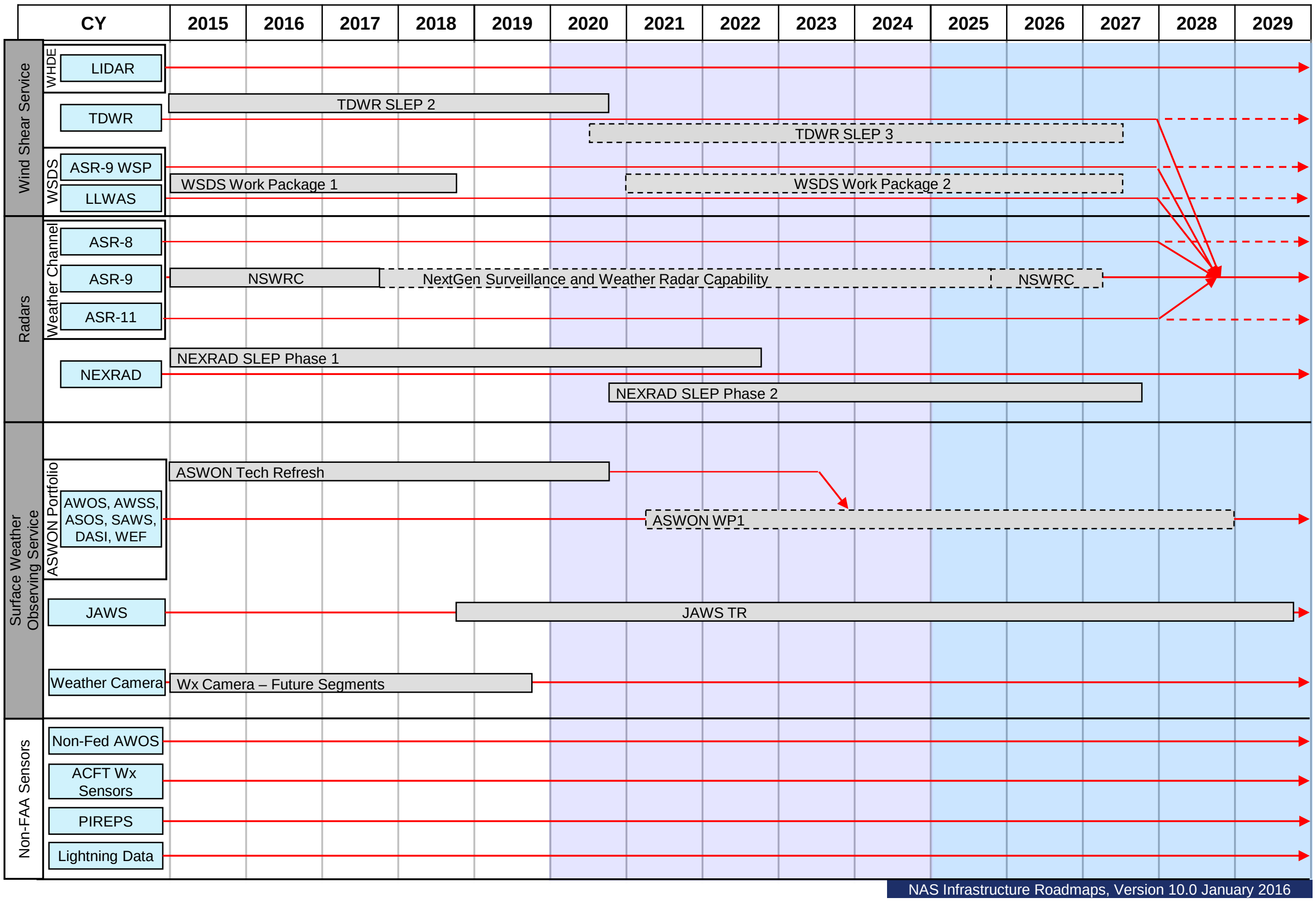

Figure 5-15 Weather Sensors Roadmap

Figure 5-15 shows the Wind Shear Services (WSS) 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.

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. 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.

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. The program achieved FID on December 16, 2015. See BLI 2B02 for more information about TDWR – SLEP – Phase 2 W03.03-02.

Wind Shear Detection Services (WSDS) Work Package 1 is a portfolio program consisting of several legacy wind shear detection systems deployed in the NAS. The program will address obsolescence of the legacy Weather Systems Processor (WSP), Low Level Windshear Alert System (LLWAS) and Wind Measuring Equipment (WME). See BLI 2A13 for more information about Wind Shear Detection Services – Work Package 1, W05.03-01.

The ASR-8/9/11 Weather Channel and the Next Generation Weather Radar (NEXRAD) detect precipitation, wind, and thunderstorms that affect aircraft in flight.

The Next Generation Surveillance and Weather Radar Capability (NSWRC) will provide a cost-effective replacement for primary terminal surveillance and weather radars. The program is working towards a FID. See BLI 2B21 for more information about Next Generation Surveillance and Weather Radar Capability (NSWRC), S14.01-01.

The development of the Next Generation Weather Radar (NEXRAD) occurred under a tri-agency partnership between the Department of Commerce's National Weather Service, Department of Defense, and FAA. 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. 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 program will identify sustainability issues of the NEXRAD system in 2021 and if needed will initiate activities towards a final investment decision. See BLI 2A03 for more information about NEXRAD – SLEP Phase 1, W02.02-02 and NEXRAD SLEP Phase 2, W02.02-03.

The Automated Surface Weather Observation Network (ASWON) Portfolio includes several surface sensors (AWOS/ASOS/AWSS/SAWS/DASI/WEF) that measure weather parameters on the surface and report conditions to air traffic facilities and pilots. The data collected is important to pilots and dispatchers as they prepare and file flight plans, and it is vital for weather forecasting.

The Automated Surface Observing Systems (ASOS) and other variants (such as the Automated Weather Observing System (AWOS); the Automated Weather Sensor Systems (AWSS); and the Stand Alone Weather Sensing (SAWS) system) have up to 14 sensors that measure weather data, including temperature, barometric pressure, humidity, type and amount of precipitation, and cloud bases and amount of sky cover.

The Digital Altimeter Setting Indicator (DASI) shows tower controllers the current barometric pressure, so they can inform pilots of the proper aircraft altimeter setting so it will display the correct ground elevation of the runway at touchdown.

The Wind Equipment F-400 Series (WEF) determines and displays 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. They also provide regular updates for the forecast models that predict future weather conditions including adverse weather. These systems will remain in operation until a decision is made to implement the NextGen Surface Observing Capability.

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. See BLI 2C01 for more information about ASWON – Technology Refresh, W01.03-01.

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. JAWS data is also available 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 JAWS – Technology Refresh, W10.01-02.

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. Without current weather information about their destination airport and route of flight, pilots cannot make informed decisions on whether it is safe to fly or to continue their flight if already airborne. This can lead to accidents or unnecessary fuel costs caused by having to circumvent bad weather or land at an alternate airport.

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. The program is working towards a FID. See BLI 2C04 for more information about Weather Camera Program – Future Segments, M08.31-02.

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. A planned activity would enhance ERAM to allow automatic entry of pilot reports. Lightning Data systems provide air traffic facilities important information about the location and intensity of thunderstorms.

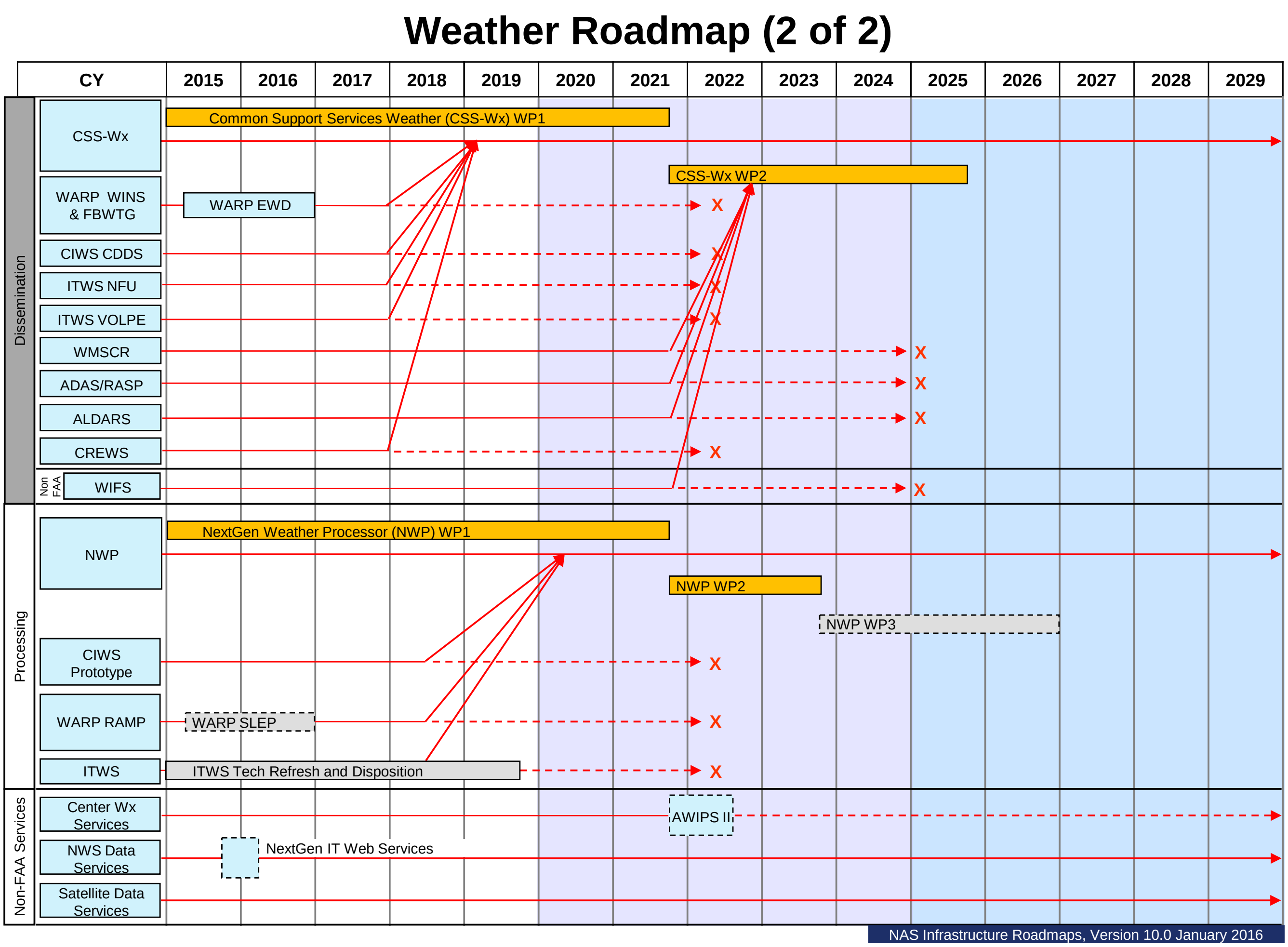

Figure 5-16 Weather Dissemination, Processing and Display Roadmap

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.

Common Support Services-Weather (CSS-Wx) Work Package 1 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. See BLI 2A11 for more information about System Wide Information Management (SWIM) – CCS-Wx – Work Package 1, G05C.01-06.

The Weather and Radar Processor Weather Information Network Server (WARP WINS) processes and stores data from multiple NEXRAD radars for use by 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) will become part of the CSS-Wx in 2021 and its information will be consolidated with other weather inputs.

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. Decisions on its future will be made in 2017.

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

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. See BLI 2A17 for more information about Next Generation Weather Processor (NWP), Work Package 1 (WP1), G04W.03-02.

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 depicts the current weather and generates short-term forecasts of terminal weather through the integration of data from FAA and NWS sensors and systems, as well as from aircraft in flight; 34 ITWS sites provide weather information to a total of 75 airports.

Integrated Terminal Weather System (ITWS) – Technology Refresh & 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 ITWS program will also fund a contingency effort to mitigate potential accelerated hardware failures. See BLI 2B19 for more information about ITWS – Technology Refresh & Disposition, W07.01-02.

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, either automatically or by request, send data to FAA facilities and users so that observations and forecasts can be more widely and consistently distributed via network-enabled communications. Decision support tools will use this weather information to assist users in understanding weather constraints and taking actions to reduce risk for aviation operations.

6 Facilities

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

There are more than 16,000 unstaffed facilities—many in very remote locations—sheltering communications, navigation, surveillance equipment and weather sensors. Much of this equipment is housed in buildings that need renovation. Many have deteriorating steel towers and foundations. Some newer unstaffed buildings and structures frequently need renovation because they are in remote and/or hazardous locations near the ocean or on mountaintops. Replacing roofing, electric power generators, heating/cooling, and structural and security components of these structures is essential to 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, each have many buildings. Each year, these complexes receive funds to both upgrade and replace infrastructure, and to improve and modernize buildings to 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, and funds are requested to pay the annual lease costs. The MMAC also receives funding for building renovation and updated infrastructure. 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. The FAA has requested funding for 2017 and beyond to upgrade buildings and supporting infrastructure, such as electrical and mechanical equipment. Annual funding is provided 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 funding for replacement of existing air traffic control towers (ATCT) and TRACON facilities. 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 on the size of the project. Each segment of a project is fully funded in the year requested, but it may take more than one year to complete that segment. Funding is allocated to the segments based on FAA priorities while maintaining the overall 5 year funding estimates for the program. The program also includes the project to replace the New York TRACON on Long Island. The existing N90 facility is old, does not meet operational requirements and needs to be replaced. FAA is currently acquiring real estate and conducting site preparation for the new facility.

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 listed below.

BLI #	CIP Title	CIP #
1A02/ 1A03	William J. Hughes Technical Center Laboratories	F14.00-00
1A04	William J. Hughes Technical Center Infrastructure Sustainment	F16.00-00
2A04	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements	F06.01-00
2A07	Long Rang Radar (LRR) Improvements – Infrastructure Upgrades/Sustain	S04.02-03
2B06	The Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Replacement	F01.02-00
2B07	Air Traffic Control (ATCT)/Terminal Radar Approach Control (TRACON) Modernization	F01.01-00
2B07	Facility Realignment Planning	F02.10-01
2B07	Facility Realignment Implementation	F02.10-02
2B09	NAS Facilities Occupational Safety and Health Administration (OSHA) & Environmental Standards Compliance	F13.03-00
2C03	Alaska Flight Service Facility Modernization (AFSFM)	F05.04-02
2E01	Fuel Storage Tank Replacement and Management	F13.01-00
2E02	FAA Buildings and Equipment Sustain Support – Unstaffed Infrastructure Sustainment (UIS)	F12.00-00
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
3A14	Logistics Center Support System (LCSS) – Technology Refresh	M21.04-02
3A04	Facility Security Risk Management (FSRM) – Two	F24.01-02
3A11	Mobile Asset Management Program	F31.01-01
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 capital equipment and infrastructure that make up the NAS. To meet forecast demand for aviation services, the agency has embarked upon a NAS transformation to deliver new capabilities, operational improvements, and additional benefits envisioned by NextGen. This transition involves changes to communication, navigation, and surveillance systems and requires systems research, changes to the NAS infrastructure, the development of new procedures, and personnel training to realize the expected benefits from NextGen. To support the transition, the NAS must be fully sustained to ensure the uninterrupted delivery of current services with the required level of safety that are both expected and relied upon by the aviation community and its passengers.

Capital investments that support NAS and Mission Support are listed below.

BLI #	CIP Title	CIP #
1A01	Runway Incursion Reduction Program (RIRP) – ATDP	S09.02-00
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	Operational Modeling Analysis and Data	M52.01-01
2D08	Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 1	A14.02-02
2D08	Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 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
2E11	System Capacity, Planning and Improvements - ATDP	M08.28-00
3A05	Information Systems Security	M31.00-00
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 and Development Support – SE2020	M03.03-01
4A01	Provide Air Navigation Facility (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 (dollars in Millions)

The table below provides the current funding for the CIP programs as requested in the FY 2017 President's Budget submission to Congress and the planning estimates for FY 2018-2021. These estimates are based upon current FAA program requirements and the agency's allocation of the most recent OMB outyear targets for the F&E account.

BLI Number	Capital Budget Line Item (BLI) Program	FY 2017 Budget	FY 2018 Est.	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.
	Activity 1: Engineering, Development, Test and Evaluation	**$147.0**	**$172.5**	**$186.0**	**$208.1**	**$229.2**
1A01	Advanced Technology Development and Prototyping (ATDP)	$24.8	$30.2	$30.2	$31.2	$28.2
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	$19.0	$19.0	$19.0	$19.0	$19.0
1A04	William J. Hughes Technical Center Infrastructure Sustainment	$12.2	$10.0	$10.0	$11.6	$11.7
1A05	NextGen – Separation Management Portfolio	$25.8	$34.5	$41.5	$50.0	$62.0
1A06	NextGen – Improved Surface Portfolio	$2.0	$4.0	$8.0	$11.0	$9.0
1A07	NextGen – On Demand NAS Portfolio	$8.5	$17.0	$21.5	$34.5	$43.5
1A08	NextGen – Improved Multiple Runway Operations Portfolio	$6.5	$2.0	$1.0	$0.0	$0.0
1A09	NextGen – NAS Infrastructure Portfolio	$17.7	$24.0	$23.0	$24.0	$29.0
1A10	NextGen – Laboratory Support Portfolio	$12.0	$12.8	$12.8	$12.8	$12.8
1A11	NextGen – Performance Based Navigation & Metroplex Portfolio	$17.5	$18.0	$18.0	$13.0	$13.0
	Activity 2: Procurement and Modernization of Air Traffic Control Facilities and Equipment	**$1,631.4**	**$1,663.1**	**$1,715.8**	**$1,736.6**	**$1,762.4**
	A. En Route Programs	**$683.7**	**$699.9**	**$677.2**	**$644.8**	**$666.0**
2A01	NextGen – En Route Automation Modernization (ERAM) – System Enhancements and Technology Refresh	$78.0	$93.6	$106.1	$126.4	$150.0
2A02	En Route Communications Gateway (ECG)	$2.7	$2.7	$4.8	$2.7	$2.7
2A03	Next Generation Weather Radar (NEXRAD)	$6.3	$5.5	$5.5	$4.0	$6.1
2A04	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements	$74.9	$81.3	$75.3	$75.3	$75.3
2A05	Air Traffic Management (ATM) – Traffic Flow Management (TFM)	$20.0	$9.3	$7.0	$7.0	$7.0
2A06	Air/Ground Communications Infrastructure	$8.8	$9.8	$8.8	$6.7	$6.4
2A07	Air Traffic Control En Route Radar Facilities Improvements	$5.8	$5.9	$5.9	$5.9	$5.9
2A08	Voice Switching Control System (VSCS)	$11.3	$12.8	$11.4	$11.7	$12.1
2A09	Oceanic Automation System (OAS)	$24.0	$31.1	$27.5	$18.0	$18.0
2A10	Next Generation Very High Frequency Air/Ground Communications System (NEXCOM)	$50.5	$60.0	$62.0	$64.0	$64.0
2A11	NextGen – System-Wide Information Management (SWIM)	$28.8	$48.1	$42.9	$28.4	$9.4
2A12	NextGen – Automatic Dependent Surveillance - Broadcast (ADS-B) NAS Wide Implementation	$31.1	$27.9	$34.7	$43.5	$70.0
2A13	Windshear Detection Service (WDS)	$4.5	$1.0	$2.8	$1.0	$1.0
2A14	NextGen – Collaborative Air Traffic Management Portfolio	$13.8	$21.0	$22.0	$14.0	$20.0
2A15	NextGen – Time Based Flow Management (TBFM) Portfolio	$50.6	$49.6	$47.4	$42.8	$46.8

BLI Number	Capital Budget Line Item (BLI) Program	FY 2017 Budget	FY 2018 Est.	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.
2A16	ATC Beacon Interrogator (ATCBI) - Technology Refresh	$1.0	$0.0	$0.0	$0.0	$0.0
2A17	NextGen – Next Generation Weather Processor (NWP)	$27.8	$35.1	$24.3	$16.0	$6.2
2A18	Airborne Collision Avoidance System X (ACAS X)	$8.9	$7.7	$7.7	$6.9	$5.1
2A19	NextGen – Data Communication in support of NextGen	$232.0	$194.7	$178.3	$170.6	$160.1
2A20	Offshore Automation	$3.0	$3.0	$3.0	$0.0	$0.0
	B. Terminal Programs	**$561.7**	**$580.2**	**$623.4**	**$684.3**	**$671.6**
2B01	Airport Surface Detection Equipment - Model X (ASDE-X)	$8.4	$0.0	$0.0	$0.0	$0.0
2B02	Terminal Doppler Weather Radar (TDWR) – Provide	$5.0	$3.8	$4.5	$2.2	$0.0
2B03	Standard Terminal Automation Replacement System (STARS) (TAMR Phase 1)	$64.2	$62.8	$66.9	$40.0	$50.0
2B04	Terminal Automation Modernization/ Replacement Program (TAMR Phase 3)	$108.9	$85.0	$8.0	$0.0	$0.0
2B05	Terminal Automation Program	$7.7	$7.8	$12.8	$12.9	$17.9
2B06	Terminal Air Traffic Control Facilities - Replace	$58.8	$87.0	$148.8	$119.5	$110.0
2B07	ATCT/Terminal Radar Approach Control (TRACON) Facilities - Improve	$47.7	$47.8	$72.8	$95.8	$91.8
2B08	Terminal Voice Switch Replacement (TVSR)	$6.0	$6.0	$6.0	$6.0	$5.0
2B09	NAS Facilities OSHA and Environmental Standards Compliance	$42.7	$42.0	$42.0	$42.0	$42.0
2B10	Airport Surveillance Radar (ASR-9)	$4.5	$2.2	$0.0	$0.0	$0.0
2B11	Terminal Digital Radar (ASR-11) Technology Refresh and Mobile Airport Surveillance Radar (MASR)	$6.1	$3.2	$4.4	$4.4	$4.4
2B12	Runway Status Lights (RWSL)	$4.8	$1.2	$0.0	$3.5	$3.5
2B13	NextGen – National Airspace System Voice System (NVS)	$48.4	$68.4	$32.2	$116.6	$105.5
2B14	Integrated Display System (IDS)	$7.7	$5.0	$18.0	$24.0	$28.0
2B15	Remote Monitoring and Logging System (RMLS)	$9.9	$10.4	$23.1	$16.4	$19.6
2B16	Mode S Service Life Extension Program (SLEP)	$37.9	$42.5	$37.5	$45.5	$35.5
2B17	Surveillance Interface Modernization (SIM)	$26.8	$32.1	$34.0	$22.2	$20.2
2B18	NextGen – Terminal Flight Data Manager (TFDM)	$42.2	$50.0	$79.0	$92.8	$95.2
2B19	Voice Recorder Replacement Program (VRRP)	$2.0	$5.0	$11.3	$14.5	$12.0
2B20	Integrated Terminal Weather System (ITWS) Technology Refresh	$1.0	$1.0	$2.1	$0.0	$0.0
2B21	Next Generation: Surveillance and Weather Radar Capability (NSWRC) and Backup Surveillance Capability (NBSC)	$6.0	$0.0	$0.0	$0.0	$0.0
2B22	Flight and Interfacility Data Interface (FIDI)	$15.0	$17.0	$20.0	$26.0	$31.0
	C. Flight Service Programs	**$17.9**	**$21.7**	**$25.7**	**$16.7**	**$12.7**
2C01	Aviation Surface Weather Observation System	$10.0	$10.0	$10.0	$2.0	$0.0
2C02	Future Flight Services Program (FFSP)	$3.0	$6.8	$12.0	$12.0	$10.0
2C03	Alaska Flight Service Facility Modernization (AFSFM)	$2.7	$2.7	$2.7	$2.7	$2.7
2C04	Weather Camera Program	$2.2	$2.2	$1.1	$0.0	$0.0

BLI Number	Capital Budget Line Item (BLI) Program	FY 2017 Budget	FY 2018 Est.	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.
	D. Landing and Navigation Aids Programs	**$146.9**	**$140.8**	**$139.1**	**$141.6**	**$158.5**
2D01	VHF Omnidirectional Radio Range (VOR) with Distance Measuring Equipment (DME)	$7.0	$11.0	$17.0	$20.0	$12.0
2D02	Instrument Landing Systems (ILS) – Establish	$7.0	$7.0	$10.0	$11.0	$11.0
2D03	Wide Area Augmentation System (WAAS) for GPS	$85.0	$78.7	$71.4	$67.0	$86.5
2D04	Runway Visual Range (RVR) & Enhanced Low Visibility Operations (ELVO) Program	$6.5	$4.0	$6.0	$6.0	$6.0
2D05	Approach Lighting System Improvement Program (ALSIP)	$3.0	$3.0	$5.0	$5.0	$5.0
2D06	Distance Measuring Equipment (DME)	$3.0	$3.0	$5.0	$5.0	$5.0
2D07	Visual Navaids - Establish/Expand	$2.0	$2.0	$2.0	$2.0	$2.0
2D08	Instrument Flight Procedures Automation (IFPA)	$9.4	$8.5	$2.2	$3.1	$1.5
2D09	Navigation and Landing Aids – Service Life Extension Program (SLEP)	$3.0	$3.5	$7.5	$12.5	$14.5
2D10	VASI Replacement – Replace with Precision Approach Path Indicator	$5.0	$5.0	$10.0	$10.0	$15.0
2D11	Runway Safety Areas – Navigation Mitigation	$14.0	$12.1	$0.0	$0.0	$0.0
2D12	NAVAIDS Monitoring Equipment	$2.0	$3.0	$3.0	$0.0	$0.0
	E. Other ATC Facilities Programs	**$221.3**	**$220.5**	**$250.3**	**$249.3**	**$253.6**
2E01	Fuel Storage Tank Replacement and Management	$22.7	$22.0	$22.0	$22.0	$22.0
2E02	Unstaffed Infrastructure Sustainment	$40.5	$41.3	$42.3	$42.4	$46.7
2E03	Aircraft Related Equipment Program	$13.0	$12.5	$13.0	$13.0	$13.0
2E04	Airport Cable Loop Systems – Sustained Support	$8.0	$8.0	$10.0	$10.0	$10.0
2E05	Alaskan Satellite Telecommunication Infrastructure (ASTI)	$6.0	$12.0	$10.3	$0.0	$0.0
2E06	Facilities Decommissioning	$6.2	$8.0	$10.0	$10.0	$10.0
2E07	Electrical Power Systems – Sustain/Support	$105.0	$102.7	$130.7	$135.7	$135.7
2E08	Energy Management and Compliance (EMC)	$2.0	$2.0	$2.0	$6.2	$6.2
2E09	Child Care Center Sustainment	$1.0	$1.0	$0.0	$0.0	$0.0
2E10	FAA Telecommunications Infrastructure 2	$10.4	$1.0	$0.0	$0.0	$0.0
2E11	System Capacity, Planning and Improvements	$6.5	$6.5	$6.5	$6.5	$6.5
2E12X	Independent Operational Test and Evaluation	$0.0	$3.5	$3.5	$3.5	$3.5
	Activity 3: Non-Air Traffic Control Facilities and Equipment	**$182.9**	**$187.9**	**$181.9**	**$166.3**	**$163.2**
	A. Support Programs	**$167.4**	**$172.9**	**$166.9**	**$151.3**	**$148.2**
3A01	Hazardous Materials Management	$31.0	$30.0	$30.0	$31.0	$31.0
3A02	Aviation Safety Analysis System (ASAS)	$11.3	$12.0	$14.0	$18.2	$15.3
3A03	National Airspace System (NAS) Recovery Communications (RCOM)	$12.0	$12.0	$12.0	$12.0	$12.0
3A04	Facility Security Risk Management	$21.0	$18.1	$15.9	$15.0	$14.9
3A05	Information Security	$25.0	$25.0	$12.0	$12.0	$12.0
3A06	System Approach for Safety Oversight (SASO)	$17.2	$25.8	$23.5	$21.0	$14.1
3A07	Aviation Safety Knowledge Management Environment (ASKME)	$4.2	$0.0	$0.0	$0.0	$0.0

BLI Number	Capital Budget Line Item (BLI) Program	FY 2017 Budget	FY 2018 Est.	FY 2019 Est.	FY 2020 Est.	FY 2021 Est.
3A08	Aerospace Medical Equipment Needs (AMEN)	$3.0	$7.0	$19.6	$12.8	$14.0
3A09	NextGen – System Safety Management Portfolio	$17.0	$17.0	$17.0	$17.0	$17.0
3A10	National Test Equipment Program	$5.0	$4.0	$5.0	$3.0	$3.0
3A11	Mobile Assets Management Program	$5.8	$3.0	$1.8	$0.0	$0.0
3A12	Aerospace Medicine Safety Information System (AMSIS)	$12.0	$14.0	$16.1	$9.3	$9.2
3A13	Tower Simulation System (TSS) Technology Refresh	$3.0	$5.0	$0.0	$0.0	$0.0
3A14X	Logistics Support System and Facilities (LSSF)	$0.0	$0.0	$0.0	$0.0	$5.7
	B. Training, Equipment and Facilities	**$15.5**	**$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	$1.5	$1.0	$1.0	$1.0	$1.0
	Activity 4: Facilities and Equipment Mission Support	**$237.4**	**$230.9**	**$232.2**	**$254.6**	**$260.1**
4A01	System Engineering (SE2020) and Development Support	$35.0	$35.0	$38.0	$38.0	$38.0
4A02	Program Support Leases	$46.6	$47.0	$47.0	$50.0	$55.0
4A03	Logistics Support Services (LSS)	$11.0	$11.0	$11.0	$11.0	$11.0
4A04	Mike Monroney Aeronautical Center Leases	$19.3	$19.7	$20.2	$20.6	$21.1
4A05	Transition Engineering Support	$24.1	$19.3	$17.0	$15.0	$15.0
4A06	Technical Support Services Contract (TSSC)	$23.0	$23.0	$23.0	$30.0	$30.0
4A07	Resource Tracking Program (RTP)	$6.0	$6.0	$6.0	$8.0	$8.0
4A08	Center for Advanced Aviation System Development (CAASD)	$60.0	$60.0	$60.0	$65.0	$65.0
4A09	NextGen – Aeronautical Information Management Program	$10.4	$7.9	$8.0	$15.0	$15.0
4A10	NextGen – Cross Agency NextGen Management	$2.0	$2.0	$2.0	$2.0	$2.0
	Activity 5: Personnel Compensation, Benefits and Travel	**$489.0**	**$496.1**	**$503.6**	**$510.8**	**$519.5**
5A01	Personnel and Related Expenses	$489.0	$496.1	$503.6	$510.8	$519.5
	Activity 6: Sustain ADS-B services and WAAS GEOs	**$150.3**	**$144.5**	**$133.5**	**$135.6**	**$136.6**
6A01	ADS-B Services and WAAS GEOs	$150.3	$144.5	$133.5	$135.6	$136.6
	Note: BLI numbers with X represent outyear programs not requested in the FY 2017 President's Budget. Note: FY 2018-2021 outyear funding amounts are estimates.					
	Total Year Funding	**$2,838.0**	**$2,895.0**	**$2,953.0**	**$3,012.0**	**$3,071.0**
	Targets	**$2,838.0**	**$2,895.0**	**$2,953.0**	**$3,012.0**	**$3,071.0**

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 ATO's performance in acquiring ATC systems.

In December 2007 the GAO issued its report GAO-08-42 entitled, "AIR TRAFFIC CONTROL FAA Reports Progress in System Acquisitions, but Changes in Performance Measurement Could Improve Usefulness of Information". This report documented the findings and provided recommendations to the FAA.

One of GAO's recommendations was to identify or establish a vehicle for regularly reporting to Congress and the public on FAA's overall, long-term performance in acquiring ATC systems by providing original budget and schedule baselines for each program and the reasons for any baseline revision. The tables below provide the most current information for FAA's Major Active Programs and is in direct response to the GAO's recommendation.

Major programs are those classified as Acquisition Category (ACAT) 1, 2 or 3 which typically are programs with total F&E costs greater than $100M or have significant impact, complexity, risk, sensitivity, safety or security issues. For more information on ACAT see: http://fast.faa.gov/LPD_Acquisition_Categories.cfm

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Current Baseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Current 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	May-12	Sep-20	$960.4	Sep-20	$960.4	
Common Support Services (CSS) Weather (Wx) ACAT 1	Mar-15	Aug-22	$120.1	Mar-15	Aug-22	$120.1	Aug-22	$120.1	NOTE: New Addition. Final Investment Decision (FID) approved by the Joint Resources Council (JRC) in Mar-15.
Data Communications (Data Comm) Segment 1, Phase 1 (S1P1) ACAT 1	May-12	May-19	$741.4	May-12	May-19	$741.4	May-19	$741.4	
Data Communications (Data Comm) Segment 1, Phase 2 (S1P2), Initial En Route Services ACAT 1	Oct-14	Feb-21	$816.7	Oct-14	Feb-21	$816.7	Feb-21	$816.7	
ERAM System Enhancements and Technology Refresh (SETR) ACAT 1	Sep-13	Sep-17	$152.9	Sep-13	Sep-17	$152.9	Sep-17	$152.9	
Facility Security and Risk Management (FSRM) 2 ACAT 2	Jun-11	Sep-22	$182.5	Jun-11	Sep-22	$182.5	Sep-22	$182.5	

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Current Baseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Current APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Logistics Center Support System (LCSS) ACAT 2	Apr-10	Feb-14	$67.4	Apr-14	Apr-16	$79.4	Apr-16	$79.4	Current Baseline 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.
NAS Voice System (NVS) Demonstration and Qualification Phase ACAT 1	Sep-14	Mar-20	$294.2	Sep-14	Mar-20	$294.2	Mar-20	$294.2	
Next Generational Weather Processor (NWP) ACAT 1	Mar-15	Aug-22	$189.3	Mar-15	Aug-22	$189.3	Aug-22	$189.3	NOTE: New Addition. Final Investment Decision (FID) approved by the Joint Resources Council (JRC) in Mar-15.
Next Generation Air-to-Ground Communication System (NEXCOM) - Segment 2, Phase 1 ACAT 2	Sep-11	Sep-18	$285.9	Sep-11	Sep-18	$285.9	Sep-18	$285.9	
Regulation and Certification Infrastructure for System Safety (RCISS) - Segment 2 ACAT 3	Oct-10	Sep-16	$90.7	Oct-10	Sep-16	$90.7	Sep-16	$90.7	

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline: Original APB Date	Original Baseline: Completion Date	Original Baseline: Budget $M	Current Baseline: Current APB Date	Current Baseline: Revised Completion Date	Current Baseline: Revised Budget $M	Current Estimate: Completion Date	Current Estimate: Budget $M	Comments
Runway Status Lights (RWSL) ACAT 1	Jan-10	Oct-15	$327.4	Jul-13	Sep-17	$366.7	Sep-17	$366.7	Current Baseline 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.
System Wide Information Management (SWIM) Segment 2A ACAT 2	Jul-12	Dec-17	$120.2	Jul-12	Dec-17	$120.2	Dec-17	$111.5	
System Wide Information Management (SWIM) Segment 2B ACAT 2	Oct-15	Sep-21	$119.6	Oct-15	Sep-21	$119.6	Jun-21	$119.6	NOTE: New Addition. Final Investment Decision (FID) approved by the Joint Resources Council (JRC) in Oct-15.

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline: Original APB Date	Original Baseline: Completion Date	Original Baseline: Budget $M	Current Baseline: Current APB Date	Current Baseline: Revised Completion Date	Current Baseline: Revised Budget $M	Current Estimate: Completion Date	Current Estimate: Budget $M	Comments
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	Oct-17	$528.6	Original Baseline vs Current Baseline: The cost increase of $90.6M (-20.7% variance) is associated with the following factors: 1) A number of new software requirements (gaps) have been identified from deploying to the first sites. These first deployments demonstrated the significant complexity of transitioning to STARS at large TRACONs which had not been considered with the original baseline and are critical for operational suitability; 2) In addition, the complexity of operations and over a decade of CARTS tailoring by sites was not understood and under-estimated; and 3) Costs were underestimated and not considered for support costs and site spares. During FY14, the JRC was notified of the current estimate to complete the program and in Aug-15, the JRC approved the BCD.
Terminal Automation Modernization and Replacement (TAMR), Phase 3, Segment 2 (P3 S2) ACAT 2	Sep-12	Aug-19	$462.5	Sep-12	Aug-19	$462.5	Aug-19	$505.7	Current Estimate vs Current Baseline: The cost increase of $43.2M (-9.3% variance) is associated with the impact of higher prime costs and a funding reduction in FY16, which may require additional funding to complete the program. The Program Office is reviewing the overall program and assessing potential mitigation actions to minimize the impact to the baseline. During FY14, the JRC was notified of the current estimate to complete the program and in Aug-15 the program provided the JRC with a status update.

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline: Original APB Date	Original Baseline: Completion Date	Original Baseline: Budget $M	Current Baseline: Current APB Date	Current Baseline: Revised Completion Date	Current Baseline: Revised Budget $M	Current Estimate: Completion Date	Current Estimate: Budget $M	Comments
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	Oct-17	$528.6	Original Baseline vs Current Baseline: The cost increase of $90.6M (-20.7% variance) is associated with the following factors: 1) A number of new software requirements (gaps) have been identified from deploying to the first sites. These first deployments demonstrated the significant complexity of transitioning to STARS at large TRACONs which had not been considered with the original baseline and are critical for operational suitability; 2) In addition, the complexity of operations and over a decade of CARTS tailoring by sites was not understood and under-estimated; and 3) Costs were underestimated and not considered for support costs and site spares. During FY14, the JRC was notified of the current estimate to complete the program and in Aug-15, the JRC approved the BCD.
Terminal Automation Modernization and Replacement (TAMR), Phase 3, Segment 2 (P3 S2) ACAT 2	Sep-12	Aug-19	$462.5	Sep-12	Aug-19	$462.5	Aug-19	$505.7	Current Estimate vs Current Baseline: The cost increase of $43.2M (-9.3% variance) is associated with the impact of higher prime costs and a funding reduction in FY16, which may require additional funding to complete the program. The Program Office is reviewing the overall program and assessing potential mitigation actions to minimize the impact to the baseline. During FY14, the JRC was notified of the current estimate to complete the program and in Aug-15 the program provided the JRC with a status update.
Terminal Automation Modernization and Replacement (TAMR), Phase 1 Technology Refresh ACAT 2	Sep-12	Feb-20	$531.5	Sep-12	Feb-20	$531.5	Feb-20	$531.5	

FAA Capital Programs
Current Information for Major Programs

Programs	Original Baseline			Current Baseline			Current Estimate		Comments
	Original APB Date	Completion Date	Budget $M	Current APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
Time Based Flow Management (TBFM) WP3 ACAT 3NI	Apr-15	Sep-22	$188.3	Apr-15	Sep-22	$188.3	Sep-22	$188.3	NOTE: New Addition. Final Investment Decision (FID) approved by the Joint Resources Council (JRC) in Apr-15.
Wide Area Augmentation System (WAAS) Phase IV, Segment 1 - Dual Frequency Operations (DFO) ACAT 1	May-14	Sep-19	$603.2	May-14	Sep-19	$603.2	Sep-19	$603.2	

FAA Capital Programs
Major Programs with Completed Acquisition Phase

Programs	Original Baseline: Original APB Date	Original Baseline: Completion Date	Original Baseline: Budget $M	Current Baseline: Current APB Date	Current Baseline: Revised Completion Date	Current Baseline: Revised Budget $M	Actual Results: Completion Date	Actual Results: Budget $M	Comments
Collaborative Air Traffic Management Technologies (CATMT) Work Package 2 (WP2) ACAT 3	Sep-08	Sep-14	$109.5	Sep-08	Sep-14	$109.5	Mar-15	$107.7	Actual Result vs Current Baseline: Traffic Flow Management System (TFMS) Release 11, which included the Airborne Reroute (ABRR) functionality, was deployed nationally on March 29, 2015. This completed the deployment of the last piece of functionality encompassed by the CATMT WP2 program. The CATMT WP2 program completed with a 6 month schedule delay (-8.3% variance). The variance was due to the impact of Sequestration in March-April 2013 and the government shutdown that occurred October 2013, adversely affecting the execution of Operational Test (OT) for TFMS Release 8 resulting in a cascading effect on the development, testing and deployment of subsequent TFMS Releases.
En Route Automation Modernization (ERAM) ACAT 1	Jun-03	Dec-10	$2,154.6	Jun-11	Aug-14	$2,484.6	Mar-15	$2,579.7	Actual Result vs Current Baseline: The ERAM program declared Operational Readiness Date (ORD) at the last site (20th site), Washington ARTCC (ZDC) on March 27, 2015 completing the program. ERAM completed with a total cost increase of $95.1M (-3.8% variance) to the current baseline. $43.9M of the variance results from transfer of O&M funding to the F&E budget line to cover second level engineering costs. $51.2M of this variance is related to the schedule slip of 7 months due to sequestration. The impact of the sequestration in March 2013 which reduced funding in the F&E and Operations accounts severely impacted the availability of resources to support site teams from March 2013 to May 2013. Specific impacts were to Subject Matter Experts (SMEs), program overtime, and travel funding, as well as the inability to proceed with any material re-planning until these teams were allowed to resume their work which occurred in late May 2013. These impacts have resulted in a schedule delay of 7 months (-5.2% variance).

FAA Capital Programs
Major Programs with Completed Acquisition Phase

Programs	Original Baseline			Current Baseline			Actual Results		Comments
	Original APB Date	Completion Date	Budget $M	Current APB Date	Revised Completion Date	Revised Budget $M	Completion Date	Budget $M	
System Approach for Safety Oversight (SASO) Phase IIa ACAT 3	Sep-08	Sep-13	$88.0	Sep-13	Jan-16	$126.9	Dec-15	$126.9	Actual Result vs Current Baseline: The SASO Phase IIa achieved Initial Operational Capability (IOC) at Miami, the 100th and last site, on December 16, 2015 completing deployment of the Safety Assurance System (SAS).
System Wide Information Management (SWIM) Segment 1 ACAT 2	Jul-09	Sep-15	$310.2	Jul-12	Sep-15	$310.2	Sep-15	$305.4	Actual Result vs Current Baseline: The SWIM Flight Data Publication Service (SFDPS) became operational May 2015 followed by approval of the In-Service Decision (ISD) Authority in July 2015. Activities were then conducted to approve multiple External Consumers for the SFDPS data. The connection of these external customers to the SFDPS data in September 2015 represents the completion of the implementation of the last SWIM Segment 1 capability.

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 its capital programs. This latest CIP reflects a balanced investment approach to support continued funding for legacy equipment, facilities, and systems to sustain the current NAS infrastructure while continuing to fund the ongoing transition to NextGen. It provides an overview all of the capital programs needed to maintain and modernize the NAS to meet both the current and forecast demand for aviation services. NAS Enterprise Architecture Roadmaps, the links between the CIP programs and the EA were depicted on the road maps for each domain; Automation, Communication, Surveillance, Navigation, and Weather. The roadmaps covered all of the CIP programs that make up the heart of the NAS and showed each system, a timeline for each CIP program, and a brief description of the systems and programs below each roadmap. The development and implementation of NextGen is well underway and plan adjustments will be made for changes in forecasted demand, emerging technologies, and the availability of sufficient funding to complete the NextGen program as planned.

As we move forward with the implementation of new applications using proven technologies (e.g. ADS-B and Data Communications), we will have new capabilities for improved surveillance, more efficient flight paths, and expanded use of automated communications between controllers and pilots to execute routine commands. Further technology improvements may also accelerate the integration of Unmanned Aircraft Systems (UAS) into the NAS and improve the management of airspace impacted by commercial space operations. While overcoming obstacles has always been challenge towards accomplishing long-term goals, FAA's capital programs are continuing to deliver new capabilities and services to the aviation community and a promising future for the NAS.

11 Acronyms & Abbreviations

--Number--	
4D	four dimensions
4DT	four dimensional trajectory
--A--	
AA&C	arrivals, approach, and cruise
AAM	FAA Office of Aerospace Medicine
AAR	airport arrival rate
ABAAS	architectural barriers act accessibility standards
ABRR	airborne reroute execution
AC	advisory circular or air conditioning
ACAS X	airborne collision avoidance system X
ACAS Xp	airborne collision avoidance system - general aviation user class
ACAS Xu	airborne collision avoidance system - UAS user class
ACE-IDS	automated surface observing system controller equipment-information display system
ACEPS	ARTCC critical and essential power systems
ACM	asbestos contaminated materials
ACS	aeronautical common services
ADA	Americans with Disabilities Act
ADAS	AWOS (automated weather observing system) data acquisition system
ADD	algorithm design description or airworthiness directives development
ADS-B	automatic dependent surveillance-broadcast
ADS-C	automatic dependent surveillance-contract
ADSIM+	airfield delay simulation model
AEB	ASIAS executive board
AEFS	advanced electronic flight strip system
AeroMACS	aeronautical mobile airport communications system
AeroNav	aeronautical navigation
AES	alternative energy systems
AFIS	automatic flight inspection system
AFS	FAA Fight 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
AGIS	airport geographic information system
AGL	above ground level
AI	aeronautical information
A-IM	advanced-IM (interval management)
AIM	aeronautical information management
AIMM	aeronautical information management modernization
AIR	FAA Aircraft Certification Service
AirNav	airports and navigations aids database
AISR	aeronautical information system replacement
AIXM	aeronautical information exchange model

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
AMSIS	aerospace medicine safety information system
ANF	air navigation facilities
ANICS	Alaskan national airspace system inter-facility communications system
ANSP	air navigation service provider
AOCC	Atlantic operations control center
APB	acquisition program baseline
APNT	alternate positioning navigation and timing system
APT	advanced persistent threat
APTS	automated process tracking system
APWS	AeroNav products workflow system
ARAIM	advanced receiver autonomous integrity monitoring
ARB	airmen records building
ARE	aircraft and related equipment
ARMS	airspace resource management system
ARMT	airport 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/IIE/IIIE	automated radar terminal system models IE, IIE, or IIIE
ASAS	aviation safety analysis system
ASDE-X	airport surface detection equipment model x
ASIAS	aviation safety information analysis and sharing
ASKME	aviation system 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
ASHRAE	American society of heating, refrigerating, and air-conditioning engineers
ASSC	airport surface surveillance capability
AST	FAA Office of Commercial Space Transportation
ASTERIX	all-purpose structure Eurocontrol radar information exchange
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	NASA airspace technology demonstration or anthropometric test device

ATD-2	NASA airspace technology demonstration-2
ATDP	advanced technology development and prototyping
ATFM	applied traffic flow management
ATIS	automated terminal information service
ATM	air traffic management
ATN	aeronautical telecommunication network or aviation training network
ATO	Air Traffic Organization
ATOP	advanced technologies and oceanic procedures
ATPA	automated terminal proximity alert
ATPA-P2	automated terminal proximity alert phase 2
ATTIK	ASIAS tagging, tracking, and integration of knowledge
AURS	advanced unmanned aircraft system research simulator
AVN	Aviation System Standards
AVS	FAA Office of Aviation Safety
AWDs	aviation weather displays
AWDE	aviation weather development and evaluation
AWI	ATM weather integration
AWOS	automated weather observing system
AWRT	aviation weather research team
AWSS	automated weather sensor systems
--B--	
BADA	base of aircraft data
BCAR	business case analysis report
BCD	baseline change decision
BLI	budget line item
BPM	business process management
BUEC	back up emergency communication
BVR	beacon video reconstitutor
BWM	bandwidth manager
--C--	
CA	conflict alert
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	commercially available software or collision avoidance system
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
CAVS	cockpit display of traffic information assisted visual separation
CCF	combined control facility
CCS	conference control switch
CD2	common digitizer format (version 2)

CDM	collaborative decision making or continuous diagnostics and mitigation
CDR	critical design review
CDTI	cockpit display of traffic information
CEA	compliance and enforcement actions
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
CFO	Chief Financial Officer
CFR	code of federal regulations
CINP	communication, information & network programs
CIO	Chief Information Officer
CIP	capital investment plan
CIWS	corridor integrated weather system
CM	configuration management
CMA	configuration management automation
CMC	corrective maintenance contract
CNS	communications, navigation and surveillance
COAs	certificates of authorizations
ConOps	concept of operations
COMSEC	secure communications
CONUS	continental United States
COO	certificate of occupancy or chief operating officer
COTS	Commercial-off-the-shelf
CPDLC	controller-pilot data link communications
CPDS	critical power distribution system
CRA	conflict resolution advisory
CRD	concept and requirements definition
CRDRD	concept and requirements definition readiness decision
CSPO	closely spaced parallel runway operations
CSPR	closely spaced parallel runways
CSSD	common status and structure data
CSG	CDM stakeholders group
CST	communication support team
CSS	common support services
CSS-Wx	common support services – weather
CTS	coded time source
CWP	corporate work plan
--D--	
DA	decision altitude
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

DCE	data communications equipment
DCIS	data communications integrated services
DCL	departure clearance
DCNS	data communications network service (air/ground)
DDCS	direct digital control systems
DELPHI	DOT accounting system
DFO	dual frequency operations
DH	decision height
DHS	Department of Homeland Security
DLP	distance learning platform
DME	distance measuring equipment
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
DPs	departure procedures
DR	data repository
DRSR	digital remote surveillance communication interface processor replacement
D side	data controller position
DSP	departure spacing program
DSR	display system replacement
DSTs	decision support tools
DT	development test
DUATS	direct user access terminal system
DVOR	Doppler VOR
DVARS	data visualization and reporting system
--E--	
EA	enterprise architecture
ECG	en route communication gateway
EDDA	environmental due diligence audits
EDMS	electronics drawing management system
eFAROS	enhanced final approach runway occupancy signal
EFD	electronic flight data
EFS	electronic file system
EFSTS	electronic flight strip transfer system
EG	engine generator
E-IDS	enterprise information display system
EISA	Energy Independence and Security Act of 2007
ELD	electrical line distribution
ELITE	enhanced local integrated tower equipment
ELVO	enhanced low visibility operations
EMC	energy management and compliance
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
EPACT	Energy Policy Act of 2005
ER	environmental remediation
ERAM	en route automation modernization
ERIDS	en route information display system
ERMS	environmental remote monitoring system
ERP	enterprise resource planning
E-Scan	electronic scan version of PRM (precision runway monitor)
ESCR	environmental site cleanup report
ESD	electrostatic discharge
ESM	enterprise service monitoring
ESSC	enhanced service small communities
ETR	emergency transmitter replacement
ETVS	enhanced terminal voice switch
EUROCONTROL	European Organization for the Safety of Air Navigation
EV	enhanced vision
EVS	enhance vision systems
--F--	
FAA	Federal Aviation Administration
FAALC	FAA Logistics Center
FAE	FAA acquisition executive
FANS	future air navigation system
FAST	FAA acquisition system toolset
FBW	fly by wire
FCD	federal continuity directive
FCI	facility condition index
FCT	federal contract tower
FDIO	flight data input/output
FDP2K	flight data processing 2000
F&E	facilities and equipment
FFRDC	federally funded research and development center
FFSP	future flight service program
FI	flight inspection
FICAM	federal identify credential and access management
FID	final investment decision
FIDI	flight and interfacility data interface
FIM	flight interval management
FIXM	flight information exchange model
FMS	flight management system
FNS	federal NOTAM system
FOC	flight operations center or final operational capability
FOMS	flight operations management system
FOQA	flight operation quality assurance
FOTT	fiber optic tie trunk
FOXS	flight object exchange service
FPPS	facility power panel schedule

fPRD	final program requirements document
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
FY	fiscal year
--G--	
GA	general aviation
GA-JSC	GA-joint steering committee
GAO	Government Accountability Office
GATTOR	general air traffic and technical operations research
GBAS	ground based augmentation system
GC	gas chromatograph
GDP	gross domestic product
GEO	geostationary communication satellite
G/G	ground to ground
GIM-S	ground based interval management-spacing
GIS	geographic information system
GLS	GPS landing system
GNAS	general national air space system
GNSS	global navigation satellite system or service
GPS	global positioning system
GPS-II or III	GPS 2nd and 3rd generation satellites
GSA	General Services Administration
GUI	graphical user interface
GUS	ground uplink station
--H--	
HADDS	HOST ATM data distribution system
HAZMAT	hazardous materials
HF	high frequency
HGOPA	high gain open planar array
HITL	human-in-the-loop
HOST	Host Computer System IBM Model 3725
HPSB	high performance sustainable building
HSDN	Homeland Security data network
HSPD	Homeland Security Presidential Directive
HUD	heads up display
HVAC	heating, ventilating and air conditioning
--I--	
IAM	identity and access management
IAP	investment analysis plan
IAPs	instrument approach procedures
IARD	investment analysis readiness decision

IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDEA	aviation integrated demonstration & experimentation for aeronautics
IDAC	integrated departure/arrival capability
IDAT	interfacility data transfer
IDLM	interference detection, location and mitigation
IDS	integrated display systems
IDP	improving demand predictions
IDRP	integrated departure route planner
IDS	integrated display system
IER	independent evaluation review
IESP	integrated enterprise service platform
IFP	instrument flight procedures
IFPA	instrument flight procedures automation
IFR	instrument flight rules
IID	initial investment decision
ILS	instrument landing system
IM	interval management
IMC	instrument meteorological conditions
IMRO	improved multiple runway operations
IM-S	interval management spacing
INDP	integrated NAS design and procedure planning
IOA	independent operational assessment
IOC	initial operating capability
IP	internet protocol
IPDS	instrument procedure development system
iPR	initial program requirements
iPRD	initial program requirements document
IRU	inertial reference unit
ISAM	integrated safety assessment model
ISD	in-service decision
ISO	International Standards Organization
IS&P	information security & privacy
ISPD	implementation strategy and planning document
ISR	in-service review
IT	information technology
ITP	in trail procedures
ITWS	integrated terminal weather system
IVSR	interim voice switch replacement
IWAFs	icing weather avoidance fields
--J--	
JAWS	Juneau airport wind system
JRC	joint resources council
--K--	
KCRT	keyboard cathode ray tube
KVM	kinetic vertical modeling or keyboard/video/mouse

--L--	
L1 C/A	GPS legacy civil frequency
L5	GPS second civil frequency
LAHSO	land and hold short operations
LAN	local area network
L-band	frequency range from 1-2 gigahertz
LCD	liquid crystal display
LC-HFDM	low-cost helicopter flight data monitoring
LCGS	low cost ground surveillance
LCSS	logistical center support system
LDACS	L-band digital aeronautical communication system
LDRCL	low-density radio communication link
LED	light emitting diode
LIDAR	light detection and ranging
LITE	local integrated tower equipment
LLWAS	low-level wind shear alert system
LOA	letters of agreement
LOB	FAA lines of business
LP	localizer performance
LPGBS	lightning protection, grounding, bonding, and shielding
LPV/LP	localizer performance with vertical guidance
LRR	long range radar
LRUs	lowest replaceable units
LSS	logistics support services
LSSF	logistics support system and facilities
--M--	
MADC	mobile asset deployment center
MALSR	medium-intensity approach light system with runway alignment indicator lights
MAMP	mobile asset management program
MASR	mobile airport surveillance radar
MATCT	mobile air traffic control tower
MAX	mobile asset exchange tool
M&C	monitor and control
MCC	motor control center
MDRs	multimode digital radios
mDAS	miniature data acquisition system
MEARTS	microprocessor en route automated radar tracking system
MET	meteorological
mGC	micro gas chromatograph
MicroEARTS	microprocessor en route automated radar tracking system
MIT/LL	Massachusetts Institute of Technology Lincoln Laboratory
MMAC	Mike Monroney Aeronautical Center
MOA	memorandum of agreement
MOCC	mid-states operations control center
Mode S	mode select
MOIE	mission oriented investigation and experimentation
MON	minimum operational network
MOPS	minimum operational performance standards

MPAR	multi-function phased array radar
M&S	Modeling and simulation
MSAW	minimum safe altitude warning
MSN	message switching network
MSSR	monopulse secondary surveillance radar
MTRs	military training routes
MX	mobile engine generator
--N--	
NADIN PSN	national airspace data interchange network – package switching network
NAFIS	next generation automated flight inspection system
NAIMES	NAS aeronautical information enterprise system
NAP	needs assessment program
NARP	national aviation research plan
NAS	national airspace system
NASA	National Aeronautics and Space Administration
NASDOC	national airspace system document
NASE	NAS adaptation services environment
NAS EA	NAS enterprise architecture
NASPAC	national airspace system performance analysis capability
NASR	national airspace system resources
NAVAIDS	navigation aids
NAV Lean	streamlined process to request, develop, and implement instrument flight procedures
NBSC	NextGen backup surveillance capability
NCAR	National Center for Atmospheric Research
NCO	National Coordination Office
NCP	NAS change proposal
NCR	NAS common reference
NEMC	network enterprise management center
NEMS	NAS enterprise messaging service
NESG	NAS enterprise security gateway
NetCDF	network common data form
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
NLN	national logging network
NMCS	network management control system
NM	nautical mile (6,076 ft.)
NME	navaids monitoring equipment
NNE	NextGen navigation engineering
NOAA	National Oceanic and Atmospheric Administration
NOCC	national operations control center
NOP	national offload program
NOTAM	notice to airmen
NPI	NEXRAD product improvement

NPN	NextGen prototyping network
NPS	NextGen performance snapshots
NRN	national remote maintenance monitoring network
NSG	navigation service group
NSIP	NAS segment implementation plan
NSOS	national security officer services
NSPD-39	National Security Presidential Directive 39
NSWRC	next generation surveillance and weather radar capability
NTEP	national test equipment program
NTML	national traffic management log
NTSB	National Transportation Safety Board
NTP	network time protocol
NVMEM	non-volatile memory
NVRP	NAS voice recorder program
NVS	national airspace system voice system
NWP	NextGen weather processor
NWS	National Weather Service
--O--	
OA	operational analysis
OAPM	optimization of airspace and procedures in the metroplex
OARS	operational analysis and reporting system
OAS	oceanic automation system
OASIS	operational and supportability implementation system
OCX	modernized operational control segment
ODS	operational data services
OE	obstacle evaluation
OEAAA	obstruction evaluation/airport airspace analysis
OFDPS	offshore flight data processing system
OIs	operational improvements
OIS	operational information system
O&M	operations and maintenance
OMB	Office of Management and Budget
OMT	operator maintenance terminal
OPDs	optimized profile descents
OPIP	operational internet protocol network
OPS	operations
OPSNET	operations network
ORD	operational readiness demonstration
O/S or OS	operating system
OSA	operational safety assessment
OSHA	Occupational Safety and Health Administration
OSI	organization success indicators
OT	operational test or testing
OT&E	operational test and evaluation
OTM-4D	oceanic trajectory management in four dimensions
OTTM	oceanic tactical trajectory management
--P--	

PA	paired approach
PAF	primary alternate facility
PAPI	precision approach path indicator
PBCS	performance-based communication and surveillance
PBN	performance based navigation
PBWP	product-based work plan
PCB	polychlorinated biphenyl
PCPS	purchase card processing system
PCS	power conditioning system
PDARS	performance data analysis and reporting system
PDR	preliminary design review
PIR	post implementation review
PIREPS	pilot reports
PIV	personal identification verification
PKI	private key infrastructure
PLA	program level agreement
PLM	programming language for microcomputers
PMO	program management office
PNT	position, navigation and timing
POCC	pacific operations control center
PPD-21	presidential policy directive-21
pPR	preliminary program requirements
PRISM	procurement information system for management
PRM	precision runway monitor
PRM-E	precision runway monitor – electronic scan radar
PS3	power systems sustained support
PTM	pairwise trajectory management
--Q--	
QA	quality assurance
QC	quality control
--R--	
RAs	resolution advisories
R2O	Nextgen research-to-operations
RAPCON	radar approach control
RAPPI	random access plan position indicator
RCAG	remote communication air/ground
RCAS	Roll Control Alerting System
RCE	radio control equipment
RCFs	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
RCM	reliability centered maintenance
RCOM	recovery communications
RCRA	resource conservation and recovery act
R&D	research and development

RDAP	radar data access point
RDP	radar data processor
RDVS	rapid deployment voice switch
REIL	runway end identifier lights
RepCON	replacement documentation and configuration identification system
RFI	radio frequency interference
RFU	radio frequency uplink
RHL	Red Hat Linux
RHWAC	regional hazardous weather advisory center
RI	runway incursion
RIRP	runway incursion reduction program
RIT	radar intelligent tool
RMLS	remote monitoring and logging system
RLMS	replacement lamp monitoring system
RMM	remote maintenance monitoring
RMP	resource and management plan
RNAV	area navigation
RNP	required navigation performance
ROC	radar operations center
ROS	reduced oceanic separation
RPA	remotely piloted aircraft
RPDs	resource planning documents
RPMs	revenue passenger miles
RRM	release of radioactive material
RSA	runway safety area or assessment
R-side	radar controller position
RTCA	Radio Technical Commission for Aeronautics, Inc.
RTF	radar training facility
RTP	resource tracking program
RTR	remote transmitter/receiver
RVR	runway visual range
RVSM	reduced vertical separation minimum
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
SAN	storage area network
SARA	Superfund Amendment and Reauthorization Act of 1986
SARPs	standards and recommended practices
SAS	safety assurance system
SASE	special automation system engineering
SASP	separation and airspace safety panel
SASS	small airport surveillance sensor
SASO	system approach for safety oversight

SAT	site acceptance test
SAWS	standalone weather sensors
SBAS	satellite based augmentation system
SBS	surveillance and broadcast service
SCDI	site control data interface
SCM	surface conformance monitoring
SDAT	sector design and analysis tool
SDD	software design document
SE2020	systems engineering 2020 contract
SE2025	systems engineering 2025 contract
SEP	systems engineering portal
SESAR	Single European Sky ATM Research
SFMA	strategic flow management application
SFMEE	strategic flow management engineering enhancement
SG	service group
SGS	surveillance gateway system
SIDs	standard instrument departures
SIGGEN	signal generator
SIIA	simultaneous independent instrument approach
SIM	surveillance interface modernization
SIR	screening information request
SLA	service level agreement
SLEP	service life extension program
SMA	surface movement advisor
SMS	Safety or Surface management system
SNMP	simple network management protocol
SOA	service oriented architecture
SOC	security operations center
SOP	standard operating procedures
SPIRE	simplified program information reporting and evaluation
SPO	safety policy
SPR	safety promotion
SPS	standard positioning service
SRM	safety risk management
SRMTS	safety risk management tracking system
SRR	system requirements review
SRS	software requirements specifications
SSCs	system support centers
SSD	system specification document
SSDI	system security design and integration
SSMT	systems safety management transformation
SSPP	strategic sustainability performance plan
SSS	system segment specification
STARS	standard terminal automation replacement system
STARS E/L	STARS enhanced local integrated tower equipment/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 (roadmaps)
SUA	special use airspace
sUAS	small UAS (unmanned aircraft system)
SV	service volume
SVT	SWIM visualization tool
SWAC	system-wide analysis capability
SWIM	system wide information management
SWx	annex 3 for space weather
--T--	
TACAN	tactical air navigation antenna
TAGARS	technically advanced general aviation research simulator
TAMR	terminal automation modernization replacement
TARGETS	terminal area route generation and traffic simulation
TAWS	terrain awareness warning system
TBFM	time based flow management
TBM	time based metering
TBO	trajectory based operations
TCAS II	traffic alert and collision avoidance system II
TCS	terrestrial communication subsystem
TDLS	tower data link service
TDM	time division multiplex
TDWR	terminal Doppler weather radar
TE	threshold event
TechNET	technicians network
Tech Ops	Technical Operations Services
TFDM	terminal flight data manager
TFM	traffic flow management
TFMS	traffic flow management system
TFR	temporary flight restrictions
TFR Bldr	temporary flight restriction builder
TMA	traffic management advisor
TMC	traffic management coordinator
TMI	traffic management initiative
TMUs	traffic management units
TPC	TFM production center
TRACON	terminal radar approach control
TRR	test readiness review
TRS	traffic flow management infrastructure field/remote site
TSAS	terminal sequencing and spacing
TSD	traffic situation display
TSO	technical standard order
TSS	tower simulation system
TSSC	technical support services contract
TVSR	terminal voice switch replacement
TWAFs	turbulence weather avoidance fields

--U--	
UAS	unmanned aircraft systems
UATR	universal access transceiver receiver
UFPF	unified flight planning and filing service
UHF	ultra high frequency
UIS	unstaffed infrastructure sustainment
UPS	uninterruptible power supply
URET	user request evaluation tool
USGCB	United States government configuration baseline
USNS	United States NOTAM (notice to airmen) system
UV/VAS	ultraviolet and visible absorption spectroscopy
--V--	
VA	volcanic ash
VASI	visual approach slope indicator
VDL	VHF data link
VHF	very high frequency
VIDS	visual information display system
VLAN	virtual local area network
VMC	visual meteorological conditions
VoIP	voice over internet protocol
VOR	very high frequency omnidirectional range
VORTAC	very high frequency omnidirectional range collocated with tactical air navigation
VPN	virtual private network
VQ	variable quantity
VRRP	voice recorder replacement program
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
WCS	web coverage service
WDS	windshear detection service
WebCM	web configuration management
WID	wireless intrusion detection
WiWaves	wind and wave evacuation & survival
WFI	weather forecast improvements
WFS	web feature service
WJHTC	William J. Hughes Technical Center
WME	wind measuring equipment
WMS	web map service or WAAS master station

WMSCR	weather message switching center replacement
WP1, 4, 5	work package 1, 4, or 5
WSDD	web service description documents
WSDS	wind shear detection services
WSP	weather systems processor
WSRF	water survival research facility
WSS	wind shear services
WTMA	wake turbulence mitigation for arrivals
WTMA-P	wake turbulence mitigation for arrivals - procedural
WTMA-S	wake turbulence mitigation for arrivals - system
WTS-BMgmt	work tracking software – budget management
Wx	weather
WXXM	weather information exchange model
–X–	
Xp	ACAS-X user class symbol for GA
XR	Input/output interface for Boeing flight simulator
Xu	ACAS-X user class symbol for UAS
–Y–	
–Z–	

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Capital Investment Plan

Appendix A

Fiscal Years 2017 – 2021

APPENDIX A

ALIGNMENT OF PROGRAMS TO STRATEGIC PRIORITIES

The Federal Aviation Administration (FAA) Administrator, in February 2014, established a new 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) 2017-2021 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 2017 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 2017 President's Budget, but future funding is planned within the FY 2018-2021 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."

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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 2017 BLI	CIP #	CIP Name
1A07B	G05A.02-01	Common Status & Structure Data
2A13	W05.03-01	Wind Shear Detection Services – Work Package 1
2A18	M54.01-01	Airborne Collision Avoidance System X (ACAS X) – Segment 1
2B19	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
2E03B	M12.01-04	NextGen Flight Simulation Testing and Research Technologies (Flight START) – Technology Refresh Program – Additional Projects
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
3A07	A26.01-01	Aviation Safety Knowledge Management Environment (ASKME) – Segment 2
3A08	M53.01-02	Aerospace Medical Equipment Needs (AMEN) – Phase 2
3A08X	M53.01-03	Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Phase 3
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
Multiple	M25.00-00	Independent Operational Assessment (IOA)

– **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 2017 BLI	CIP #	CIP Name
2C02	A34.01-01	Future Flight Services Program
2C04	M08.31-02	Weather Camera Program – Future Segments
2D03A	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
6A01B	N12.01-09	Wide Area Augmentation System (WAAS) – Phase IV Segment 1 Sustain Leased Services
6A01X	N12.01-10	Wide Area Augmentation System (WAAS) – Phase IV Segment 2 Sustain Leased Services

- **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 2017 BLI	CIP #	CIP Name
2A05C	M55.01-01	Commercial Space Integration Into The NAS

- **Performance Metric 4:** Reduce Category A & B (most serious) runway incursions to a rate of no more than 0.395 per million operations, and maintain or improve through FY 2018.

FY 2017 BLI	CIP #	CIP Name
1A01A	S09.02-00	Runway Incursion Reduction Program (RIRP) – ATDP
2B01	S09.01-01	Airport Surface Detection Equipment Model-X (ASDE-X) –Technology Refresh & Disposition
2B12	S11.01-02	Runway Status Lights (RWSL) – Implementation – Phase 1
2B12X	S11.01-04	Runway Status Lights (RWSL) – Technology Refresh & Disposition

- **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.

FY 2017 BLI	CIP #	CIP Name
1A01F	M08.32-03	Operational Analysis and Reporting System (OARS)
1A05H	G02S.04-01	Reduced Oceanic Separation
2A09C	A10.06-01	Oceanic Separation Standards Dvelopment and Analysis

- **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.

FY 2017 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 2017 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 2017 BLI	CIP #	CIP Name
1A05C	G06A.01-06	Alternative Positioning, Navigation, and Timing (APNT)
2A01A	G01A.01-10	En Route Automation Modernization (ERAM) Technology Refresh
2A02	A01.12-02	En Route Communication Gateway (ECG) – Technology Refresh
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
2A04	F06.01-00	Air Route Traffic Control Center (ARTCC) & Combined Control Facility (CCF) Building Improvements
2A06	C04.01-01	Radio Control Equipment (RCE) – Sustainment
2A06	C06.01-00	Communications Facilities Enhancement (CFE) – 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) – Technology Refresh
2A10	C21.02-01	Next-Generation VHF and UHF A/G Communication System (NEXCOM) – Segment 2 – Phase 1 of 2
2A10X	C21.02-02	Next-Generation VHF and UHF A/G Communication System (NEXCOM) – Segment 2 – Phase 2 of 2
2A13X	W10.01-02	Juneau Airport Wind System (JAWS) – Technology Refresh
2A16	S02.03-03	ATC Beacon Interrogator Model-6 (ATCBI-6) – Technology Refresh
2A20	A38.01-01	Offshore Automation
2B02	W03.03-02	Terminal Doppler Weather Radar (TDWR) – Service Life Extension Program (SLEP) – Phase 2
2B03	A04.01-01	Standard Terminal Automation Replacement System (STARS) – Technology Refresh (TAMR Phase 1)
2B03X	A04.01-03	Standard Terminal Automation Replacement System (STARS) – Infrastructure Modernization Program
2B05A	A01.11-01	Flight Data Input/Output (FDIO) Replacement
2B06	F01.02-00	Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Replacement
2B07A	F01.01-00	Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization
2B08	C05.02-00	Terminal Voice Switch Replacement (TVSR) II
2B10	S03.01-09	Airport Surveillance Radar Model-9 (ASR-9) Service Life Extension Program

FY 2017 BLI	CIP #	CIP Name
		(SLEP), Phase 2
2B11A	S03.02-05	Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 2
2B11B	S03.02-06	Airport Surveillance Radar Model-11 (ASR-11) – Mobile Airport Surveillance Radar (MASR)
2B11X	S03.02-07	Airport Surveillance Radar Model-11 (ASR-11) – Technology Refresh, Segment 3
2B14A	A03.05-01	Integrated Display Systems (IDS) – Replacement
2B14	A03.05-02	Integrated Display Systems (IDS) – Replacement – Technology Refresh
2B15	M07.04-02	Remote Monitoring and Logging System (RMLS) – Technology Refresh
2B15X	M07.05-01	Automated Maintenance Management System (AMMS)
2B16A	S03.01-08	Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2
2B16B	S03.01-11	Airport Surveillance Radar Model-9 (ASR-9) and Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3 Planning
2B17	S13.01-01	Surveillance Interface Modernization (SIM)
2B20	W07.01-02	Integrated Terminal Weather System (ITWS) – Sustainment & Disposition
2B22	G08A.01-01	Flight and Interfacility Data Interfaces (FIDI) – Phase 1, Segments 1 & 2
2C01	W01.03-01	Aviation Surface Weather Observation Network (ASWON) – Technology Refresh
2C03	F05.04-02	Alaska Flight Service Facility Modernization (AFSFM)
2D01A	N06.00-00	Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC)
2D04A	N08.02-00	Runway Visual Range (RVR) – Replacement/Establishment
2D09	N04.04-00	Navaids – Sustain, Replace, Relocate
2D12	M08.41-02	NAVAIDS Monitoring Equipment
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)
2E07	F11.01-01	Power Systems Sustained Support (PS3)
2E07X	F11.01-02	Power Systems Sustained Support (PS3) – Future Segments
3A04	F24.01-02	Facility Security Risk Management (FSRM) – Two
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) – Technology Refresh
Multiple	M08.49-01	NAS Resiliency Assessment

– **Performance Metric 2:** Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures.

FY 2017 BLI	CIP #	CIP Name
1A01B	M08.29-00	Operations Concept Validation and Infrastructure Evolution – ATDP
1A01C	M08.28-04	Major Airspace Redesign – ATDP
1A01D	M46.01-01	Strategy and Evaluation – ATDP
1A01G	A37.01-01	Operations Network (OPSNET) Replacement – ATDP
1A01H	M52.01-01	Operational Modeling Analysis and Data
1A05A	G01S.02-01	Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management
1A05B	G01A.01-01	Modern Procedures
1A05D	G06M.02-02	Wake Turbulence Re-Categorization
1A05E	G01A.02-02	Oceanic Tactical Trajectory Management
1A05G	G01M.02-04	Separation Managemnt Concepts & Analysis
1A05I	G01A.01-06	Separation Automation System Engineering
1A05X	G01A.01-07	NextGen Oceanic Capabilities
1A05X	G01A.02-03	Conflict Advisories
1A06	G02A.01-01	Surface Tactical Flow
1A06X	G02A.01-02	Surface Conformance Monitoring
1A07A	G05A.02-03	Flight Object
1A07C	G05A.02-08	Flight Object Exchange Services (FOXS)
1A07D	G05A.04-01	Dynamic Airspace
1A07E	G05A.02-02	Advanced Methods
1A08A	G06A.01-02	Wake Turbulence Mitigation for Arrivals (WTMA)
1A08B	G06N.01-02	Closely Spaced Parallel Runway Operations
1A09A	G04W.02-01	Weather Observation Improvements
1A098B	G04W.03-01	Weather Forecast Improvements – Work Package 1
1A09C	G06N.01-03	NextGen Navigation Engineering
1A09D	G01M.02-02	New Air Traffic Management (ATM) Requirements
1A09E	G06A.02-01	Surface/Tower/Terminal Systems Engineering
1A09F	G01N.01-02	NextGen Distance Measuring Equipment (DME) Support For Performanced Based Navigation (PBN) Strategy
1A09G	G05M.03-01	Information Management
1A11B	G05A.02-04	Concept Development for Integrated NAS Design & Procedure Planning
2A01B	G01A.01-04	En Route Automation Modernization (ERAM) Sector Enhancements
2A05B	A05.01-14	Traffic Flow Management (TFM) Infrastructure – TFM Service Enhancements
2A11A	G05C.01-06	System Wide Information Management (SWIM) – Common Support Services Weather (CSS-Wx) Work Package 1
2A12B	G02S.01-02	Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Future Segments
2A14A	G05A.01-01	Strategic Flow Management Application
2A14B	G05A.01-02	Strategic Flow Management Engineering Enhancement (SFMEE)
2A15	G02A.01-06	Time Based Flow Management (TBFM) Work Package 3
2A15	G02A.01-07	Time Based Flow Management (TBFM) Technology Refresh

FY 2017 BLI	CIP #	CIP Name
2A15	G02A.01-08	Time Based Flow Management (TBFM) Work Package 4
2A19	G01C.01-05	Data Communications – Segment 1 Phase 1
2A19	G01C.01-06	Data Communications – Segment 1 Phase 2 Initial En Route Services
2A19	G01C.01-10	Data Communications – Segment 1 Phase 2 Full En Route Services
2A19X	G01C.01-07	Data Communications – Segment 1 Phase 1 & 2 Data Comm Integrated Services (DCIS) Network Services
2A19X	G01C.01-08	Data Communications – Aeronautical Telecommunications Network (ATN) Gateway
2A19X	G01C.01-09	Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application
2B04A	A04.07-01	Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 1
2B04B	A04.07-02	Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2
2B04C	A04.07-04	Terminal Automation Modernization – Replacement (TAMR) – Post Operational Readiness Demonstration (ORD) Enhancements
2B05B	A04.08-01	Terminal Work Package 1
2B13	G03C.01-01	NAS Voice System (NVS) – Demonstration & Qualification
2B13X	G03C.01-02	NAS Voice System (NVS) – Deployment
2B14B	A03.05-03	Enterprise Information Display System (E-IDS)
2B18	G06A.03-01	Terminal Flight Data Manager (TFDM) – Segment 1
2D02	N03.01-00	Instrument Landing Systems (ILS)
2D03B	N12.03-01	Global Positioning System (GPS) Civil Requirements
2D04B	N08.03-01	Enhanced Low Visibility Operations (ELVO) – Phase II
2D06	N09.00-00	Sustain Distance Measuring Equipment (DME)
2E11	M08.28-00	System Capacity, Planning, and Improvements – ATDP

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

FY 2017 BLI	CIP #	CIP Name
1A07X	G05A.02-09	Airspace Resource Management System (ARMS)
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 Service Enhancements
2A12A	G02S.03-01	Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume)
2A12X	G02S.03-04	Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications, Future Segments
2A14C	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
2A17	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

FY 2017 BLI	CIP #	CIP Name
6A01A	G02S.03-05	Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services

– **Performance Metric 4:** The U.S. population exposed to significant aircraft noise around airports has been reduced to less than 328,000 persons by 2015.

FY 2017 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 2017 BLI	CIP #	CIP Name
2A09X	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 2017 BLI	CIP #	CIP Name
1A11A	G05N.01-01	NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP)
1A11X	G05N.01-03	NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP) - Future Plans
2D01B	N06.01-01	Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program

– **Performance Metric 7:** Achieve documented cost savings and cost avoidance of $50.27 million in FY 2016.

FY 2017 BLI	CIP #	CIP Name
1A02 / 1A03	F14.00-00	William J. Hughes Technical Center Laboratories & William J. Hughes Technical Center Laboratory Systainment
1A04	F16.00-00	William J. Hughes Technical Center Building and Plan Support
1A06X	G03M.04-02	Enhanced Service Small Communities (ESSC)
1A10	G03M.02-01	NextGen Laboratories
2A11B	G05C.01-08	System Wide Information Management (SWIM) – Segment 2B
2B07B	F02.10-01	Facility Realignment Planning
2B07X	F02.10-02	Facility Realignment Implementation
2B21A	S14.01-01	Next Generation Surveillance & Weather Radar Capability (NSWRC)
2B21B	S15.01-01	Next Generation Backup Surveillance Capability (NBSC)
2D08	A14.02-02	Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 1
2D08	A14.02-03	Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 2
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

FY 2017 BLI	CIP #	CIP Name
3A01	F13.02-00	Environmental Cleanup / Hazardous Materials (HAZMAT)
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 – SE2020
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 2016. (FAA Business Planning Metric)

FY 2017 BLI	CIP #	CIP Name
1A01E	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 2017 BLI	CIP #	CIP Name
1A05F	G01A.01-09	Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development

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 2017 BLI	CIP #	CIP Name
2B09	F13.03-00	NAS Facilities Occupational Safety and Health Administration (OSHA) & Environmental Standards Compliance

– **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 2017 BLI	CIP #	CIP Name
2E09	F22.01-01	Child Care Centers – Infrastructure Improvements
4A03	M05.00-00	NAS Regional/Center Logistics Support Services

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Appendix B

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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 2017 President's Budget Request. Budget Activities group together budget line items (BLI) with similar objectives. There are 6 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 subscription 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 2017, 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

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ACTIVITY 1: ENGINEERING, DEVELOPMENT, TEST, AND EVALUATION

1A01, ADVANCED TECHNOLOGY DEVELOPMENT AND PROTOTYPING (ATDP)

FY 2017 Request $24.8M

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

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 direct safety indications and alerts to pilots at large airports, as well as, those that can be applied cost effectively at small to medium airports. The program will test alternative airport surface detection technology 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 (RSA) studies, Enhanced Final Approach Runway Occupancy Signal (eFAROS) evaluations, and the removal of the Low Cost Ground Surveillance (LCGS) 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 0.395 per million operations, and maintain or improve through FY 2018.*

Relationship to Performance Metric

The program is developing and testing technologies that provide direct and preventive alerts to pilots and vehicle operators to reduce both the frequency and 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 Runway Status Lights (RWSL) technology have yielded a reduction in runway incursions of up to 70% at the test runways. Other RIRP technology development initiatives will explore other technologies that further support the performance metric.

Program Plans FY 2017 – Performance Output Goals
- Complete annual technical and operational evaluation report of existing RIRP prototype systems.
- Complete annual report documenting results of human-in-the-loop (HITL) testing Human Factors (HF), safety logic, aircraft performance, or any uncertainty or deficiency pertaining to surface based Runway Incursion (RI) indications.
- Complete annual report on testing of safety logic enhancements to RI detection and prevention products.
- Complete report documenting candidate site selection for a system to test the utilization of a SASS as a sensor to drive the activation of direct to pilot alerting safety logic.
- Complete report on integration of a system to test the utilization of a SASS as a sensor to drive the activation of direct to pilot alerting safety logic.
- Publish the initial Project Plan and Resource Management Plan (RMP) for the utilization of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.

Program Plans FY 2018 – Performance Output Goals
- Complete annual technical and operational evaluation report of existing RIRP prototype systems.
- 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 on testing of safety logic enhancements to RI detection and prevention products.
- Complete report on results of initial shadow operations testing for the utilization of a SASS as a sensor to drive the activation of direct to pilot alerting safety logic.
- Complete report documenting 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 annual technical and operational evaluation report of existing RIRP prototype systems.
- 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 on testing of safety logic enhancements to RI detection and prevention products.
- Complete annual report documenting results of using a SASS 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.
- Complete preliminary report on Digital-Lighting Application (surveillance integration).

Program Plans FY 2020 – Performance Output Goals
- Complete annual technical and operational evaluation report of existing RIRP prototype systems.
- 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 on testing of safety logic enhancements to RI detection and prevention products.
- Complete annual report documenting results of using a SASS as a sensor to drive the activation of direct to pilot alerting safety logic.
- Select site, complete SRMD, and initiate operational evaluation of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.
- Complete final report on Digital-Lighting Application (surveillance integration).

Program Plans FY 2021 – Performance Output Goals

- Complete annual technical and operational evaluation report of existing RIRP prototype systems.
- 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 on testing of safety logic enhancements to RI detection and prevention products.
- Complete annual 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 ATO Program Management Office (PMO).
- Complete operational evaluation of an advanced ground surveillance sensor to drive the activation of direct to pilot alerting safety logic.

B, 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 project also supports the development and sustainment of analytical and computer models used to assess and validate operational changes to the NAS. Specifically, the program 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 (SESAR) 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 57,975, 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 2017-2021 – Performance Output Goals

- Develop annual updates to the NAS Enterprise Level Operational Requirements based on prior year research and development.
- Develop 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, the premier public-private partnership forum to develop consensus among aviation stakeholders across the globe. These artifacts include safety and performance requirements, operational services and environment definitions, minimum aviation system performance standards, minimum operational performance standards, and other reports as necessary.
- Support NAC priorities through various activities, such as:
  - Monitor and report on current commitments as outlined in the Joint Implementation Plan and updated in October 2015;
  - Develop a traffic flow management strategy to maintain capacity during PBN operations commensurate with the FAA's implementation of the PBN Navigation Strategy; and
  - Review and assess FAA operational increments for NextGen planning commensurate with the FAA's NextGen Vision.

C, 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 Airspace Redesign funding will be used in support of airspace projects, including but not limited to, the Palm Beach International TRACON / Airspace Expansion Project and Miami (ZMA) Oceanic and San Juan (ZSU) airspace. 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Airspace Redesign will increase system efficiency by reducing limitations that the airspace places on the system. Congestion, complexity and limited departure points in the current airspace can result in restrictions, limiting airport throughput. Airspace redesign addresses large, complex, multi-facility changes impacting NAS performance.

Program Plans FY 2017 – Performance Output Goals
- Conduct engineering analysis as needed for Caribbean airspace redesign implementation.
- Implement infrastructure changes resulting from airspace redesign.

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 2019-2021 – Performance Output Goals
- Conduct engineering analysis for airspace redesign implementation.
- Implement infrastructure changes resulting from airspace redesign.

D, 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 of the existing models have become obsolete and cannot support the analysis of 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 System-Wide NAS Model is being developed to replace the existing National Airspace System Performance Analysis Capability (NASPAC) model. This new system-wide model is required to analyze advanced ATM concepts and aid with NextGen program trade-off studies, investment analyses, and NAS performance analyses. The model adds enhancements to the initial model as they are completed. The new

model, known as the System-Wide Analysis Capability (SWAC), is currently being used by FAA and contractors to support ongoing analyses.

2. An Airport Capacity Model 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 57,975, 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 2017 – Performance Output Goals

- Delivery of new SWAC executable software integrating the FAA Air Traffic Organization's near-term traffic forecasts.
- Delivery of new SWAC executable software containing an initial model for addressing commercial space activities in the NAS.
- Delivery of new ADSIM+ executable software incorporating wake mitigation modeling.
- Delivery of new ADSIM+ executable software integrating time-based airport configuration definition to the delay model.

Program Plans FY 2018 – Performance Output Goals

- Delivery of new SWAC executable software incorporating advanced RNP concepts (e.g., dynamic RNP).
- Delivery of new SWAC executable software integrating the ATO gate assignment model.
- Delivery of new SWAC executable software with an improved commercial space model.
- Delivery of new ADSIM+ executable software improving the blocking rule-set used to limit inter-aircraft interactions based upon wingspan and available space.
- Delivery of new ADSIM+ executable software improving 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

- Delivery of new SWAC executable software integrating Base of Aircraft Data (BADA) version 4.0.
- Delivery of new SWAC executable software capable of interacting with Geographical Information System (GIS).
- Delivery of new ADSIM+ executable software capable of generating and creating user-defined scenarios and applications.
- Delivery of new ADSIM+ executable software with an enhanced Graphical User Interface (GUI).

Program Plans FY 2020 – Performance Output Goals
- Delivery of new SWAC executable software updating the integration of Base of Aircraft Data (BADA) version 4.0.
- Delivery of new SWAC executable software updating the interface with Geographical Information System (GIS).
- Delivery of new ADSIM+ executable software updating the capability to generate user-defined scenarios and applications.
- Delivery of new ADSIM+ executable software with an enhanced Graphical User Interface (GUI).

Program Plans FY 2021 – Performance Output Goals
- Delivery of new SWAC executable software with initial capability of enhanced airport representation.
- Delivery of new SWAC executable software with enhanced command line interface.
- Delivery of new ADSIM+ executable software with disaggregation of gate nodes and taxi-path cloning model.
- Delivery of new ADSIM+ executable software with an application program interface for integrating with NAS-wide models.

E, Dynamic Capital Planning, M47.01-01

Program Description

The Dynamic Capital Planning tools and support will allow FAA to make optimal decisions based on best business practices. These tools and support will 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 to approved baselines for all major programs;
- Milestone tracking and schedule modeling;
- Tracking field implementation status of all NAS programs by site;
- Earned value monitoring through program life cycle;
- Post implementation analysis for corporate lessons; and
- Capitalizing NAS Plan installed equipment including disposal 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 2015. (FAA Business Planning Metric)*

Relationship to Performance Metric

Dynamic Capital Planning helps capital programs maintain baselines by providing program tracking and analysis which leads to better baseline investment decisions and early identification of programs that are not performing so that corrective actions can be implemented.

Program Plans FY 2017-2021 – Performance Output Goals
- Complete monthly Capitalization report.
- Complete monthly program baseline status report.

F, 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 predictive approach to identifying and managing NAS-wide safety trends and emerging risks before they result in accidents or incidents. 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 near real time automated data sharing capability among legacy and future systems, databases, and tools utilized for safety risk analysis across the NAS. By facilitating automated data sharing, 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 a centralized platform for ATO data distribution, fusion of data from multiple locations, and data warehousing. It will be an integrated suite of interconnected databases and applications. OARS will be one system comprised of centralized hardware and software consisting of commercial off the shelf (COTS) technology when possible. OARS will also leverage technology from existing FAA systems such as the System-Wide Information Management (SWIM) system and the FAA Telecommunications Infrastructure (FTI).

Functionally, OARS will: (1) Directly support the ATO's safety core business functions by integrating all ATO domains to identify, create, standardize, analyze, assess, and disseminate safety data throughout ATO and external organizations; and (2) Integrate with operational NAS systems to ensure that the information required to successfully implement the SMS is readily available, not only for component-level safety assessments, but for an integrated system safety approach.

The OARS Program achieved a successful Investment Analysis Readiness Decision (IARD) in FY 2015. The Initial Investment Decision (IID) is planned for 3rd quarter, FY 2016. The Final Investment Decision (FID) is planned in 4th quarter, FY 2017.

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

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. This data 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 2017 – Performance Output Goals
- 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 (ISPD); and
  - Acquisition Program Baseline (Execution Plan).
- Achieve a JRC FID.

Program Plans FY 2018 – Performance Output Goals
- Pending JRC approval:
  - Award Development Contract.
  - Begin System Development and Integration.

Program Plans FY 2019-2021 – Performance Output Goals
- Output goals will be determined at FID.

G, 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 (the 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 (IARD) is planned for FY 2017; the Initial Investment Decision (IID) is planned for FY 2018; and the Final Investment Decision (FID) is planned 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Target

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 2017 – Performance Output Goals

- Complete the following products in support of the IARD:
  - Final Shortfall Analysis Quantification
  - Solution Concept of Operations
  - Functional Analysis
  - Enterprise Architecture Products
  - Preliminary Program Requirements
- Achieve IARD.
- Complete the following products in support of the IID:
  - Initial Program Requirements
  - Business Case Analysis Report (BCAR)
  - Enterprise Architecture Products
- Conduct Market Research.

Program Plans FY 2018 – Performance Output Goals

- Complete the Initial Implementation Strategy and Planning Document (ISPD).
- Complete the Final Investment Analysis Plan.
- Achieve IID.
- Complete the following products in support of the FID:
  - Final Program Requirements (fPR) Document
  - Enterprise Architecture Products
  - Business Case documentation
  - Final Implementation Strategy and Planning Document (ISPD)
  - Acquisition Program Baseline (APB) (Execution Plan)
- Achieve FID.

Program Plans FY 2019 – Performance Output Goals

- 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.

H, 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 datasets and other tools used to assess the performance of the NAS as a whole, and its component parts. Many ATO operational units model and analyze NAS data to support operational and capital investment planning. A previous study of FAA-wide operational databases identified a shortfall in available analytical products. The study recommended that the FAA create a database to capture operational events associated with individual flights to improve the timeliness and reduce the cost of operational analyses. Because most 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 develop an analytics database that provides standardized operational events data on a per-flight basis and by facility (e.g. airport). The initial analytics database will be based on currently available operational data. As new operational data becomes available, this program will evaluate and integrate the new data.

The following products are planned:

- An analytics database that provides operational events data on a per-flight basis;
- An analytics database that provides operational events data by facility;
- Operational efficiency and performance reporting tools developed from data collected in the analytics databases; 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Operational modeling and analysis are used by the ATO 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 ATO to determine the potential benefits of capacity initiatives and help in choosing the most promising investments to expand capacity.

Program Plans FY 2017 – Performance Output Goals

- Award contract for Analytics Database.
- Develop means for analyzing and modeling fix capacity.
- Develop and publish Release 1 of Analytics Database (combined flight and track data).

Program Plans FY 2018 – Performance Output Goals

- Develop and publish Release 2 of Analytics Database (National Traffic Management Log (NTML) and weather data added).
- Develop analysis methodology for weather delay and efficiency.

Program Plans FY 2019 – Performance Output Goals

- Complete requirements definition for surface data capture tool.
- Develop and publish Release 3 of Analytics Database (Data Comm added).

Program Plans FY 2020 – Performance Output Goals

- Develop and publish Release 4 of Analytics Database (combined surface data added).

Program Plans FY 2021 – Performance Output Goals

- Develop and publish Release 5 of Analytics Database.

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

FY 2017 Request $1.0M
FY 2017 Request $19.0M

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;
- Human Factors Laboratory; and
- Flying Laboratories which are specially instrumented test aircraft.

The program uses shared support services to sustain the operation of the laboratories, including infrastructure engineering, flight test support, 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 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017 – Performance Output Goals

- Implement the 2nd 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 1 of 2, installation of Terminal Flight Data Manager (TFDM), and relocation of Automatic Dependent Surveillance Broadcast (ADS-B).
- 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 installation of Traffic Flow Production Control Emergency Power-Off & Fire Suppression system.
- Complete 70% of the NAS Modernization projects scheduled for completion in FY 2017.

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

- 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.

1A04, William J. Hughes Technical Center Infrastructure Sustainment

FY 2017 Request $12.2M

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 $400 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 crucial systems hosted at the Technical Center such as

Traffic Flow Management Production Center (TPC), FAA Telecommunications Infrastructure (FTI), and the Enterprise Data Centers that support FAA Information Technology (IT) 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 (RVSM), Wide Area Augmentation System (WAAS), Automatic Dependent Surveillance Broadcast (ADS-B) and System Wide Information Management (SWIM). The infrastructure also supports second level engineering support to resolve critical issues for operational NAS systems (e.g., En Route Automation Modernization (ERAM), Standard Terminal Automation Replacement System (STARS), and Advanced Technologies and Oceanic Procedures (ATOP)).

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).

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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 316 Electrical Substation Replacements (2 Substations plus Switch House) (Phase 1 of 2).
- Complete Building 316 Chiller Replacements (2 Chillers).
- Complete Buildings 211 and 303 Roof Replacements.
- Complete Design for Building 300 Mechanical Equipment Replacements (Air Conditioning (AC) Units 6, 7 and 8) (Phase 3 of 4).
- Complete Main Electrical Substation Upgrades (Switchgear Enclosure).
- Complete Design for Central Utilities Plant Chiller Replacements (Nos. 2 & 3).
- Complete Design for Central Utilities Plant Electrical Switchgear Replacement.
- Complete Life Safety Improvements to Five Facilities (Buildings 27 and 28) (Phase 1 of 2).

Program Plans FY 2018 – Performance Output Goals

Execute the following Center Facility System Improvements:

- Complete Building 316 Electrical Substation Replacements (3 Substations) (Phase 2 of 2).
- Complete Central Utilities Plant Chiller (No. 2 of 3) Replacement.
- Complete Life Safety Improvements to Five Facilities (Buildings 33, 56 and 270) (Phase 2 of 2).
- Complete Refurbishment of Elevators in Five Buildings (Building 316) (Phase 2 of 3).
- Complete Building 300 Mechanical Equipment Replacements (AC Units 10 and 17) (Phase 2 of 4).

Program Plans FY 2019 – Performance Output Goals
Execute the following Center Facility System Improvements:
- Complete Central Utilities Plant Chiller (No. 3 of 3) Replacement.
- Complete Building 300 Mechanical Equipment Replacements (AC Units 6, 7 and 8) (Phase 3 of 4).
- Complete Central Utilities Plant Electrical Switchgear Replacement.
- Complete Refurbishment of Elevators in Five Buildings (Buildings 27, 287 and 301) (Phase 3 of 3).
- Complete Design for Architectural, Mechanical and Electrical Systems Improvements to Various Research and Development Buildings.
- Complete Design for Primary Electrical Feeder Replacement to Building 316.
- Complete Design for Building 316 Fire Detection/Annunciation System Upgrades.
- Complete Master Plan for Site Utilities and Infrastructure.
- Complete Technical Support Space Utilization Strategy.

Program Plans FY 2020 – Performance Output Goals
Execute the following Center Facility System Improvements:
- Complete Architectural, Mechanical and Electrical Systems Improvements to Various Research and Development Buildings.
- Complete Primary Electrical Feeder Replacement to Building 316.
- Complete Building 316 Fire Detection/Annunciation System Upgrades.
- Complete Design for Building 300 Mechanical Equipment Replacements (Remaining AC Units) (Phase 4 of 4).
- Complete Design for Buildings 275 and 305 Roof Replacements.

Program Plans FY 2021 – Performance Output Goals
Execute the following Center Facility System Improvements:
- Complete Center Wide Building Automation System Upgrade/Expansion.
- Complete Design for Overhead Electrical Distribution System Replacement.
- Complete Design for Sanitary Sewer System Improvements.
- Complete Repairs to Storm Water Distribution System.

1A05, NEXTGEN – SEPARATION MANAGEMENT PORTFOLIO
FY 2017 Request $25.8M

- A, Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management, G01S.02-01
- B, Modern Procedures, G01A.01-01
- C, Alternative Positioning Navigation and Timing (APNT), G06N.01-06
- D, Wake Turbulence Re-Categorization, G06M.02-02
- E, Oceanic Tactical Trajectory Management, G01A.02-02
- F, Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development, G01A.01-09
- G, Separation Management Concept & Analysis, G01M.02-04
- H, Reduced Oceanic Separation, G02S.04-01
- I, Separation Automation System Engineering, G01A.01-06
- X, NextGen Oceanic Capabilities, G01A.01-07
- X, Conflict Advisories, G01A.02-03

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 inter-aircraft spacing (e.g., achieve a precise interval between aircraft in a stream of traffic). 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. Changes to ERAM, STARS, and TBFM automation systems will be needed to support the initiation and monitoring of IM operations. Interval Management-Spacing (IM-S) Arrivals, Approach, & Cruise (AA&C) supports IM operations for arrival and approach applications for independent runway operations and for cruise operations (i.e., spacing during en route metering and Miles-in-Trail operations). Advanced-IM (A-IM) will extend the capabilities developed as a part of IM-S AA&C to dependent runway and departure operations, Pairwise Trajectory Management (PTM) operations in oceanic airspace, and will support changes to the current separation standards to enable additional benefits.

The Surveillance and Broadcast Services Office is maturing the requirements definition of a suite of ADS-B In IM applications and will pursue a series of Final Investment Decisions (FID) as each application or set of applications are deemed suitably defined for implementation. Pre-implementation activities and AMS milestones through FID for ADS-B In IM Applications are funded under this program, G01S.02-01. FID for the first set of ADS-B In Applications, IM-S AA&C is planned in FY 2020.

Post FID implementation activities will be funded and executed under ADS-B NAS Wide Implementation - Future Segments, G02S.01-02.

IM-S AA&C is applicable to oceanic, en route, and terminal airspace and will require investments in both air traffic management and decision support automation systems, as well as flight deck avionics. Additional pre-implementation activities under this program include:

- Developing prototype ground-based automation software for ERAM, STARS, and TBFM and completing prototype avionics enhancements;
- Completing integrated air-ground Human-in-the-Loop (HITL) simulation and IM Flight Test;
    - The IM Flight Test is intended to validate Flight-deck based Interval Management (FIM) Minimum Operational Performance Standards (MOPS) v1 avionics functionality; prototype automation functionality; and IM-S AA&C procedures; and
- Working with RTCA to update the Safety Performance Requirements Document and develop FIM A-IM avionics standards.

A-IM dependent runway, departure and oceanic operations, and other future concepts along with the associated avionics standards will be developed with RTCA and the user community. SBS plans to complete investment activities both Initial Investment Decision (IID) and FID for A-IM after the completion of IM-S AA&C 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Interval management 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 FID.

Program Plans FY 2017 – Performance Output Goals

- Complete revised draft of the RTCA SC-186 navigation and communication integration requirements for FIM MOPS v2 for A-IM.

Program Plans FY 2018 – Performance Output Goals
- Develop the Implementation Strategy and Planning Document in support of IM-S AA&C FID.
- Complete the draft RTCA SC-186 Integrated Test Procedures for FIM MOPS v2 for A-IM.

Program Plans FY 2019 – Performance Output Goals
- Develop the following products in support of IM-S AA&C FID:
    - Business Case documentation; and
    - Acquisition Program Baseline.
- Complete RTCA SC-186 Integrated Test Procedures for FIM MOPS v2 for A-IM.

Program Plans FY 2020 – Performance Output Goals
- Achieve FID for IM-S AA&C.
- Complete Final Review and Comment and Program Management Committee approval for RTCA SC-186 SPR and FIM MOPS v2 for A-IM.

Program Plans FY 2021 – 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.

The concepts and capabilities of NextGen require accurate aircraft trajectory modeling using advanced Kinetic Vertical Modeling (KVM) techniques involving aircraft characteristics, trajectory modeling when an aircraft turns, and trajectory modeling based on runway assignment.

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:
- ERAM KVM Phase 2 – which is intended to improve the ERAM Trajectory Model:
    - Base of Aircraft Data KVM in Aircraft Trajectory Modeling
        - "Hybrid (Kinetic and Parametric) Model" prototyping
        - Complex Turn Modeling (Study)
        - Runway assignment data and availability into ERAM (Study)
    - ERAM and TBFM Harmonization
    - Kinetic Aircraft Performance Model Parameter Accuracy
    - Modern Procedures Support for Optimized Profile Descent Standard Terminal Arrival Route Execution
- KVM Enhancements – Operational Evaluation

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 57,975, 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 2017 – Performance Output Goals

- Complete complex turns prototype.
- Complete analysis of potential ERAM vertical modeling changes based on runway information being available.
- Complete Automation-Assisted Controller-to-Controller Coordination prototype.
- Conduct an initial operational evaluation for Probe Menu and Trial Planning extensions to En Route Radar Controller Conflict Detection.
- Develop detailed KVM concepts and requirements documents.

Program Plans FY 2018 – Performance Output Goals

- Develop Probe Menus and Trail Planning concepts and requirements documents.
- Develop Multi-step Probe menus scenarios for Human-in-the-Loop (HITL) evaluations.
- Develop resolutions for Reduced Controller Coordination scenarios for HITL evaluations.

Program Plans FY 2019-2021 – Performance Output Goals

- None.

C, Alternative Positioning Navigation and Timing (APNT), G06N.01-06

Program Description

Presidential Policy Directive 21 (PPD-21) and National Security Presidential Directive 39 (NSPD-39) were directed towards Department of Homeland Security, Department of Defense, and Department of Transportation (DOT) to implement a national Position, Navigation, and Timing (PNT) to mitigate the possibility of a Global Positioning System (GPS) outage. The FAA under DOT is tasked to establish a resilient backup for aviation services in the event of a GPS outage or interference event to maintain safety and security; maintain a reasonable level of capacity and efficiency; and minimize economic impact. The FAA during analysis of their operational Alternative Positioning, Navigation and Timing (APNT) solution for aviation will ensure that it fits into the framework of the national strategy solutions and is harmonized with the international community.

The APNT program is investigating alternatives for providing a backup for GPS based PNT services. GPS PNT services enable Performance Based Navigation (PBN) and Automatic Dependent Surveillance – Broadcast (ADS-B) services, which are necessary for Trajectory Based Operations (TBO), Area Navigation (RNAV), Required Navigation Performance (RNP), and other NextGen advanced implementations. The objective of the NextGen APNT program is to provide critical Air Traffic Management (ATM) services if GPS services become temporarily unavailable so that users can seamlessly continue RNAV operations to a safe landing.

The FAA currently relies on existing legacy systems including Very High Frequency Omnidirectional Range (VOR), Distance Measuring Equipment (DME) and Tactical Air Navigation (TACAN) as a backup to GPS navigation, but these systems do not fully support RNAV, RNP or TBO. The NextGen APNT program is exploring a full range of alternatives to provide the NAS with a GPS independent backup solution to support PBN. Services provided by APNT must be near equivalent to those provided by GPS. The program will identify and evaluate new technical concepts and operational alternatives for GPS back-up and select the best alternative to recommend for development based on cost and 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

This program supports sustainment of NAS operational availability by ensuring PNT services remain available during periods of GPS outage. The APNT strategy is consistent with the NextGen Implementation Plan and FAA Strategic Priorities 1 and 2 for increased safety and delivering benefits, respectively. Pilots, dispatchers, and air traffic controllers will all benefit from the availability of APNT services. Pilots will have access to an accurate and reliable source for aircraft position, navigation and timing services during a GPS outage. Airline dispatchers will retain the ability to schedule operations and choose preferred trajectories during a GPS outage. Controllers, in conjunction with automation improvements, can continue to manage separation using performance based operations during a loss of GPS.

Program Plans FY 2017 – Performance Output Goals

- Complete Refinement of Operational Requirements.
- Complete Refinement of Concept of Operations.
- Analyze the Current and Future Concepts Based on Needs, Requirements, and Concept of Operations.

Program Plans FY 2018-2021 – Performance Output Goals

- None.

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

Program Description

Since the last full review of wake separation standards used by air traffic control (ATC), fleet mixes have changed dramatically. Airport runway complexes have also changed, and new aircraft designs such as the A380, B787, B747-8, A-350, very light jets, and unmanned aircraft systems have been introduced into the NAS. The approximately 25 year old wake separation standards provided safe separation of aircraft from each other's wake vortices, but no longer provided the most capacity efficient spacing and sequencing of aircraft in terminal and en-route operations. This loss of efficient spacing has contributed to the gap between current demand and NAS capacity.

The Wake Turbulence Re-Categorization project, begun in collaboration with EUROCONTROL, has developed and implemented new airport runway ATC wake mitigation separation standards (RECAT Phase I); and, based on that work, has developed tailored leader and follower aircraft static pair-wise wake mitigation separation standards (RECAT Phase II) for 99% of all aircraft types operating in the United States. Use of the RECAT Phase II standards will result in increased airport runway arrival and departure capacity above what can be achieved with the RECAT Phase I standards, especially when the airport is experiencing weather or other conditions requiring it to operate with instrument landing procedures. The final phase of the project (RECAT Phase III) will develop the ATC based capabilities required to achieve the NextGen goal of safe, most capacity efficient, pair-wise dynamic wake mitigation separations of aircraft.

This project originated as part of a joint EUROCONTROL and FAA program that reviewed the then current required wake mitigation aircraft separations used in both the USA's and Europe's air traffic control processes and determined the then current standards could be safely modified to increase the operational capacity of airports and their surrounding airspace. Work to address the introduction of large aircraft into the NAS has occurred over the last several years to accommodate the A380, B747-8 and B787 aircraft and work will continue to address the introduction of other aircraft types into the NAS. This program builds on that joint work and is accomplishing a more general review to include regional jets, and is working towards potential procedural mitigations for Unmanned Aircraft Systems (UASs), micro-jets, etc. The work is phased, and started with optimizing the then current standards to reflect the change in fleet mix that occurred during the last 25 years. In 2010, this project provided a set of recommendations (RECAT Phase I) for international review that focused on changes to the then current static standards. To accomplish this, the project used a data driven, relative risk safety analysis approach. That approach was complimented with enhanced analysis tools to link observed wake behavior to standards and provide additional confidence in the determined safety risk associated with potential new standards relative to existing standards. Use of the RECAT Phase I standards in the United States began at the Memphis International Airport in November 2012 and since have been implemented at the Louisville International Airport in FY 2013, Cincinnati/Northern Kentucky (CVG) International Airport and Atlanta area airports in FY 2014, and Houston, Charlotte, New York and Chicago area airports in FY 2015. In FY 2015, the RECAT Phase II portion of this program developed a wake separation minimum matrix of approximately 100 aircraft type pairs for use by controllers and associated decision support tools to provide more capacity efficient static wake separations of aircraft flying into and out of U.S. airports. The RECAT Phase II standards and supporting benefit and safety cases have been provided to ICAO for their review. It is projected that the RECAT Phase II wake separation standards will begin initial implementation for evaluation in FY 2017.

The final phase of this project, developing RECAT Phase III dynamic wake separation standards and processes for application, will encompass extensive analyses, modeling, and data collection to further define and validate potential improved wake mitigation processes and standards developed by the FAA NextGen – Wake Turbulence research project. Unlike the static separations, which are constant at all times, the ATC dynamic pair-wise wake separation standards will adjust the required minimum aircraft wake mitigation separations based on the aircraft types in the pairing as well as likely parameters such as winds and turbulence being experienced by the aircraft being separated.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

The Wake Turbulence Re-Categorization project is addressing one of the major constraints in implementing processes and procedures that will allow more aircraft flights into and out of airports and through congested air corridors. In the near term, RECAT Phase I has rebalanced the wake turbulence separation standards to address today's mix of aircraft utilizing the nation's core airports. RECAT Phase I has yielded significant additional arrival and departure runway throughput for those airports whose fleet mix closely matches the design of the RECAT Phase I standards. The first operational use of the RECAT Phase I standards occurred in November 2012 at the Memphis International Airport (MEM), and since been implemented at ATC facilities serving six additional metropolitan area (Louisville/Cincinnati, Atlanta, Houston, Charlotte, New York City/Newark, and Chicago) airports. FedEx, the major air carrier at MEM, has received a double digit MEM departure runway throughput capacity increase since the introduction of the RECAT Phase I standards as well as significant fuel savings in their MEM arrival operations. United Parcel Service is seeing similar benefits at its major hub airport Louisville International Airports. Delta Air Lines, the major air carrier at Hartsfield-Jackson Atlanta International Airport (ATL), is reporting significant decrease in operating cost at ATL. The increased runway throughput capacity is achieved by reduction in many of the previously required wake mitigation in-trail separation distances of aircraft. Implementation of the RECAT Phase II wake separation standards is projected to provide an additional 4-7% increase in a Core airport's runway throughput capacity.

Program Plans FY 2017 – Performance Output Goals
- Complete initial deployment of the RECAT Phase II wake separation standards to three metropolitan area airports – for evaluation of the standards use and modification (if required) for ease of application by controllers.
- Develop detail descriptions of ATC dynamic wake separation standards alternatives and how they would be applied in the NAS.
- Deliver briefings to and conduct data gathering with the aviation community concerning alternative ATC dynamic wake separation processes and procedures.

Program Plans FY 2018 – Performance Output Goals
- Complete high level analyses supporting the development of ATC dynamic wake separation standards.

Program Plans FY 2019 – Performance Output Goals
- Complete design of ATC dynamic wake separation standards.
- Develop process and procedures for the ATC dynamic wake separation standards.

Program Plans FY 2020-2021 – Performance Output Goals
- None.

E, Oceanic Tactical Trajectory Management, G01A.02-02

Program Description

The Oceanic Tactical Trajectory Management (OTTM) program addresses Oceanic Trajectory Management in Four Dimensions (OTM-4D). The key objective of this concept is to use trajectory-based operations to improve fuel efficiency, system predictability, and performance by enabling airlines and other operators to flight plan and fly closer to their optimal, or preferred 4D trajectories while in oceanic airspace. This requires new decision support capabilities and integration with traffic flow management. OTTM has adopted specific initiatives that address both the pre-departure and in-flight phases of the oceanic flight, as well as improvements that allow sharing additional information between the FAA and airspace users in a collaborative arrangement.

OTTM takes advantage of Airline Operations Center and Air Navigation Service Provider oceanic capabilities, as well as evolving technologies such as System-Wide Information Management to develop these potential concepts. These oceanic capabilities involve both procedural and automation changes. The implementation of these capabilities will occur incrementally and will eventually affect all domains and phases of flights to improve airspace capacity and allow more airspace users to optimize their flight trajectories through collaborative efforts with air traffic management resulting in savings of time, fuel, and emissions.

This program provides the following operational improvements:
- Interactive Planning Using 4D Trajectory Information in the Oceanic Environment (OI:104102)

This program will develop the following capabilities: Traffic Congestion Depiction and Flight Specific Likelihood Feedback, Re-Profile Alert and Pre-Oceanic Planner. These capabilities are all dependent on the 4-D Stochastic Trajectory Model which provides a three-dimensional (longitude, latitude, altitude) density function of a flight position with respect to its planned flight time:

- User Trajectory Planning in Pre-Oceanic Phase Capability (OI:104102-23):
  - Traffic Congestion Depiction and Flight Specific Likelihood Feedback – Will enable interactive flight plan collaboration between airspace users and the FAA in which the airspace user informs the FAA of their intended 4D oceanic trajectory and receives feedback on the trajectory considering the constraints of traffic, weather, and special activity airspace prior to the flight's entry into oceanic airspace.

  - Re-Profile Alert – Will notify airlines of the changes in the flight likelihood or congestion based on the parameters determined by the airline. The airline can then choose how to best respond to the changes.

- Pre-Oceanic Planner – A system designed for more congested airspace where flight specific likelihood does not give enough predictability to the flight operators. Considering the ordered preferences of the participants and acceptable variances, the planner provides a schedule that considers the full oceanic trajectory for de-conflicting rather than just the oceanic entry point.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

With increased system precision and enhanced automation, aircraft can more closely fly routes to realize the airlines' goals for fuel efficiency and schedule reliability. Reduced separation standards for aircraft that rely on shared state and intent data will lead to fewer predicted conflicts, and as a result, fewer diversions from the preferred routing. Reduced separation standards will also result in more efficient use of capacity within flow-constrained airspace, allowing more aircraft to fly through those areas, rather than being re-routed or delayed to avoid them.

Program Plans FY 2017 – Performance Output Goals

- Complete Benefits Analysis and Validation and report results.
- Complete tech transfer and associated documentation.

Program Plans FY 2018-2021 – Performance Output Goals

- None.

F, Unmanned Aircraft Systems (UAS) Concept Validation and Requirements Development, G01A.01-09

Program Description

The UAS Concept Validation and Requirements Development program conducts the overall analysis and planning for the development, integration, and subsequent implementation of emerging UAS enabling technologies within the NAS infrastructure. This program executes concept development, engineering analysis, and evaluation in support of mission and investment analysis activities; 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.

UAS operations have increased dramatically in both the public and private 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:

- Public UAS operations (all sizes and airspace): Accommodated through Certificates of Authorizations (COAs), with risk controls tailored to the operation.
- Integrated UAS operations: UAS operating in airspace widely used by manned aircraft.
- Low altitude, beyond visual-line-of sight commercial small UAS (sUAS) operations: sUAS that are operated at low altitudes or remote areas, outside areas typically used for manned aircraft.
- Low altitude, visual line-of-sight sUAS operations: sUAS operated for other than hobby or recreation purposes, including private and commercial purposes, within visual line-of-sight (Part 107 operations).
- Model aircraft operations: UAS flown for hobby or recreation within visual line-of-sight.

The program will identify and mature UAS enabling technologies within the NAS infrastructure to support these categories of operations. The need for new capabilities, mitigations, and verification and validation methods to enable safe UAS operations will require the development, integration, and implementation of emerging technologies. These new technologies may include communications, surveillance, and automation changes to support continued evolution of UAS in the NAS. Issues involved with UAS integration include the inability to comply with traditional see and avoid requirements, unique communications needs, lost link procedures, and other challenges which dictate that concept engineering activities address all aspects of how UAS operations fit with other NAS operations. Work to address existing UAS shortfalls must be completed to inform Acquisition Management System decision points for changes to FAA systems required to support UAS operations. If the concept development, maturation, and validation activities are not performed in a timely manner, all subsequent activities will be delayed, such as necessary ATM automation enhancements, significantly prolonging the timeline for achieving UAS integration. UAS Command and Control (C2) capability requirements and solution sets will be identified for each category of UAS operations as needed. In order to ensure effective coordination of the tightly-coupled activities necessary to address and resolve these issues, a centralized ATO 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 Target

Successful integration of UAS into the NAS provides benefits to both public and civil users. Studies indicate benefits when UAS are used in missions related to agriculture, search and rescue, border protection and pipeline monitoring among other applications. These public and civil users, as well as the general public and Commercial and General Aviation, benefit from the work being conducted under this activity which will lead to the safe integration of UAS in the NAS.

Program Plans FY 2017 – Performance Output Goals

- Develop, review and approve additional operational scenarios for integrated UAS operations.
- Complete update of existing UAS concept maturation products (e.g., mid-term and mature state scenarios, allocation tables).
- Complete annual update of UAS shortfalls and operational requirements database (identify new/updated requirements).
- Complete annual update of UAS Concept Maturation Plan based on findings from FY 2017 work (identify new concept maturation areas).
- Finalize initial C2 operational requirements for each category.

Program Plans FY 2018 – Performance Output Goals

- Complete annual update of existing UAS concept maturation products (e.g., mid-term and mature state scenarios, allocation tables).
- Complete annual update of UAS shortfalls and operational requirements database (identify new/updated requirements).
- Complete annual update of UAS Concept Maturation Plan based on findings from FY 2018 work.
- Complete Spectrum Management Alternative Analysis and identify initial spectrum required, by UAS usage category.
- Complete conversion of C2 ground Infrastructure Alternative Analysis into a Concept of Operations.

Program Plans FY 2019 – Performance Output Goals

- Complete annual update of existing UAS concept maturation products (e.g., mid-term and mature state scenarios, allocation tables).
- Complete annual update of UAS Concept Maturation Plan based on findings from FY 2019 work.
- Finalize UAS shortfalls and operational requirements database.
- Complete development of draft AMS artifacts to support Concept and Requirements Definition Readiness Decision (CRDRD):
    - Concept and Requirements Definition (CRD) Plan;
    - Preliminary shortfall analysis report; and
    - Enterprise Architecture (EA) change notices, products, and amendments.
- Complete documentation of Spectrum Allocation and Management Approach, by UAS usage category.
- Complete analysis of the UAS C2 solutions; identify C2 infrastructure solution(s), by UAS usage category.

Program Plans FY 2020 – Performance Output Goals

- Complete AMS artifacts to support CRDRD:
    - Preliminary shortfall analysis report;
    - CRD Plan; and
    - EA change notices, products, and amendments.
- Achieve CRDRD.
- Complete development of draft AMS artifacts to support Investment Analysis Readiness Decision (IARD):
    - Solution Concept of Operations;
    - Preliminary program requirements;
    - Technical alternatives and associated cost estimates;
    - Final shortfall analysis report; and
    - Investment analysis plan.

Program Plans FY 2021 – Performance Output Goals

- Complete AMS artifacts to support IARD:
    - Solution Concept of Operations;
    - Preliminary program requirements;
    - Technical alternatives and associated cost estimates;
    - Final shortfall analysis report; and
    - Investment analysis plan.

G, Separation Management Concept & Analysis, G01M.02-04

Program Description

As NextGen evolves, precise flight trajectories will require accurate monitoring capability to maintain consistent or increasing levels of airspace capacity and efficiency while maintaining safety. This program provides Operational Concepts and sets of scenarios that describe operational changes which provide controllers with decision support tools and enhanced procedures to manage aircraft in a mixed environment of varying navigation equipment and wake performance capabilities. The program will evaluate the applicability and feasibility of using such criteria, recommendations, standards and practices to inform and positively impact the engineering, design, acquisition and selection of new tools and the implementation of necessary updates to the procedures to achieve the operational performance. Automation enhancements will not only alert controllers of pending conflicts but decision support tools (DSTs) will provide rank-ordered conflict resolution actions to controllers based on environmental factors such as efficiency, weather, risk that an action creates additional conflicts, and overall system resiliency in maintaining safe separation standard when using the added level of automation. Human performance issues for controllers will be considered to ensure safe operations at increased capacity levels and assess how operational changes will be supported by allocation of functions between humans and automation.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

This program will develop concepts for improving the use of airport capacity; evaluate whether proposed benefits for new operational concepts can be achieved; and assess the implications on human factors of new and other related NextGen concepts and technologies. Incorporation of these concepts and products into NAS systems will result in improvements in air traffic controller efficiency to meet forecast demand and increase airport throughput while maintaining required safety.

Program Plans FY 2017 – Performance Output Goals

- Complete concept validation studies for end-to-end and lower level operational concepts for implementation in 2023 and beyond.
- Develop operational requirements and other documents required for technical transfer of validated concepts for NAS implementation in 2020-2022 and beyond.
- Document and report findings to reduce risk/uncertainties of NextGen Mid Term Operational Concepts.
- Document procedures to decrease workload/increase reliance on automation for routine tasking, to increase efficiency of the NAS.
- Develop and document operational methods to address future growth in demand and reduce gate-to-gate transit time.
- Complete report documenting initial research on assessing human and system performance of reduced horizontal separation standards, 3 nautical miles (nm), in the en route environment.
- Complete report documenting initial research for assessing "no closer than" spacing operations in the terminal area where Time Based Flow Management (TBFM) is not being used and describe interactions of the controller, ground automation, and required avionics on the flight deck for successful operations.

Program Plans FY 2018 – Performance Output Goals

- Complete concept validation studies for lower level operational concepts for implementation in 2022 and beyond and to reduce risk/uncertainties of NextGen Mid Term Operational.
- Develop and document operational methods and procedures that will address future growth in demand; reduce gate-to-gate transit time; and increase efficiency through decreased controller workload through greater reliance on automation.
- Develop criteria for assessing human and system 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 criteria to conduct and assess information and design requirements for performing relative spacing "no closer than" in the terminal environment for the air traffic controller and associated automation systems.
- Document findings from concept validation studies for assessing enhancements of conflict resolution automation and advisories.

Program Plans FY 2019 – Performance Output Goals
- Document findings from concept validation studies for lower level operational concepts for implementation in 2022 and beyond and to reduce risk/uncertainties of NextGen Mid Term Operational Improvements.
- Develop and document operational methods and procedures that will address future growth in demand; reduce gate-to-gate transit time; and increase efficiency through decreased controller workload through greater reliance on automation.
- 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 new en route separation standards.
- Validate the information and design requirement evaluation criteria for "no closer than" spacing operations and start evaluation with a subset of relevant use cases.
- Develop evaluation criteria to assess the rank-ordered conflict resolutions recommendations that the 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.

Program Plans FY 2020 – Performance Output Goals
- Document findings from concept validation studies for lower level operational concepts for implementation in 2022 and beyond and to reduce risk/uncertainties of NextGen Mid Term Operational Improvements.
- Develop and document operational methods and procedures that will address future growth in demand; reduce gate-to-gate transit time; and increase efficiency through decreased controller workload through greater reliance on automation.
- Consolidate identified impacts and issues from assessment on 3-nm separation operations en route and deliver a report that provides guidance for enhancing human and system performance to accommodate and comply with 3-nm separation in en route airspace.
- Consolidate data gathered from the evaluation exercises and provide guidance for the presentation of the information to the controller through the primary automation system display.
- Provide recommendation on updates to operational procedures through advisory circulars and/or updates to FAA Orders to support "no closer than" spacing.
- 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.

Program Plans FY 2021 – Performance Output Goals
- Develop ATC requirements for the display of separation management tools for UAS.
- Develop ATC requirements for display of separation management tools for Space Vehicle path of travel/debris through FAA controlled airspace.

H, Reduced Oceanic Separation, G02S.04-01

Program Description

The Reduced Oceanic Separation (ROS) program will increase the use of 30/30nm separation and potentially reduce separation to 15/15nm in Oceanic Flight Information Regions (FIRs). Oceanic and remote domestic airspace is different from the rest of the NAS due to current limitations in surveillance, navigation, and communication capabilities. Enhancing surveillance and communication capabilities can provide significant improvements to air navigation services by reducing separation minima for optimum routing or new air routes for increased 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 program will reexamine current limitations to reducing oceanic separation standards. 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.

Despite improved capability to control aircraft in oceanic sectors there are still limitations associated with oceanic airspace. These limitations include insufficient radar coverage due to vast areas of airspace over the ocean and inherent inefficiencies associated with data link and high frequency communications; this requires more separation between aircraft to ensure safe operations. Required oceanic separation is also dependent upon aircraft equipage. Inadequate equipage for aircraft flying oceanic routes requires greater separation than for well-equipped aircraft.

To address 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. This automated information displayed on ATOP is generated by the Future Air Navigation System (FANS) onboard aircraft today; in the future this information could be generated and/or enhanced by one of the ROS alternatives.

An Investment Analysis Readiness Decision was completed in January 2014 followed by a JRC Strategy Briefing in October of 2014. In the October 2014 strategy briefing, the program requested approval to continue maturing three alternatives to provide users with the service opportunity to best suits their business needs. The three alternatives presented included the use of: 1) FANS-1/A; 2) space-based surveillance using ADS-B; and 3) ADS-B In Pairwise Trajectory Management (PTM). At the recommendation of the ROS program manager, Alternative 3, ADS-B In PTM, ceased to be part of the Reduced Oceanic Separation program and was incorporated into the ADS-B NAS Wide Implementation – Future Segments (CIP G02S.01-02) program. The JRC approved the strategy as proposed.

For Alternatives 1 and 2, the following activities would be conducted:

- Collision Risks and Safety efforts with ICAO
- Separation assurance and safety assessments
- FAA Safety Management efforts for changes to the NAS
- Engage in testing
- Develop requirements

As an initial step towards an ROS investment, the FAA is pursuing the concept to Ingest and Process Space-Based ADS-B reports to update the ATOP flight profile and further strengthen 30/30nm Oceanic Separation. Another JRC Strategy Decision took place on July 15, 2015 to request approval to use FY 2016 CIP funding to begin software development of ATOP enhancements.

In addition the JRC approved the ROS program to seek an Initial Investment Decision in FY 2017 with a Final Investment Decision in FY 2018 for ROS alternatives 1 and 2.

- Evaluate Space-Based ADS-B for:
  - 30/30nm separation
  - 15/15nm separation
- Evaluate Enhanced FANS 1/A for:
  - Less-than 30/30nm separation (separation minima unknown)

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 Target

This program supports the strategic priority of making aviation safer and smarter by improving air traffic services in US-controlled oceanic airspace as well as in remote NAS airspace. By increasing the use of 30/30nm separation and pursuing reductions to 15/15nm separation standards, this investment will increase the precision of information used for aircraft separation resulting in safer operations.

Program Plans FY 2017 – Performance Output Goals
- Complete development of ATOP upgrades to Ingest and Process Space-based ADS-B.
- Complete Target Level of Safety Analysis.
- Obtain Service Acceptance Test at the WJHTC for Oceanic service volumes.
- Conduct ICAO and FAA Safety Assessments – FANS-1/A and Space Based ADS-B.
- Develop the following draft products in support of the FID:
    - Final Program Requirements (fPR) Document;
    - Enterprise Architecture Products;
    - Business Case documentation;
    - Final Implementation Strategy and Planning Document (ISPD); and
    - Acquisition Program Baseline (Execution Plan).
- Achieve IID for ROS.

Program Plans FY 2018 – Performance Output Goals
- Conduct ICAO & FAA safety assessments.
- Develop the following final products in support of the FID:
    - Final Program Requirements (fPR) Document;
    - Enterprise Architecture Products;
    - Business Case documentation;
    - Final Implementation Strategy and Planning Document (ISPD); and
    - Acquisition Program Baseline (Execution Plan).
- Achieve FID for ROS.

Program Plans FY 2019-2021 – Performance Output Goals
- Milestones will be developed at FID.

I, 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 Air Traffic Control (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 provide 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)
- Trial Planning (new on R-side)
- Flight data display and data entry capabilities
- 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)
- Automation-assisted controller to controller coordination (Reduce controller coordination for strategic resolution maneuver implementation)

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 (TBO) 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 can be anticipated that there will be a need for data exchange or greater interplay between the ERAM and Time Based Flow Management (TBFM) 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. Even with certain improvements (e.g., Terminal Sequencing and Spacing/TBFM) the extent of RNAV and RNP route usage will remain constrained by the lack of automation and information exchange. Without implementation of these capabilities, utilization of PBN in the TRACON will be reduced, resulting in a significant reduction of PBN benefits across the NAS. These capabilities provide the automation to support and maximize use of PBN in the TRACON, facilitating capture of full PBN benefits.

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 57,975, 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 4D Trajectories 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 2017 – Performance Output Goals

- Enhance controller operational decision support tools with the following activities:
  - Conduct concept engineering activities to identify shortfalls associated with terminal conflict alert (CA) and minimum safe altitude warning (MSAW) functions and potential enhancements to those functions.
- Enhance the trajectory modeling capabilities with the following activities:
  - Conduct an operational assessment of extended en route trajectory prediction and automated conflict detection capabilities for all airspace domains; and
  - Complete a gap analysis of ERAM's ability to issue a 4D Trajectory for direct routes.

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 within the scope of an air-ground trajectory synchronization/negotiation;
  - Conduct engineering analysis of operational needs, ops concept, and scenarios for improved approval of user requests, conditional handoffs, and pointouts;
  - 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;
  - Complete concepts and requirements for preferred routing in constrained oceanic airspace;
  - Complete prototype and operational evaluation for approval of user requests in oceanic airspace;
  - Complete concept engineering efforts to improve terminal CA and MSAW; and
  - Conduct concept engineering evaluation for airspace configuration management capability in the Terminal domain.
- Enhance the trajectory modeling capabilities with the following activities:
  - Update ERAM KVM prototype using Flight Management System (FMS) Extended Projected Profile data downlinked via Automatic Dependent Surveillance – Contract (ADS-C).
- Exploit and prototype Flight-specific Aircraft Intent, from trajectory exchanged between ANSP (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 a future ERAM Segment:
  - Preliminary shortfall analysis;
  - As-Is and To-Be functional analyses;
  - Preliminary concept of operations document; and
  - Concept and Requirements Definition plan.
- Develop the following for future Terminal enhancements:
  - Develop preliminary shortfalls analysis
  - Conduct preliminary functional analysis
  - Perform initial algorithmic modeling and develop initial operational requirements
  - Perform preliminary cost, risk and safety assessments

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;
  - Complete an operational concept of rank-ordered conflict resolution based on efficiency of the maneuvers; and
  - Perform an initial feasibility study of user requests and resolving conflicts with multiple maneuvers in En Route airspace.
- 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 4D trajectory operations; and
  - Analyze HITL simulation test results and develop technical report on the impact of 4D trajectory modeling.
- Develop the following products in support of Investment Analysis Readiness Decision (IARD) for a future ERAM Segment:
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operations;
  - Functional Analysis;
  - Enterprise Architecture Products; and
  - Preliminary Program Requirements.
- Conduct engineering analysis to refine the operations, scenarios, and use cases for the following Terminal areas:
  - Improved coordination and utilization of available PBN procedures/routes;
  - Enhancements in the prediction, coordination, execution, and overall management of NAS assets;
  - Enhancements in the accuracy, availability, and dissemination of runway assignment data; and
  - Improved Terminal airspace/route demand and capacity modeling.

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 a future ERAM Segment:
  - Initial Program Requirements;
  - Business Case Analysis Report (BCAR);
  - Enterprise Architecture Products;
  - Initial ISPD; and
  - Final Investment Analysis Plan (IAP).
- 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 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 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 Flight Management Computer (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 an operational concept for Interval Management – Spacing during departure operations.
- Develop the following products in support of the Final Investment Decision (FID) for Sector Enhancements 2:
  - 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 WP2:
  - Shortfall Analysis/Quantification;
  - Enterprise Architecture Products; and
  - Preliminary Program Requirements.
- Develop the following products in support of the IID for Terminal WP2:
  - Initial Program Requirements;
  - Business Case Analysis Report (BCAR);
  - Enterprise Architecture Products;
  - Initial ISPD; and
  - Final Investment Analysis Plan (IAP).

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.

NextGen Oceanic Capabilities will handle a wide-range of aircraft equipage, Airline Operations Center capabilities, and Air Navigation Service Provider capabilities, as well as using evolving technologies such as System-Wide Information Management (SWIM) to develop and deploy NextGen 4D trajectories capabilities in oceanic airspace. The implementation of these capabilities will involve procedural and automation changes and will occur incrementally. Trajectory-based operations will allow more airspace users to collaborate with air traffic management to obtain desired routes. Optimized flight trajectories will result in fuel and time savings and lower emissions.

This program will provide the following operational improvements:

- Flexible entry time for oceanic tracks;
- Aircraft-specific traffic flow management capability with optimized flight trajectories;
- Improved management of traffic flow at merge points;

- Improved Oceanic Air Traffic Management by integrating weather information into decision support tools; and
- Providing decision support tools for the controllers, resulting in improved efficiency and increased safety.

Planned capabilities include the following enhancements:

- NextGen: Data Exchange via SWIM - new services;
- NextGen: Enhanced conflict probe for airspace controlled by advanced technologies and oceanic procedures automation;
- NextGen: Approval of user requests in oceanic airspace - auto re-probe; and
- NextGen: Approval of user requests in oceanic airspace - conflict resolution advisory.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

With increased system precision and enhanced automation, aircraft can be assigned to more closely spaced 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 2017-2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Begin development of the engineering requirements.
- Begin development of software design and development for candidate capabilities.
- Publish synchronized data using SWIM data exchange.

Program Plans FY 2020 – Performance Output Goals

- Complete development of the engineering requirements.
- Complete software design and development for candidate capabilities.

Program Plans FY 2021 – Performance Output Goals

- Publish system analysis recording via SWIM.

X, Conflict Advisories, G01A.02-03

Program Description

This program provides the analysis, development and pre-implementation activities required to reduce en route controller workload by assisting controllers in determining conflict resolutions. It produces computer generated conflict resolution advisories (CRA), which are initially transmitted to aircraft using both voice and data communications, and ultimately using only data communications when equipage permits. It investigates the impacts of various equipage levels on the benefits associated with this solution as well as on controller workload and task performance. High performance aircraft will connect via air-ground data communications that link directly to the flight management system, facilitating electronic data communications between the ATC automation and the flight deck automation.

In airspace with mixed equipage aircraft, the controller will still be responsible for aircraft separation by responding to problems predicted by the ATC automation. Instead of monitoring the sector airspace display to predict potential problems and mentally calculating problem resolutions, the automation will not only predict the problems but determine the best solution. The controller will have the option to transmit the solution via voice or data link for equipped aircraft. This level of automation support helps manage controller workload as a means of safely dealing with the predicted increases in traffic volume. This program will initially prototype relatively basic resolution capabilities, such as pre-probed altitude and speed amendments, that can be transferred either verbally by controllers or via data link. The program will also evaluate the impact these clearances have on the Computer-Human Interface design and system performance. As the research matures, more complex capabilities will be investigated for future implementation such as multiple horizontal segment maneuvers. The research will evaluate the role of the human versus automation in voice clearance, mixed voice and data communications environments, and eventually data communications only.

The program is defined in terms of incremental builds of deployable capabilities. Build 1 capability includes the most mature set of tools and menus that support basic two stage maneuvers and an initial ranked list of automation generated resolutions. Build 2 will add more complex multiple segment maneuvers and more constraints such as time based metering. Future builds may include more complex topics such as the airspace constraints caused by convective weather.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Automated problem prediction and resolution will allow the controller to handle more aircraft (i.e., demand) because predicted problems will be resolved strategically, reducing the number of situations that require multiple time-critical actions.

Program Plans FY 2017-2019 – Performance Output Goals
- None.

Program Plans FY 2020 – Performance Output Goals
- Complete revision of trajectory based operations separation management CONOPS re-aligning to Data Communications and ERAM Sector Enhancements programs.
- Update impacted automation functional and nonfunctional requirements based on re-alignment.
- Validate requirements and update benefits case through engineering analysis, prototyping development, and simulation.

Program Plans FY 2021 – Performance Output Goals
- Update requirements document for CRA Build 1 automation capability based on re-alignment and corresponding validation exercises.
- Perform tasks to support the benefits case for the CRA Build 1 JRC decision.
- Perform safety assessment to support the CRA Build 1 JRC decision.
- Develop operational concept for CRA Build 2 automation capability.
- Validate requirements and update benefits case to include CRA Build 2 automation capability through engineering analysis, prototyping development, and simulation.

1A06, NextGen – Improved Surface Portfolio

FY 2017 Request $2.0M

- Surface Tactical Flow, G02A.01-01
- X, Surface Conformance Monitoring, G02A.01-02
- X, Enhanced Service Small Communities (ESSC), G03M.04-02

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 (CDM) sub team of the CDM Stakeholder's Group (CSG) 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.

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 57,975, 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 2017 – Performance Output Goals

- Complete deployment of NASA Airspace Technology Demonstration -2 (ATD-2) Surface Subsystem to Charlotte Tower and Atlanta ARTCC.
- Conduct and deliver a limited field evaluation report of collaborative departure management (CDM) capability, to include surface CDM and collaboration with flight operators, airport operators, and ATC to support Terminal Flight Data Manager (TFDM) contractor technical design review.

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 (PMO).
- Deliver a FAA assessment of NASA's ATD-2 collaborative departure metering capability including Surface-Collaborative Decision Making 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.

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.
- Analyze 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; Time Based Flow Management, Traffic Flow Management System, and Terminal Flight Data Manager.
- 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.

X, Surface Conformance Monitoring, G02A.01-02

Program Description

The Surface Conformance Monitoring (SCM) program will develop surface conformance monitoring concepts and will demonstrate and validate procedures and algorithms. Current runway incursion capabilities detect when an aircraft is about to enter a safety area such as the runway and is not capable of identifying a taxi deviation such as a missed hold short instruction. SCM will provide monitoring of an aircraft following an assigned taxi route. The air traffic controller transmits a precise, unambiguous taxi clearance to the aircraft via data link and conformance to the clearance would be monitored by automation in the tower. The SCM program will develop and demonstrate user-friendly, minimal-workload methods to help the controller specify the taxi route. Conformance monitoring can be limited to route adherence only, or both route and timing through the inclusion of timed check points in the taxi clearance. By using a proactive approach to separation on the airport surface, taxiing aircraft can be "de-conflicted" with other aircraft in the taxi, landing, and takeoff phases of flight, resulting in safer ground operations.

The program will:

- Demonstrate and validate procedures for Taxi Conformance Monitoring in a realistic ATCT environment;
- Evaluate performance of pre-established taxi routes vs. controller-generated taxi routes in a SCM environment;
- Evaluate performance of prototype surface conformance algorithms;
- Demonstrate Trajectory Based Operations (TBO) concept feasibility on airport surface; and
- Transfer mature concepts and supporting documentation to the Terminal Flight Data Manager program for 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

An automated means to monitor surface conformance and alert controllers to deviations from the expected taxi route will reduce controller workload and allow controllers to more efficiently manage aircraft on the surface environment resulting in reduced taxi times and fewer surface delays at congested airports.

Program Plans FY 2017-2018 – Performance Output Goals

- None.

Program Plans FY 2019 – Performance Output Goals

- Complete assessment of state of the art technologies for Surface Conformance Monitoring.
- Complete update of Concept of Use document for Surface Conformance Monitoring to include flight deck and ground based conformance integration.
- Deliver report on shortfalls and potential benefits of surface conformance monitoring.
- Develop Human-in-the-Loop (HITL) evaluation plan for Time Based Surface Conformance Monitoring incorporating Departure-Taxi clearance delivery.
- Develop integrated research platform integrating Departure-Taxi Capability with Surface Management to support HITL's.

Program Plans FY 2020 – Performance Output Goals

- Conduct HITL simulations of Time-Based Surface Trajectory Based Operation Surface Conformance Monitoring evaluating the performance of Departure-Taxi clearance delivery.
- Complete HITL evaluation report for Time-Based Surface Trajectory Based Operation Surface Conformance Monitoring evaluating the performance of Departure-Taxi clearance delivery.
- Complete initial use case and operational procedures for Conformance Monitoring with integrated Flight Deck.
- Develop HITL evaluation plan for Time Based Surface Conformance Monitoring integrating NASA Integrated Surface Management with Flight Deck.
- Complete HITL evaluation of Time Based Surface Conformance Monitoring integrating NASA Integrated Surface Management with Flight Deck.

Program Plans FY 2021 – Performance Output Goals

- Complete HITL evaluation report for Time Based Surface Conformance Monitoring integrating NASA Integrated Surface Management with Flight Deck.
- Complete Technology transfer of SCM artifacts to PMO.

X, Enhanced Service Small Communities (ESSC), G03M.04-02

Program Description

Current Air Traffic Control (ATC) services at airports that support small communities are severely limited. The ESSC program will develop an approach to expanding low-cost service capability to small communities that are currently served by non-towered airports or airports with limited ATC services. ESSC will identify and group airports based on similar configurations. ESSC will evaluate a group of airports based on their required level of service and make recommendations based on the potential benefits that could be achieved. Improving ATC services at these locations will enable increased capacity, improved safety and incentivize communities served by these airports to increase aviation support. This program will evaluate procedures and technologies, and leverage NextGen surveillance, communications, data sharing, and new optical technologies to provide ATC tower-like services at airports that do not currently meet the criteria for an ATC Tower. The FAA will identify and develop recommended changes to controller equipment, standards, procedures and policies to provide required surveillance, communications, and other capabilities to support improved air traffic services and access to smaller airports. These services may be performed from a remote location.

Additional access to small airports will also be achieved by utilizing en route and/or terminal surveillance capability down to, and including the surface movement area (runways and taxiways) for these small airports. This will reduce delays due to one-in and one-out operations at these airports, and strengthen economic opportunities for these communities. This effort expands on existing FAA activities which leverage improved surveillance using technologies such as multilateration, ADS-B and cameras to track aircraft down to and on the airport surface, and by adding capabilities to controller workstations at other locations to support these non-towered airports.

The FAA will use its authority to enter into cost recovery mechanisms for enhanced service to small communities through state, municipal, or local airport funding of the infrastructure enhancements.

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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

ESSC will develop tailored solutions or options based on needed level of service and potential benefits to be achieved. Improving ATC services at these locations will allow for increased capacity and improved safety, and will provide incentives for increased aviation support for the communities served by these airports. This program will include future technologies, standards, procedures and policies to accommodate the need for improved airport services in these small communities. ESSC will improve access to non-towered airports and airports with limited ATC services reduce one-in and one-out delays, expand service to meet the demand for greater capacity and provide economic opportunities to these smaller communities in a cost effective manner. ESSC will leverage existing NextGen surveillance, communications, data sharing and new optical technologies to provide potential alternatives to the costly construction of new staffed ATC towers.

Program Plans FY 2017 – Performance Output Goals

- None.

Program Plans FY 2018 – Performance Output Goals

- Complete analysis of selected airport category for operational capabilities and configurations.
- Complete draft ESSC alternatives analysis document.
- Complete draft ESSC feasibility study document.
- Complete draft concept of operations (ConOps) document for ESSC.

Program Plans FY 2019 – Performance Output Goals
- Initiate simulation activity for ESSC.
- Complete initial safety case analysis.
- Develop draft operational procedures.

Program Plans FY 2020 – Performance Output Goals
- Update operational procedures.
- Complete simulation activity for ESSC.
- Update ConOps for ESSC.
- Prepare for field demonstration and evaluation at key site(s) for ESSC.

Program Plans FY 2021 – Performance Output Goals
- Conduct field demonstration and evaluation at key site(s) for ESSC.
- Complete benefits analysis for ESSC.
- Complete initial requirements document for ESSC.
- Update safety case analysis.

1A07, NEXTGEN – ON DEMAND NAS PORTFOLIO
FY 2017 Request $8.5M

- 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
- E, Advanced Methods, G05A.02-02
- X, Airspace Resource Management System (ARMS), G05A.02-09

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 (ANSPs) also operate as separate entities servicing their own airspace. Even though flight data is found in multiple NAS systems, a unified, complete, accurate, up-to-date, and easily-accessible picture of all flights does not exist today. The primary goal of the Flight Object program is to develop an International data standard, "FIXM" (Flight Information Exchange Model) and to support 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 will be the standard medium for capturing and sharing the most up-to-date information on any flight, and will serve as the single common reference for all system information about that flight. A flight object will be created for each proposed flight, and the flight object information will be updated throughout the entire time the flight progresses from gate to gate. The flight object will collect, manage and provide flight-specific data, such as aircraft identification, aircraft parameters, current flight plan information, operator preferences, flight capabilities, and security information. The flight object is not envisioned to include environment or weather information, since these are system-wide elements that affect multiple flights. The sum of information contained in the flight object will be more detailed than today's flight data construct. FIXM is part of a family of information exchange models that includes the Aeronautical Information Exchange Model (AIXM) and the Weather information Exchange Model (WXXM) designed to cover the information needs of Air Traffic Management (ATM). FIXM is an International data exchange standard, and will periodically require incremental updates at regular intervals to add/delete/modify FIXM data elements as necessary.

There are several initiatives to implement FIXM in today's ATM operations in both domestic and international domains. FAA's Flight Data Publication Service (FDPS) under the SWIM Segment 1 program, G05C.01-01, currently publishes SWIM-compliant flight data from En Route Automation Modernization (ERAM) in the FIXM standard. Release 10 of the Traffic Flow Management System publishes FIXM formatted data through a mediator provided by SWIM and with release 13 will publish FIXM format without a mediator. International data exchange will also be available soon. Airservices Australia's Flight Information Broker (FIB) provides a variety of flight information services in the FIXM format, and Australia's Operational Data Services (ODS), a future flight information management system, is planning to deploy using FIXM.

The FIXM data model will continue to grow into 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 the 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 from particular communities of interest. Concepts and data elements from regional extensions can be promoted to the core if they demonstrate global applicability. FAA publishes and manages the FIXM US extension, which contains the flight data specific to NAS operations.

For future versions of FIXM, the Core is expected to include additional sets of data elements to support the four-dimensional trajectory (4DT) concept. A series of 4DT operational scenarios are being developed and coordinated between the Single European Skies ATM Research Program (SESAR) and NextGen and have initially been incorporated in FIXM beginning with version 3.0 in FY 2014. The continued development of these scenarios, along with FIXM data elements necessary to support the 4DT concept, will provide additional input for the development of FIXM Core data standard. The 4DT concept is part of a larger effort to define new provisions through International Civil Aviation Organization (ICAO) to support a Flight and Flow Integrated Collaborative Environment (FF-ICE). FF-ICE defines international information requirements for flight planning, flow management and trajectory management and aims to be a cornerstone of performance-based navigation. 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.

Along with the continued development and evolution of the FIXM Core, the FIXM US Extension will supplement FIXM content in the following data areas to support various FAA NextGen initiatives. Future version releases of v5.0 through v7.0 are planned to contain elements related to the following areas:

- Surface flow Collaborative Decision Making;
- Unmanned Aircraft System (UAS) operations; and
- 4D Trajectory operations.

The Flight Object program will be composed of two major components:

- Development of the FIXM standard; and
- FIXM Operational Analysis.

<u>Development of FIXM Standard:</u>
The FIXM Core Standard and US extension will be updated as needed to support NextGen capabilities and the FF-ICE international initiative. The following artifacts will be created for each version: FIXM Operational Data Description, FIXM Logical Model and XML schema. The updates will be created with collaboration with FAA stakeholders, International partners, industry, ICAO, and International Air Transport Association (IATA).

<u>FIXM Operational Analysis:</u>
The operational analysis will assess various ATM capabilities and identify the data requirements that should be considered for inclusion in each release of FIXM. Additionally, operational scenarios will be developed to define operational context in FIXM artifacts and verify that their contents accurately address the operational 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Use of FIXM will provide 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 2017 – Performance Output Goals
Development of FIXM Standard:

- Complete work to accommodate maintenance updates to FIXM Core v4.0 to reflect corrections/modifications as a result of FF-ICE/1 Implementation Guidance and early user review.
- Develop updated US Extension to support v4.0 maintenance release.

FIXM Operational Analysis:

- Develop a FIXM NAS Implementation Strategy for transitioning from today's ATM environments to the full implementation of FIXM. This strategy will provide a projected overview on which NAS System will implement FIXM at what time frame. FIXM must ensure it is prepared to accommodate the systems to be transitioned.
- Conduct the assessment for the NAS FIXM messaging guideline for constructing and exchanging FIXM compliant messages for various NAS data exchanges.
- Identify and prioritize changes to FIXM in support of FAA and non-FAA systems migrating to FIXM standard.

Program Plans FY 2018 – Performance Output Goals
Development of FIXM Standard:

- Complete impact assessment of an ICAO Reference Model on the FIXM Standards.
- Complete impact assessment of the ICAO FF-ICE/1 Implementation Manual on FIXM.
- Develop draft FIXM Core v5.0 artifacts. This release may include 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.
- Develop a FIXM Global Implementation Strategy. This strategy will provide a projected overview on implementing FIXM for global data exchanges.
- Conduct the assessment for the Global FIXM messaging guideline for constructing and exchanging FIXM compliant messages in the global data exchanges.
- Identify and prioritize changes to FIXM in support of FAA and non-FAA systems migrating to FIXM standard.

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.
- Update the FIXM messaging standard based on FIXM content changes.

FIXM Operational Analysis:

- Develop Operational Scenarios to support FIXM US Extension v5.1 (if needed).
- Initiate developing Operational Scenarios to support FIXM Core v6.0.
- Initiate developing Operational Scenarios to support FIXM US Extension v6.0.
- Identify and prioritize changes to FIXM in support of FAA and non-FAA systems migrating to FIXM standard.

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:

- Develop Operational Scenarios to support FIXM Core and US Extension v6.

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.
- Update the FIXM messaging standard based on FIXM content changes.

FIXM Operational Analysis:

- Develop and complete final operational scenarios to define the operational context for FIXM Core v7.0.
- Develop and complete final operational scenarios to define the operational context for FIXM US extension v7.0.

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 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 DoD, Airline Operations Centers, Flight Operation Centers, pilots and Air Navigation Service Providers (ANSP) 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, this platform 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 (SOP) and Letters of Agreement (LOA), real-time Special Activity Airspace (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.

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 2017 – Performance Output Goals

- Develop the following products in support of the Investment Analysis Readiness Decision (IARD) for AIMM S3, which will focus on the digitization of constraint data, integration of AI data with decision support tools, improved adaptation generation, and digitized charting:
    - 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 S3.

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 (BCAR);
    - Enterprise Architecture Products; and
    - Initial Implementation Strategy and Planning Document (ISPD).

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 (fPR) Document;
    - Enterprise Architecture Products;
    - BCAR;
    - Final ISPD;
    - Acquisition Program Baseline (Execution Plan);
    - Independent Evaluation Review (IER); and
    - Project Management and Communications Plan.
- Achieve FID for AIMM S3.

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.

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.

C, Flight Object Exchange Services (FOXS), G05A.02-08

Program Description

Flight data is essential to air traffic control. It alerts controllers to the intended flight path of the aircraft they are controlling. Even though flight data may be found in multiple NAS systems, a unified, complete, accurate, and up-to-date data-set containing all flights managed by en route, terminal and surface facilities in the various stages of flight does not exist today. Coordination of flight data with two way data exchange is needed to support future concepts, such as Trajectory Based Operations, that require gate to gate planning for execution of the flight.

FOXS will establish the information architecture for modifying NAS interfaces to support the transition of real time operational NAS systems from existing data standards and interfaces into a data standard and interface that will support coordinated use. FOXS will support the Flight Information Exchange Model (FIXM) standard which is a part of a family of information exchange models that includes the Aeronautical Information Exchange Model (AIXM), and the Weather information Exchange Model (WXXM) designed to support the information needs of Air Traffic Management (ATM). FIXM is an International data exchange standard which will be updated annually and will require that FOXS also be updated to support new versions of the standard.

Integration of FIXM into NAS flight data will be managed through the implementation of the NAS flight object. The FOXS program will incorporate flight object data and support NAS and Non-NAS client connectivity to the service. FOXS connected clients will be able to access flight object data and modify flight object data as authorized. Flight object information will be used to capture and distribute the most up-to-date information on any flight, and will serve as the single common reference for all system information about that flight. A flight object will be created for each proposed flight, and the flight object information will be updated in real time as the flight progresses through planning states to active states gate to gate. The flight object will collect, manage and provide flight-specific data, such as aircraft identification, aircraft parameters, current flight plan information, operator preferences, flight capabilities, trajectory, and security information. Over time, flight-specific data and other information contained in the flight object may become more detailed to support new capabilities.

The program is currently in the Concept and Requirements Definition (CRD) phase. It is scheduled for an Investment Analysis Readiness Decision (IARD) in FY 2017, Initial Investment Decision (IID) in FY 2018 and a Final Investment Decision (FID) by 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

FOXS will provide a unified, complete, accurate, up-to-date, and easily-accessible picture of all flights. Connectivity to FOXS, and the use of flight object data will improve the information management and availability of flight object data between stakeholders, enabling operational benefits such as improved non-verbal coordination, common operational situational awareness, and collaborative decision-making across all phases of flight; improving planning, decision making, and the use of NAS capacity.

Program Plans FY 2017 – Performance Output Goals

- Complete operational analysis and system allocation of:
  - Flight Data Common Service (FDCS);
  - Flight Object Exchange Services (FOXS); and
  - Unified Flight Planning and Filing Service (UFPF).
- Complete the following products in support of the FOXS IARD:
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operations;
  - Functional Analysis; Enterprise Architecture Products; and
  - Preliminary Program Requirements.
- Achieve IARD for FOXS.

Program Plans FY 2018 – Performance Output Goals

- Conduct engineering development of:
  - Flight Data Common Service (FDCS)
  - Flight Object Exchange Services (FOXS)
  - Unified Flight Planning and Filing Service (UFPF)
- Complete the following products in support of the FOXS IID:
  - Initial Program Requirements;
  - Initial Business Case Analysis Report (BCAR);
  - Enterprise Architecture Products;
  - Initial Implementation Strategy and Planning Document (ISPD); and
  - Final Investment Analysis Plan (IAP).
- Achieve IID for FOXS.
- Complete engineering and investment analysis planning to incorporate FIXM changes into FOXS and SWIM services.

Program Plans FY 2019 – Performance Output Goals

- Complete the following products in support of the FOXS FID:
  - Final Program Requirements (fPR) Document;
  - Enterprise Architecture Products;
  - Business Case documentation;
  - Final ISPD; and
  - Acquisition Program Baseline (Execution Plan).
- Achieve FID for FOXS.

Program Plans FY 2020 – Performance Output Goals

- Initiate FOXS implementation, including:
  - FOXS hardware infrastructure; and
  - FOXS services (including Globally Unique Flight Identifier (GUFI) service and data fusion service).

Program Plans FY 2021 – Performance Output Goals

- Complete FOXS implementation, including:
  - FOXS hardware infrastructure; and
  - FOXS services (including GUFI service and data fusion service).
- Complete the following products to support the FOXS In-Service Decision (ISD):
  - Operational test report(s);
  - Independent Operational Assessment Report; and
  - In-Service Review (ISR) Checklist completed or action plans for those remaining open.

D, Dynamic Airspace, G05A.04-01

Program Description

The Dynamic Airspace program will develop the requirements and algorithms for tools to enable air traffic managers to reconfigure airspace to expand or contract air traffic control sectors to match the overall level of activity in the facility's airspace and dynamically manage restrictions on travel through designated areas. Airspace reconfiguration will be flexible, so that it can be applied across time horizons of varying scale; from years, to months, to days, to hours. It will allow the transfer of airspace from adjacent areas within a facility, as well as airspace from adjacent facilities to improve the overall efficiency of operations. When mitigating constraints such as weather and Special Use Airspace (SUA), Dynamic Airspace provides an additional tool to support robust aviation capabilities and ensuring a continuous NAS flow strategy.

The acquisition milestones for the Dynamic Airspace Program are planned as follows: Concept and Requirements Definition Readiness Decision (CRDRD) in FY 2019; Investment Analysis Readiness Decision (IARD) in FY 2020; Initial Investment Decision (IID) in FY 2021; and a 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 2 – Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Dynamic Airspace will allow traffic managers to optimize the airspace configuration across the NAS to decrease congestion in workload-constrained airspace while addressing weather and SUA.

Program Plans FY 2017 – Performance Output Goals
- Develop Project Plan.
- Develop a preliminary shortfall analysis.

Program Plans FY 2018 – Performance Output Goals
- Develop an initial Concept of Operations (ConOps).

Program Plans FY 2019 – Performance Output Goals
- Conduct concept validation activities, such as a human-in-the-loop simulation.
- Complete documentation in preparation for CRDRD:
  - Concepts and Requirements Definition Plan
  - Updated ConOps
  - Updated Shortfall Analysis
- Achieve CRDRD.
- Conduct concept validation activities, such as a human-in-the-loop simulation.
- Complete the following documentation in preparation for IARD:
  - Final Shortfall Analysis Document
  - Final Solution ConOps

Program Plans FY 2020 – Performance Output Goals

- Complete the following documentation in preparation for IARD:
  - Functional Analysis document
  - NAS EA Products
  - Operational Safety Assessment (OSA)
  - Preliminary Program Requirements
  - Range of Alternatives Document
  - Acquisition Category
- Achieve IARD.
- Complete the following documentation in preparation for IID:
  - Initial Plan for Final Investment Analysis
  - Initial Program Requirements (IPR)

Program Plans FY 2021 – Performance Output Goals

- Complete the following documentation in preparation for IID:
  - Initial Business Case Definition for each alternative
  - Initial Implementation Strategy and Planning Document (ISPD)
  - Safety Assessment
  - NAS EA Products
- Complete initial Screening Information Request.
- Achieve IID.

E, Advanced Methods, G05A.02-02

Program Description

Advanced Methods for Traffic Flow Management (TFM) 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.

The capabilities developed through Advanced Methods, together with those developed through the Strategic Flow Management Application (SFMA) program (G05A.01-01) will provide the concepts and requirements to the Strategic Flow Management Engineering Enhancements program (SFMEE) (G05A.01-02) to progress these through the AMS process as part of future investments for CATMT.

The capabilities defined by this program are grouped in the following enhancement areas:

- Constraint Prediction, Monitoring and Alerting:
  - Translate the effects of weather and traffic complexity on the number of flights that can fly through constrained airspace during a specific timeframe (airspace resource capacity);
  - 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. The initial step would be to provide enhanced risk assessment information to users as they conduct what if analyses on the parameters of potential Traffic Management Initiative (TMI) strategies;

  - Continue to enhance models that map a current operational event to similar historical events and associated TMI strategies. Engage operational subject matter experts to identify and capture relevant attributes to develop models for decision support capabilities; and
  - Continue to explore methods to allow operators to submit quantitative input to system performance goals such as capacity, predictability, efficiency, and equity, and appropriately weigh and aggregate operator inputs. Begin to explore methods for translating aggregated performance expectations into TMI parameter recommendations.

- 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.

- Flow Management to Support Dynamic Airspace:
  - Provide ability to assess post-operations data from areas with known problem of matching demand and capacity;
  - Leverage post-operations data to enable airspace redesign to incorporate user-proposed routings, Special Activity Airspace, reverse or combined traffic flow capabilities and common weather impact configurations;
  - Leverage post-operations data to enable flexible sector design based on time of day, season, typical weather, or staffing; and
  - Determine methods to display predicted congestion, weather events, and constraints to assist in configuration selections by Traffic Management Coordinators (TMCs).

- Collaborative Airport and Airspace Configuration Management:
  - Increase departure flow efficiency and reduce delays by providing decision-making support capabilities to optimize integrated arrival/departure flow planning and execution;
  - Automate the process of monitoring departure demand and the identification of departure slots in relationship to airport arrival demand; and
  - Support evaluation and coordination of related airspace and airport configuration changes with associated route changes. It includes collaboration among the tower, TRACON, en route, airport authority, and airspace users.

- Improved Weather Integration into Flow Planning:
  - Increase flow efficiency by incorporating improved weather products (e.g. CoSpa) into flow planning capabilities; and
  - Provide improved weather display on Traffic Situation Display (TSD) for flow planning purposes.

All of the above capabilities, along with other emerging TFM capabilities, will be prioritized as the program moves forward. Prioritization will be based on concept maturity, operational benefit(s), and schedule. The prioritized capabilities will be recommended for future CATMT investment based upon available funding and may be updated once prioritization is completed.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Advanced Methods for TFM 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 2017 – Performance Output Goals
- Conduct concept validation activities – prototyping/evaluations/human in the loop (HITLs)/reports for individual capabilities under Constraint Prediction, Monitoring and Alerting; and TFM System Performance Analysis Capability.

Program Plans FY 2018 – Performance Output Goals
- Conduct concept engineering activities to develop the following products for individual capabilities under Constraint Prediction, Monitoring and Alerting, Operational Response Development, and TFM System Performance Analysis Capability:
  - Updated Capability Functional Analysis;
  - Updated Capability Requirements;
  - Rough order of magnitude cost estimates; and
  - Rough order of quantitative capability benefits.
- Update products as necessary for individual capabilities under Constraint Prediction, Monitoring and Alerting; Operational Response Development; and TFM System Performance Analysis Capability:
  - Capability Functional Analysis;
  - Capability Requirements;
  - Rough order of magnitude cost estimates; and
  - Rough order of quantitative capability benefits.
- Conduct and report on a gap analysis between existing/near-term planned TFM capabilities and the NextGen Concept of Operations (CONOPs)/Operational Improvements (OIs) in the enhancement areas of Flow Management to Support Dynamic Airspace, Collaborative Airport and Airspace Configuration Management, and Improved Weather Integration into Flow Planning.
- Develop the following products based on the above analysis:
  - Capability Shortfall Analysis; and
  - Preliminary Capability CONOPS.

Program Plans FY 2019 – Performance Output Goals
- Develop the following products for new capabilities:
  - Preliminary Capability Functional Analysis;
  - Preliminary Capability Requirements;
  - Concept Validation Activities – Prototyping, Evaluations, Human in the Loop, and Reports; and
  - Updated Capability CONOPS.

Program Plans FY 2020 – Performance Output Goals
- Conduct concept engineering activities to complete the following:
  - Update Capability Functional Analysis;
  - Update Capability Requirements; and
  - Update rough order of magnitude cost estimates.

Program Plans FY 2021 – Performance Output Goals

- Provide Quantitative Capability Benefits for individual capabilities under Flow Management to Support Dynamic Airspace, Collaborative Airport and Airspace Configuration Management, and Improved Weather Integration into Flow Planning.
- Update the following products as necessary for individual capabilities of Flow Management to Support Dynamic Airspace, Collaborative Airport and Airspace Configuration Management, and Improved Weather Integration into Flow Planning:
    - Capability Functional Analysis;
    - Capability Requirements; and
    - Rough order of magnitude cost estimates.
- Conduct a gap analysis between existing/near-term planned TFM capabilities and the NextGen CONOPs/OIs in the enhancement areas of Automated Execution of TMIs, Advanced Arrival Parameter Setting, and Advanced Ground Delay Program.
- Develop the following products based on the above analysis:
    - Quantitative Capability Benefits for individual capabilities;
    - Capability Shortfall Analysis; and
    - Preliminary Capability CONOPS.

X, Airspace Resource Management System (ARMS), G05A.02-09

Program Description

The future NextGen framework for airspace allocation will no longer rely on navigation aids and sectors. The Airspace Resource Management System (ARMS) will implement the tools for controlling the reconfiguration of the NextGen networked communications infrastructure to support the operational requirement for reconfigurable airspace. ARMS will allocate airspace as a resource to meet demand, safety, and environmental requirements and will manage voice, data link communications, and communication links between facilities.

Key benefits from ARMS include:

- Reduced air traffic controller workload while controlling constrained airspace (i.e. Special Activity Airspace, weather).
- More flexibility for air traffic managers to reconfigure airspace to address convective weather and fluctuations in user demand.

An Investment Analysis Readiness Decision (IARD) for this program is planned for FY 2020. Initial Investment Decision (IID) is planned for FY 2020. A 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 3 – Achieve a NAS on-time arrival rate of 88 percent at Core airports and maintain through FY 2018.*

Relationship to Performance Metric

The performance metric to increase on-time arrivals is supported by providing tools to air traffic managers for more flexibility to reconfigure airspace to address convective weather and meet fluctuations in user demand.

Program Plans FY 2017-2019 – Performance Output Goals

- None.

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the IARD:
    - Shortfall Analysis/Quantification;
    - Solution Concept of Operation;
    - Functional Analysis;
    - Enterprise Architecture Products;
    - Program requirements; and
    - Safety Assessment.
- Achieve IARD.
- Develop the following products in support of the IID:
    - Initial Program Requirements;
    - Business Case Analysis Report (BCAR);
    - Enterprise Architecture Products;
    - Initial Implementation Strategy and Planning Document (ISPD); and
    - Final Investment Analysis Plan (IAP).
- Achieve IID.

Program Plans FY 2021 – Performance Output Goals

- Develop the following products in support of the FID:
    - Final Program Requirements (fPR) Document;
    - Enterprise Architecture Products;
    - Business Case documentation;
    - Final Implementation Strategy and Planning Document (ISPD); and
    - Acquisition Program Baseline (Execution Plan).
- Complete Chief Financial Officer Package.
- Achieve FID for ARMS.
- Release Screening Information Request.

1A08, NEXTGEN – IMPROVED MULTIPLE RUNWAY OPERATIONS PORTFOLIO

FY 2017 Request $6.5M

- A, Wake Turbulence Mitigation for Arrivals (WTMA), G06A.01-02
- B, Closely Spaced Parallel Runway Operations, G06N.01-02

A, Wake Turbulence Mitigation for Arrivals (WTMA), G06A.01-02

Program Description

The WTMA program is developing Air Traffic Control (ATC) wake mitigation separation arrival procedures and supporting decision support technology. When development of ATC wake mitigation separation and arrival procedures are completed the throughput capacity benefit will be evaluated in operational demonstrations prior to the WMTA being fully implemented in the NAS. If the program's developed procedures and supporting technology demonstrate a reasonable benefit in NAS throughput, they will be incorporated into FAA terminal area air traffic control procedures and supporting terminal automation systems.

The WTMA capabilities, when implemented, will restore part of the airport runway throughput capacity lost when airports change from visual approach operations to instrument approach operations and implement required wake mitigation separation minima between landing aircraft. High level analyses have indicated that current air traffic control wake mitigation separation process when aided by technology can safely increase capacity efficiency. The WTMA procedure evaluation and requirements development products are expected to allow a rapid integration of the WTMA capability into NextGen ATC procedures and supporting automation platforms.

Wake Turbulence Mitigation for Arrivals – Procedural (WTMA-P) only requires extensive collection and analysis of aircraft wake track data to determine which closely spaced parallel runways (CSPR) airports have the required runway configuration to allow the use of WTMA-P reduced diagonal wake mitigation spacing between aircraft operating at that airport. In FY 2015, WTMA-P was incorporated into FAA Order 7110.308A which approved the use of WTMA-P will at Philadelphia International Airport (PHL) and Detroit Metropolitan Wayne County Airport (DTW) once their operations can be adjusted for the use of the procedure. Additional Core CSPR airports may qualify to run WTMA-P, based on the operational analyses that will continue into FY 2016.

Associated with the development of WTMA-P, the WTMA project is developing as the second part of the project, the Automated Terminal Proximity Alert Phase 2 (ATPA-P2) product. ATPA-P2 is being designed for use by controllers in conducting the dependent approach procedures, such as WTMA-P and other dependent approaches authorized by FAA Order 7110.308A. Controller use of ATPA-P1, designed to assist in single runway approach operations, has resulted in a 1% increase in the number of approach operations a controller conducts per hour/per runway. It is expected that controller use of ATPA-P2 for dependent stagger approaches to parallel runways will net a similar percentage increase in the number of instrument flight rule operations controllers can conduct on the parallel runways using the dependent stagger approach procedures. ATPA-P2 is also an enabling ATC display capability for display of Wake RECAT Phase II separations for parallel runway approach operations and the display of the WTMA System (WTMA-S) crosswind dependent wake protection separation limits.

WTMA-S, the third product of the project, is a more complex technology supported solution that builds on the analysis work accomplished to develop the procedures defined by FAA Order 7110.308 and the development of WTMA-P. WTMA-S will be available for use by all CSPR airports that require more efficient use of runway capacity during instrument approach operations. The WTMA-S procedure and supporting technology allows controllers to position aircraft in a separation interval ahead of wake turbulence from the leading aircraft on the adjacent CSPR approach to the airport. WTMA-S will determine, based on the actual and predicted crosswinds in the approach corridor, the maximum allowed diagonal separation between paired aircraft to keep the following aircraft safely in front of the leading aircraft’s wake. WTMA-S requires knowledge of the current measured and forecast wind conditions in the approach corridor and a longer term forecast, up to 2 hours in the future, to advise on the airport acceptance rate. WTMA-S can provide WTMA-P like CSPR instrument arrival throughput capacity to almost all Core CSPR airports when crosswinds are favorable at those airports.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

The WTMA project, part of the Improved Multiple Runway Operations portfolio, contributes to the FAA Strategic Priority of "Deliver Benefits through Technology and Infrastructure" by developing technology solutions that will provide increased arrival throughput capacity for Core CSPR airports. The developed WTMA procedure and supporting technology for some CSPR airports, allows ATC, when unable to use visual approach procedures, to implement a diagonal reduced wake separation procedure resulting in more arrivals per hour than can be obtained by present ATC wake separation procedures.

PHL and DTW are already approved by FAA Order 7110.308A to use the WTMA-P CSPR arrival procedure. Once PHL is able to add WTMA-P CSPR instrument approach procedures to its arrival operations, the benefit to PHL and its air carriers, is a 30% to 40% increase above PHL's CSPR instrument arrival operational capacity would be without the use of FAA Order 7110.308A. Similar benefit is estimated for DTW, when it is able to conduct WTMA-P CSPR instrument approach operations. The WTMA-S product will extend the WTMA-P type of benefit to CSPR airports that do not have the runway configuration to allow use of WTMA-P. Simulation of the WTMA-S capability has shown that airport arrival rate (AAR) during airport conditions requiring instrument approaches can be increased by up to 10 arrivals per hour, changing the AAR for airports like Boston from 30 an hour to 40 an hour.

Program Plans FY 2017 – Performance Output Goals

- Complete development and one year operational demonstration of the ATPA-P2 modification to the ATPA STARS software module for use with WTMA-P dependent stagger approaches.
- Complete Functional Description Narratives for the development of software modifications in NAS automation platforms to implement the WTMA-S air traffic control decision support capability.
- Complete review by Stakeholders of the WTMA-S Functional Description Narratives.
- Complete WTMA-S concept refinement and preliminary safety analysis documentation for future investment analysis.

Program Plans FY 2018-2021 – Performance Output Goals

- None.

B, 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 single and multiple 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 Instrument Approach (SIIA) operations significantly reduces the impact on the airport arrival rate by maximizing the use of available capacity.

Recently, dual SIIA 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 SIIA.

The CSPO program will accelerate activities to provide increased arrival and departure operations to airports with closely spaced parallel runways 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 to closely spaced parallel runways or converging approaches to runways greater than 700 feet apart, as well as supporting independent operations to 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 (ADS-B), navigation system performance and pilot and controller response times used for risk assessments, and the development of new standards to facilitate NextGen applications.

This program will also evaluate Flight Deck Interval Management (FIM) and Cockpit Display of Traffic Information (CDTI) technologies providing the aircrew with a monitoring capability that mimics the visual monitoring the aircrew uses to self-separate from other aircraft and obstacles, as allowed in Visual Meteorological Conditions (VMC) operations.

The Paired Approach demonstration will demonstrate how satellite surveillance of aircraft for controllers, using ADS-B and FIM pilot automation tools, can be combined to conduct simultaneous instrument approaches in all weather conditions to runways that are closely spaced and parallel to each other. This demonstration is expected to show benefits such as increased airport arrival rates, less time spent in the air maneuvering for a final approach, fuel savings for the airlines, and reduced emissions for the environment. This demonstration is funded through G08M 01-04.

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 57,975, 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 closely spaced parallel runways 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 2017 – Performance Output Goals

Closely Spaced Parallel Runway Operations:

- Perform analysis of data collected in Paired Approach (PA) to CAT I minima human in the loop (HITL) simulations and provide technical report.
- Complete Simultaneous Approaches using High Update Rate surveillance technical report and supply a status memo.
- Perform analysis of course divergence on departure to support future CSPO departures HITL simulations and provide technical report.

Stakeholder Demo – Improved Multiple Runway Ops Portfolio - Paired Approach:

- Complete Demonstration Execution Plan.
- Perform safety assessment for flight demonstration.
- Complete prototype demonstration cockpit avionics and ground ATC tools (as needed).

Program Plans FY 2018 – Performance Output Goals

Closely Spaced Parallel Runway Operations:

- Finalize analysis of PA to CAT I minima and provide technical report.

Stakeholder Demo – Improved Multiple Runway Ops Portfolio - Paired Approach:

- Conduct demonstration of Paired Approach for CAT I capability.
- Complete demonstration evaluation report and benefits assessment.

Program Plans FY 2019 – Performance Output Goals

Closely Spaced Parallel Runway Operations:

- 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.

Program Plans FY2020-2021 – Performance Output Goals

Closely Spaced Parallel Runway Operations:

- None.

1A09, NextGen – NAS Infrastructure Portfolio

FY 2017 Request $17.7M

- 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, Surface/Tower/Terminal Systems Engineering, G06A.02-01
- F, NextGen Distance Measuring Equipment (DME) Support For Performance Based Navigation (PBN) Strategy, G01N.01-02
- G, 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 the high priority shortfalls. Technical studies are underway to identify methods to optimize existing ground-based legacy surface platforms. In the near term, this program is addressing current limitations of the sensor network for the Terminal environment; specifically, the ability to identify the type and intensity of frozen precipitation which impacts the efficiency of winter weather and deicing operations and conduct technical and operational risk assessments of alternative solutions. 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 (NOAA) and the Department of Defense (DoD).

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 57,975, 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 2017 – Performance Output Goals

- Produce a concept maturity technology plan for terminal wind operational improvements that identifies improved spatial sampling in the terminal area, improved information availability, and sensor modernization and consolidation opportunities.
- Complete update of weather observations shortfall analysis; ascertain stakeholder buy-in and prioritization, and document terminal winds operational improvement in NAS Infrastructure portfolio.
- Deliver assessment of market technologies and maturing research and development programs for adverse wind mitigating applications.
- Complete required AMS system engineering artifacts for terminal-area adverse winds useful segment.

Program Plans FY 2018 – Performance Output Goals
- Deliver Terminal Winds Risk Mitigation Plan for Newark Liberty (EWR), LaGuardia (LGA) and John F. Kennedy (JFK) airports.
- Deliver draft ConOps and initial concept level requirements (CML 2) for wind measuring technologies and siting/installation alternatives.
- Complete stakeholder review and assessment of draft ConOps document for wind measuring technologies and siting/installation alternatives.
- Complete laboratory and field infrastructure upgrades required to perform CML 3 demonstration of wind measuring technologies and siting/installation alternatives.
- Deliver results of stakeholder focus group meetings conducted to strategize how information gathered as a result of improved wind measuring technologies and siting/installation techniques can be integrated into existing/proposed information display systems.
- Deliver draft feasibility study (cost, schedule, and logistics) report for conducting CML 4 demonstration of wind mitigation concepts at EWR, LGA and JFK versus alternate location(s).

Program Plans FY 2019 – Performance Output Goals
- Deliver CML 3 results, analysis and recommendations report of wind measuring technologies and siting/installation alternatives at Atlantic City (ACY) airport.
- Deliver final feasibility study (cost, schedule, and logistics) for conducting CML 4 demonstration of wind mitigation concepts at EWR, LGA and JFK versus alternate location(s).
- Deliver CML 4 plan for conducting shortfall-mitigating techniques needed to eliminate technical risk, thus allowing concept to enter investment analysis.
- Complete site survey for CML 4 demonstration.
- Deliver CML 4 site configuration document.
- Issue Screening Information requests for CML 4 equipment and services.
- Deliver design document for web-based tool for presentation of archive wind event data collected during CML 4 for the evaluation of operational decision-making benefits.

Program Plans FY 2020 – Performance Output Goals
- Demonstrate web-based tool for presentation of archive wind event data collected during CML 4 for the evaluation of operational decision-making benefits.
- Procure CML 4 demonstration equipment and services.
- Complete installation of CML 4 wind measuring and data collection equipment at identified location(s).
- Deliver update to Terminal Winds Risk Mitigation document.
- Deliver draft report documenting which other Core 30 terminals would benefit from Terminal Winds Work Package.

Program Plans FY 2021 – Performance Output Goals
- Deliver CML 4 demonstration results and analysis to key stakeholders and users and formulate operational performance requirements.
- Deliver final report documenting which other Core 30 terminals would benefit from Terminal Winds Work Package.
- Deliver results report from model and simulation activities of legacy vs improved wind sensor positioning at EWR, LGA and JFK.
- Deliver technical transfer package of siting guidelines, installation procedures, validated equipment and integration paradigms to the Program Management Organization for incorporation into Aviation Surface Weather Observation Network (ASWON).
- Remove evaluation equipment from demonstration locations.
- Deliver work package closeout materials such as 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. There is very little automation currently available to assist with identifying, analyzing, and developing mitigation strategies for weather-constrained airports and airspace.

Sophisticated National Weather Service (NWS) forecast models will be overlaid on areas of constrained airspace that can then be interpreted for NAS impact and problem resolution. In today's NAS, traffic managers and users must mentally interpret weather conditions and the potential impact of weather on ATC decisions. This program will improve the decision process and the accuracy of aviation weather information to include an automated indication of the constraints placed on the NAS. It will enable the integration of aviation weather information into collaborative and dynamic decision-making processes by implementing advanced aviation weather forecasting models to determine the effects on traffic forecasts. Metrics will be developed and applied to evaluate how effective weather forecast improvements can be in increasing usage of NAS capacity.

The program will also develop the necessary policies and guidance in the provision of aeronautical meteorological services under U.S. commitments to the International Civil Aviation Organization (ICAO). Specific work elements under Weather Forecast Improvements include the following:

- ATM Weather Integration (AWI) – This work includes exploration of weather translation techniques for non-convective weather constraints, weather alerting 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 (CATM-T) and Time Based Flow Management (TBFM) work packages. This work also supports the evaluation of remaining shortfalls in support of service analysis for a future NextGen Weather Processor (NWP) work package and includes AWI activities necessary to help support 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. (Note: ICAO Annex 3 is updated on a 2-year cycle.)
- NWP & Common Support Services-Weather (CSS-Wx) Future Work Package Analysis – This work will also support the evaluation of remaining shortfalls and prepare investment analysis products in support of investment decisions for a future NWP and CSS-Wx work package.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

The Weather Forecast Improvements 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 2017 – Performance Output Goals

ATM Weather Integration (AWI):

- Traffic Flow Management (TFM) Alerting Concept Development – Expand automated Threshold Event (TE); Identification and Alerting analysis to Core 30 airports #2 and #3; explore methods of weather alerting for traffic managers; conduct Human in the Loop (HITL) tests with simulated alerting systems for airport and en route events in collaboration with FAA Aviation Weather Development and Evaluation (AWDE) personnel.
- Evolution of Translation – Threshold Events. Develop report on translation of threshold events to inform future NextGen weather processing systems; develop associated techniques to be implemented in airport capacity and decision support tools (DSTs) with designated CATM-T researchers.
- Develop recommended TFM training concepts to improve the cognitive assessment of probabilistic weather forecasts and incorporation of risk management by TFM decision-makers.
- AWI Change Management – Explore issues in human factors related to the introduction of AWI processes and evaluates the utility of weather information translations in operational decision making in collaboration with the FAA AWDE group.
- AWI Roadmap – Complete bi-annual AWI Progress Assessment and Recommendations.

International:

- Complete draft Standards and Recommended Practices (SARPs) for Amendment 78 to Annex 3 for Space Weather (SWx), Regional Hazardous Weather Advisory Center (RHWAC), Release of Radioactive Material (RRM), and the Volcanic Ash (VA) work streams for approval by the ICAO Air Navigation Commission.
- Develop draft guidance material for the SWx, RHWAC, RRM, and VA work streams to support the SARPs included in Amendment 78 to Annex 3.
- Complete annual report on US differences and assessment of opportunities to harmonize US Meteorological (MET) practices and procedures with ICAO SARPs.
- Coordinate and harmonize the requirements for the provision and dissemination of meteorological information to support NextGen and SESAR operational capabilities.
- Complete US position on draft Amendment 78 to ICAO Annex 3.

Program Plans FY 2018 – Performance Output Goals

ATM Weather Integration:

- TFM Alerting Concept Development – Expand automated Threshold Event (TE); Identification and Alerting analysis to Core 30 airports #4 and #5; explore methods of weather alerting for traffic managers; conduct Human in the Loop (HITL) tests with simulated alerting systems for airport and en route events in collaboration with FAA AWDE personnel.
- Evolution of Translation – Turbulence. Develop report on translation of turbulence to inform future NextGen weather processing systems; produce turbulence weather avoidance fields (TWAFs) for implementation in CATM airspace DSTs in collaboration with the FAA Aviation Weather Research Team (AWRT). Complete development of recommended TFM training concepts to improve the cognitive assessment of probabilistic weather forecasts by TFM decision-makers.

International:

- Complete draft SARPs for Amendment 79 to Annex 3 for the SWx, VA, and World Area Forecast System (WAFS) work streams for approval by the ICAO Air Navigation Commission.
- Develop draft guidance material for SWx and VA work streams to support the SARPs included in Amendment 78 to Annex 3.
- Complete annual report on US differences and assessment of opportunities to harmonize US MET practices and procedures with ICAO SARPs.
- Coordinate and harmonize the requirements for the provision and dissemination of meteorological information to support NextGen and SESAR operational capabilities.
- Complete US response to final version of Amendment 78 to ICAO Annex 3.

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;
  - EA products;
  - Preliminary program requirements;
  - Safety Assessment;
  - Alternatives & ROM Costs; and
  - Investment Analysis Plan.

Program Plans FY 2019 – Performance Output Goals

ATM Weather Integration:

- TFM Alerting Concept Development – Expand automated Threshold Event (TE) Identification and Alerting analysis to Core 30 airports #6 and #7; Explore methods of weather alerting for traffic managers; Conduct Human in the Loop (HITL) tests with simulated alerting systems for airport and en route events in collaboration with FAA AWDE personnel.
- Evolution of Translation – Icing. Develop report on translation of icing to inform future NextGen weather processing systems; produce IWAFs for implementation in CATM airspace DSTs in collaboration with members of the FAA AWRT.
- AWI Lab HITLs and M&S – Sector Capacity. Develop concepts and capabilities for sector capacity management in the 2-4 hour planning horizon; test the concepts via lab HITLs and modeling and simulation (M&S) in collaboration with FAA AWDE and transfer successful concepts and capabilities to appropriate programs.
- AWI Roadmap – Complete bi-annual AWI Progress Assessment and Recommendations.

International:

- Complete draft SARPs for Amendment 79 to Annex 3 for SWx, VA, and WAFS work streams for approval by the ICAO Air Navigation Commission.
- Develop draft guidance material to support the SARPs included in Amendment 79 to Annex 3.
- Complete annual report on US differences and assessment of opportunities to harmonize US MET practices and procedures with ICAO SARPs.
- Coordinate and harmonize the requirements for the provision and dissemination of meteorological information to support NextGen and SESAR operational capabilities.
- Complete US position on draft Amendment 79 to ICAO Annex 3.

NWP & CSS-Wx Future Work Package Analysis:

- Achieve IARD for NWP WP2/CSS-WP2.
- Develop the following products in support of the Initial Investment Decision (IID) for targeted AMS investment:
  - Initial Program Requirements;
  - Business Case Analysis Report (BCAR);
  - Enterprise Architecture Artifacts; and
  - Implementation Strategy and Planning Document (ISPD).
- Achieve IID for NWP WP2/CSS-Wx WP2.

Program Plans FY 2020 – Performance Output Goals

ATM-Weather Integration:

- TFM Alerting Concept Development – Expand automated Threshold Event (TE) Identification and Alerting analysis to Core 30 airports #8-10; explore methods of weather alerting for traffic managers; conduct Human in the Loop (HITL) tests with simulated alerting systems for airport and en route events in collaboration with FAA AWDE personnel.
- AWI Change Management – Complete human factors studies with emphasis on Human Over the Loop (HOTL) decision-making in collaboration with FAA AWDE; transfer key HOTL considerations and change management techniques to groups implementing new weather-related DSTs.
- AWI Lab HITLs and M&S – Flight Object Exchange Services (FOXS). Develop concepts and capabilities for the use of Flight Object Exchange Services (FOXS) to supplement translation and conversion of weather constraint information; test the concepts via lab HITLs and modeling and simulation (M&S) in collaboration with FAA AWDE and transfer successful concepts and capabilities to appropriate programs.
- AWI Performance Metrics – Potential Shortfalls. Initiate quantitative study to measure the performance of currently integrated weather products and services to find potential shortfalls.

International:

- Complete draft SARPs for Amendment 80 to Annex 3 for the SWx, VA, and WAFS work streams for approval by the ICAO Air Navigation Commission.
- Develop draft guidance material for the SWx and VA work streams to support the SARPs included in Amendment 79 to Annex 3.
- Complete annual report on US differences and assessment of opportunities to harmonize US MET practices and procedures with ICAO SARPs.
- Coordinate and harmonize the requirements for the provision and dissemination of meteorological information to support NextGen and SESAR operational capabilities.
- Complete US response to final version of Amendment 79 to ICAO Annex 3.

NWP & CSS-Wx Future Work Package Analysis:

- Develop the following products in support of the Final Investment Decision (FID) for targeted NWP WP2 / CSS-Wx WP2 investment:
    - Final Program Requirements documentation;
    - Enterprise Architecture Artifacts;
    - Business Case documentation;
    - Implementation Strategy and Planning Document (ISPD); and
    - Acquisition Program Baseline (Execution Plan).
- Achieve FID for NWP WP2/CSS-Wx WP2.

Program Plans FY 2021 – Performance Output Goals

ATM-Weather Integration:

- TFM Alerting Concept Development – Expand automated Threshold Event (TE) Identification and Alerting analysis to remaining Core 30 airports; explore methods of weather alerting for traffic managers; conduct Human in the Loop (HITL) tests with simulated alerting systems for airport and en route events in collaboration with FAA AWDE personnel.
- AWI Performance Metrics – Future NWP. Complete quantitative study measuring AWI performance of currently integrated weather products to help support service analysis activities for a future NWP work package.
- AWI Roadmap – Complete bi-annual AWI Progress Assessment and Recommendations.

International:

- Complete SARPs for Amendment 80 to Annex 3 for the SWx, VA, and WAFS work streams for approval by the ICAO Air Navigation Commission.
- Develop draft guidance material to support the SARPs included in Amendment 80 to Annex 3.
- Complete annual report on US differences and assessment of opportunities to harmonize US MET practices and procedures with ICAO SARPs.
- Coordinate and harmonize the requirements for the provision and dissemination of meteorological information to support NextGen and SESAR operational capabilities.
- Complete US position on draft version of Amendment 80 to ICAO Annex 3.

C, NextGen Navigation Engineering, G06N.01-03

Program Description

The NextGen Navigation Engineering program supports the NextGen goal to increase NAS efficiency and capacity and increase access to airports through innovation. The two activities in NextGen Navigation Engineering performing this work 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 (AGL) 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 modelling and testing results from previous years already show that additional Class A and Class B airspace could be supported through DME-only defined airspace and that the United States standard for DMEs, not currently in alignment with the International Civil Aviation Organization (ICAO) standard, could be moved to be the same. Work progressing to define the Very High Frequency Omnidirectional Range (VOR) system, Minimum Operational Network (MON) supports cases 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.

NextGen Navigation Support – ELVO Phase 3:
This activity supports requirements analysis for low visibility operations for landing or departing aircraft when the horizontal visibility along the runway is less than 1,200 feet. These low visibility operations cover takeoff using Heads Up Display (HUD) reference to centerline orientation via a “high quality” CAT I ILS localizer signal. This Low Visibility Operations (LVO) 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 (RVR) 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 57,975, 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 2017 – Performance Output Goals
RNAV DME-DME:
- Complete coordination and approval of FAA Order 9840.1 (RNAV-DME).
- Develop spectrum plan for integration of non-collocated DME-only facilities into NAS Operations.
- Finalize planning documentation in support of the Acquisition Decision for the NextGen DME.

NextGen Navigation Support – ELVO Phase 3:
- None.

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 and develop IARD artifacts.
- Develop the following draft products in support of the IARD:
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operation;
  - Functional Analysis;
  - Enterprise Architecture Products;
  - Program requirements; and
  - Safety Assessment.

Program Plans FY 2019-2021 – Performance Output Goals

RNAV DME-DME:

- None.

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:

New Radar Requirements (Surveillance and Weather):

New Radar Requirements is a technology development initiative to identify viable alternatives that could provide for FAA's future weather and surveillance radar needs. This initiative involves identification of technical challenges; evaluation of cost models; development of technology approaches and proposed solutions; and performance of concept demonstrations, modeling and prototyping. The overall activity includes multifunction phased-array antenna maturation; engineering studies – technology assessment; multifunction radar data processing and control definition; and acquisition management system support. The outcome of this work will result in an initial antenna and radar electronics specification and support an FAA investment analysis decision.

Enterprise Information Protocol & Exchange Standards:

This project addresses the need for harmonization protocols 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 ICAO standards.

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 (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. Weather Transition will manage appropriate activities to include: (a) development, validation, and allocation of aviation requirements for weather; (b) analysis of current FAA weather-related services and unmet operational needs; (c) develop initial operational concepts to satisfy those needs and determine which concepts should be further developed; and (d) creation, testing and evaluation of prototypes, including operational demonstrations, for the purpose of defining and refining their operational use.

Synchronization of Air/Ground Procedures:
In an effort to reduce the strain on the limited-capacity storage on the aircraft Flight Management System (FMS), this activity will evaluate methods for ground systems to communicate procedures to the aircraft. This will reduce the need to load the FMS with variations of the same procedure for different flight conditions. This will also allow air traffic to provide tactical capacity management methods with automation, such as extending the down-wind leg of the approach, increasing predictability and efficiency.

Advanced Air Ground Communications:
In partnership with international partners, this project will evaluate advanced communications standards such as L-band Digital Aeronautical Communication System (LDACS) and satellite-based communication for operational usage. This activity will also evaluate advanced communications to support new capabilities such as Push-to-Talk in remote areas; and the capability for these links to alleviate spectrum congestion issues and meet the more stringent NextGen performance requirements.

Command & Control in a Cloud Environment:
This activity will identify and assess current and future command and control capability for NAS Systems in a cloud environment. As part of this effort, technical assumptions will be evaluated based on safety, mission criticality, and the ability of current and future cloud architecture to provide command and control services in the future.

Common Displays/Commercial-Of-The-Shelf (COTS):
This activity addresses the need to transition to COTS displays for use as Common Displays in the NAS. As part of this effort, current COTS display capabilities will be reassessed and previously identified gaps in using COTS displays as Common Displays will be reevaluated. 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 57,975, 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 2017 – Performance Output Goals
New Radar Requirements (Surveillance & Weather):
- Finalize Multi-function Phased Array Radar (MPAR) performance requirements.
- Develop detailed MPAR advanced technology demonstrator test and evaluation plan.

Enterprise Information Protocol and Exchange Standards:
- Assess Flight Information Exchange Model (FIXM) compliance with ICAO Reference Model.
- Develop transition plan for FIXM.
- Conduct Quality Assurance (QA)/Quality Control (QC) validation for Weather information Exchange Model (WXXM).

Future CAS:

- Review the ACAS Xu System Requirements and Specification (SRS) V1.0 document to inform RTCA SC-147 and SC-228 with standards development activities.
- Incorporate optimization and tuning updates with stakeholder feedback into the ACAS Xu Run 3 logic.
- Complete the ACAS Xu Run 3 Algorithm Design Description (ADD) document.

Weather Transition:

- Conduct engineering studies and analyses which evaluate the translation of weather information into operational impacts.
- Develop and validate weather requirements for NWS to improve forecasts in support of FAA operational decision-making.

Synchronization of Air/Ground Procedures:

- Develop validation plan for air/ground procedure synchronization.
- Develop documentation of air/ground procedures standards with user community.
- Conduct trials and develop a validation report for air/ground procedure synchronization.

Advanced Air/Ground Communications:

- Conduct engineering assessment of L-band communication system performance from prototype testing conducted under Single European Sky ATM Research (SESAR) development activities.
- Develop Minimum Operational Performance Standards (MOPS) for Iridium-Next which will enable the Satcom system to support data communications in domestic airspace.
- Conduct prototype testing to support the development of Internet Protocol (IP) Standards to support the FAA's Data Comm Segment 2 and Future Communication Systems including NextSat, LDACS and Aeronautical Mobile Airport Communications System (AeroMACS).

Program Plans FY 2018 – Performance Output Goals

- Enterprise Information Protocol and Exchange Standards:
- Assess WXXM compliance with ICAO Reference Model.
- Develop transition plan for WXXM.
- Develop mitigation artifacts for enterprise service (SWIM) to mitigate to the latest version of the exchange models.

Future CAS:

- Complete worksheet review and gap analysis on ACAS Xu System Requirements to inform RTCA SC-147 and SC-228 with standards development activities.
- Integrate analysis results and logic changes from the 2016 ACAS Xu Flight Test into the ACAS Xu Run 4 candidate.
- Input changes and updates from the ACAS Xu Run 4 candidate into a revised ACAS Xu ADD document.

Weather Transition:

- Conduct engineering studies and analyses which evaluate the translation of weather information into operational impacts.
- Develop and validate weather requirements for NWS to improve forecasts in support of FAA operational decision-making.

Synchronization of Air/Ground Procedures:

- Document trials results and provide recommendations.

Advanced Air/Ground Communications:

- Evaluate standards validation test results for the new L-band communications system and develop a Validation Matrix to support ICAO Standards and Recommended Practices (SARPS) acceptance.
- Initiate development of the ICAO Class B Satellite SARPS to support Data Communications in domestic airspace.
- Initiate development of IP Standards to support the FAA's Data Comm Segment 2 and Future Communication Systems including NextSat, LDACS and AeroMACS.
- Identify Security requirements for future ATN/IP Air-Ground Communication Systems.

Command & Control in a Cloud Environment:
- Develop engineering study evaluating the command & control capability for NAS Systems in a cloud environment.
- Update technical assumptions documentation based on safety and mission criticality, and ability of cloud architecture to provide command and control services.

Common Displays/COTS:
- Evaluate performance requirements for NAS information systems displays.
- Conduct assessment of strategic decision displays data requirements.

Program Plans FY 2019 – Performance Output Goals

Enterprise Information Protocol and Exchange Standards:
- Assess Aeronautical Information Exchange Model (AIXM) compliance with ICAO Reference Model.
- Develop transition plan for AIXM.
- Conduct QA/QC validation for ICAO Reference Model.

Future CAS:
- Formalize ACAS Xp system concept and requirements to inform ongoing RTCA SC-147 standards development activities.

Weather Transition:
- Develop and validate weather requirements for NWS to improve forecasts in support of FAA operational decision-making.
- Conduct technical analyses of current FAA weather-related services and unmet operational needs.
- Conduct engineering studies and analyses which evaluate the translation of weather information into operational impacts.
- Create and evaluate prototypes and conduct operational demonstrations for the purpose of defining and refining operational use concepts.

Advanced Air/Ground Communications:
- Complete the LDACS SARPS and associate Technical Manual.
- Complete development of the ICAO Class B Satellite SARPS to support Data Communications in domestic airspace.
- Complete development of IP Standards to support the FAA's Data Comm Segment 2 and Future Communication Systems including NextSat, LDACS and AeroMACS.
- Initiate 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.
- Identify and evaluate NAS Systems potentially suitable for command and control in a cloud environment

Common Displays/COTS:
- Evaluate existing commercial common display/COTS capabilities.
- Assess and validate previously identified gaps in common display/COTS.

Program Plans FY 2020 – Performance Output Goals

Enterprise Information Protocol and Exchange Standards:
- Maintain and update information protocols and exchange standards documentation.

Future CAS:
- Complete draft ACAS Xu Minimum Operational Performance Standards (MOPS) for review and comment within RTCA.

Weather Transition:
- Develop and validate weather requirements for NWS to improve forecasts in support of FAA operational decision-making.
- Create and evaluate prototypes and conduct operational demonstrations for the purpose of defining and refining operational use concepts.
- Conduct technical analyses of current FAA weather-related services and unmet operational needs.
- Conduct engineering studies and analyses which evaluate the translation of weather information into operational impacts.

Advanced Air/Ground Communications:
- Initiate development of ICAO Class A Satcom Standards to support full 4D trajectory operations.
- Complete Security standards development for future ATN/IP Air-Ground Communication Systems.

Command & 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:
- 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

Enterprise Information Protocol and Exchange Standards:
- Maintain and update information protocols and exchange standards documentation.
- Develop mitigation artifacts for enterprise service (SWIM) to mitigate to the latest version of the exchange models.

Future CAS:
- Initiate limited Implementation Program partnerships to validate ACAS Xu / inform Technical Standard Order development activities.

Weather Transition:
- Develop, validate, and refine weather requirements for NWS to improve forecasts in support of FAA operational decision-making.
- Create and evaluate prototypes and conduct operational demonstrations for the purpose of defining and refining operational use concepts.
- Conduct technical analyses of current FAA weather-related services and unmet operational needs.
- Conduct engineering studies and analyses which evaluate the translation of weather information into operational impacts.

Advanced Air/Ground Communications:
- Complete development of ICAO Class A Satcom Standards to support full 4D trajectory operations.
- Establish requirements for a Software Defined Radio to support multi-modal operations.

E, Surface/Tower/Terminal Systems Engineering, G06A.02-01

Program Description

The Surface/Tower/Terminal Systems Engineering program is an early stage developmental program to refine and validate Terminal NextGen concepts for improving the efficiency of traffic flow in the terminal area. This program will reduce risk associated with the introduction of new technology and operational procedures by using systems engineering analysis to identify and evaluate potential impacts from the integration of the techniques and equipment necessary to achieve traffic flow efficiencies. The systems engineering work will also assess the impact on NAS architecture and any changes needed throughout the product development lifecycle for terminal systems.

The Surface/Tower/Terminal Systems Engineering program will perform a Safety Risk Management study to identify these issues relative to the proposed TRACON automation capabilities. Concept engineering activities include analysis, evaluation, and assessments to develop and mature concepts for changes to Terminal/TRACON automation, as well as identifying associated procedural changes. The primary focus areas are:

- Enhanced inter/intra-facility coordination
  - Enhanced communication methods between control positions
  - Improved information sharing between facilities
- Facilitated airspace and sector management
  - Assess sector loading/demand prediction
  - Airspace changes – timing and impact of airspace changes
- Augmented flight data management at the control position
  - Flight Data Input/Output functionality at control position

    - View available route and altitude options from control position
- Decision support for managing air traffic operations
    - Support for merging and spacing, and conflict detection
- Improved operations at uncontrolled airports
    - Improved communication to pilots at uncontrolled airports
    - Display of aircraft position outside of surveillance coverage
- Collaboration with airspace users (Pilots / Flight Operation Centers/ Airline Operation Centers)
    - Exchanging information with pilots and flight operators

The concept engineering activities conducted by the Surface/Tower/Terminal Systems Engineering program will reduce technical risk, quantify benefits, support alternatives development, and identify safety concerns prior to implementation by the Terminal Work Package 1 program, A04.08-01. The Initial Investment Decision (IID) and Final Investment Decision (FID) are both planned for 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

The Surface/Tower/Terminal Systems Engineering program supports the efficient use of air traffic capacity by analyzing and evaluating new concepts to improve the transfer of flight information, including movement constraints to interconnected systems, facilities, controllers, pilots, and airport operators. This program will identify and develop capabilities that will enable the Terminal domain to more efficiently balance arrivals, departures, and surface operations.

Program Plans FY 2017 – Performance Output Goals
- Conduct a gap analysis designed to identify the remaining shortfalls and opportunities in the TRACON in the 2020 and beyond time frame following the implementation of capabilities planned for implementation by 2020.
- Refine the overall strategic plan for the Terminal domain in terms of out-year capabilities.
- Conduct initial human-in-the-loop (HITL) prototyping and evaluation to support concept development, validation, and refinement, for the airport, runway, route, and airspace configuration management capability.
- Document initial functions and concept of operations.
- Complete algorithmic development and documentation.

Program Plans FY 2018 – Performance Output Goals
- Conduct second round of HITL prototyping and evaluation to support concept development, validation, and refinement, for the airport, runway, route, and airspace configuration management capability, based on findings from the initial round in 2017.
- Develop preliminary shortfall analysis.
- Update the functional analyses and conops.
- Develop initial requirements.
- Develop a projected benefits analysis.
- Conduct an initial safety assessment.
- Update algorithmic development and documentation.

Program Plans FY 2019-2021 – Performance Output Goals
- None.

F, 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 both enroute and terminal airspace to provide a resilient, complimentary navigation service to support Performance Based Navigation (PBN) operations in the event of a disruption to the Global Navigation Satellite Service (GNSS). Existing coverage and redundancy gaps will be filled in Class A Airspace and the busiest Navigation Service Group (NSG) one and two airports for DME/DME aircraft without the need for an Inertial reference Unit (IRU).

The NextGen DME program will provide the following benefits:

- Aircraft equipped with Area Navigation (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 DME failures;
- DME/DME Area Navigation (RNAV) service will be available to almost all commercial and business aircraft without the need to carry an IRU; and
- Pilot and controller workload will be reduced during GNSS service disruptions, while maintaining PBN capacity and efficiency benefits.

This activity performs the solution implementation work for the engineering analysis and acquisition planning activity for DME-DME RNAV performed under NextGen Navigation Engineering (NNE), G06N.01-03. New DMEs will be installed, existing DMEs with limited capacity will be replaced, and unneeded DMEs will be discontinued consistent with the technical and programmatic requirements approved at the Final Investment Decision (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 57,975, 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 impacts to capacity and efficiency benefits at the Core airports during arrivals and departures.

Program Plans FY 2017 – Performance Output Goals

<u>EnRoute:</u>

- Procure 5 NextGen DMEs for installation.

<u>Terminal:</u>

- Procure 21 NextGen DMEs for installation.

Program Plans FY 2018 – Performance Output Goals

<u>EnRoute:</u>

- Procure 3 NextGen DMEs for installation.
- Commission 2 NextGen DME sites.

<u>Terminal:</u>

- Procure 20 NextGen DMEs for installation.

Program Plans FY 2019 – Performance Output Goals

EnRoute:
- Commission 3 NextGen DMEs sites.

Terminal:
- Procure 37 NextGen DMEs for installation.
- Commission 38 NextGen DMEs sites.

Program Plans FY 2020 – Performance Output Goals

EnRoute:
- Commission 3 NextGen DME sites.

Terminal:
- Procure 37 NextGen DMEs for installation.
- Commission 30 NextGen DMEs sites.

Program Plans FY 2021 – Performance Output Goals

Terminal:
- Procure 29 NextGen DMEs for installation.
- Commission 35 NextGen DMEs sites.

G, Information Management, G05M.03-01

Program Description

Information management 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 Information Management program will identify the shortfalls in moving from data sharing to a network environment and will address authoritative operational data stores, use of emerging technologies in machine learning and analytics, information management governance and evaluation techniques, and performance monitoring techniques and policies to ensure compliance. Research will also identify existing hardware and software that would be used to resolve 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 Information Management could be leveraged by other information driven FAA programs to support their 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

In the transformation to NextGen, the 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 2017 – Performance Output Goals
- Develop a plan for the migration of NER (NAS Enterprise Repository) prototype to FAA Cloud Services in an enterprise data management production environment.

Program Plans FY 2018 – Performance Output Goals
- Enhancement of NER infrastructure in keeping with Enterprise Information Management goals and to facilitate alignment of programs with the enterprise capability.
- Enhance NER infrastructure and software based upon feedback and lessons learned.
- Develop Plan for supporting additional users /programs.

Program Plans FY 2019 – Performance Output Goals
- Develop training materials and roles and responsibilities for those who interact with NER.
- Migrate capability to FAA Cloud Services.
- Evaluate Information Management performance and assess additional features.
- Perform functionality comparison of Information Management system data to other systems in the NAS.

Program Plans FY 2020 – Performance Output Goals
- Support the migration to real-time safety analysis via enterprise data infrastructure.
- Complete analysis and deliver report on availability of additional data for the extended user community.
- Complete strategic plans for long-term enhancements of Information Management baseline capabilities.

Program Plans FY 2021 – Performance Output Goals
- Complete analysis and deliver report on enhanced analytical capabilities.
- Deliver report on initial coordination with key organizations to ensure compliance of Information Management Governance.

1A10, NEXTGEN – LABORATORY SUPPORT PORTFOLIO

FY 2017 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. This program provides the test platforms at the NextGen Integration and Evaluation Capability (NIEC) and Florida NextGen Test Bed (FTB). These labs facilitate conducting NextGen demonstrations quickly and efficiently using replicated NAS environments without affecting actual NAS operations. This approach reduces overall risk and costs by enabling the FAA to evaluate the viability of new technologies before committing to further investment or making system implementation decisions.

Operational Assessment supports the transition to NextGen by developing a NAS implementation plan in the mid-term and far-term timeframes that support a comprehensive evaluation of fielded capabilities and reporting of post-implementation performance information on the NextGen Performance Snapshots (NPS) website. These activities also support NextGen benefits modeling and cost-benefit data collection.

<u>NextGen Integration and Evaluation Capability (NIEC):</u>
The NIEC is a NextGen integration and evaluation facility located at the William J. Hughes Technical Center (WJHTC) in Atlantic City, New Jersey. The NIEC provides a real-time, NextGen-capable environment that allows for concept development and validation, integration and operations analysis capabilities through Human-in-the Loop

simulation testing and data analysis capability. NextGen systems and procedures will be developed and integrated into the NIEC to support studies that measure and validate concept feasibility, human performance, usability, changes in workload, and safety. The program will include the development and validation of prototypes and analysis capabilities to support the definition of NextGen requirements while researching possible solutions to challenges posed by the integration of NextGen technologies.

Florida NextGen Test Bed (FTB):
The FTB is located at the Daytona Beach International Airport (DAB) in Florida and provides a platform where early-stage NextGen concepts can be integrated, demonstrated, and evaluated. The FTB core infrastructure is architected and configured to enable remote connections with other FAA NextGen and industry partner sites to allow for multi-site demonstration capabilities. Through appropriate governance and oversight, the FTB provides the ability for industry to bring and integrate new concepts and technologies; maintain and sustain their systems at the FTB; and conduct ongoing activities.

NextGen Operational Assessment – Performance:
This activity supports NextGen implementation in three areas: Systems Analysis, 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 William J. Hughes Technical Center to provide a high fidelity 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 at an early stage 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 in operations. In addition, the FTB approach of establishing partnerships with industry promotes contributions and R&D investment from industry, and 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 providing a cohesive implementation plan for NextGen portfolios in the mid-term and far-term timeframes. Includes information on projected qualitative benefits, system dependencies, success criteria, identified integration challenges for implementation, established follow-on activities, and deployment progress reports. Additionally, through conducting operational performance assessments of fielded capabilities it serves as lessons learned for making sound investment decisions to appropriately plan for expenditure of taxpayer funds. It also reports progress of NextGen implementation on the NPS website.

Program Plans FY 2017 – Performance Output Goals

NIEC:

- Provide engineering support for the infrastructure and NextGen research.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the necessary licenses, maintenance agreements, and equipment of the laboratory.
- Install upgrades to the laboratory infrastructure to support a NextGen research platform.
- Complete integration of Ground-Air Data Communication capabilities.

FTB:

- Provide engineering support for the infrastructure and capabilities to support NextGen demonstrations.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the licenses, leases, utilities, equipment, and maintenance necessary to maintain the laboratory at a high level of readiness to respond to emergent needs.
- Complete installation of upgrades to the laboratory infrastructure to support a NextGen integration platform.

NextGen Operational Assessment – Performance:

- Evaluate the operational performance impacts of NextGen technologies and procedures, and publish an annual report. Candidate capabilities for performance studies include:
  - Wake Re-categorization, Phase 2 – pair-wise wake separation standards that uniquely address the needs of a given airport (Denver, CO (DEN) and Anchorage, AK (ANC)).
  - Dual parallel operations between 2,500 and 3,600 feet – for parallel runways that are between 2,500 and 3,600 feet, dependent stagger-separation will be removed from 1.5 nm to 1.0 nm (Minneapolis-St. Paul, MN (MSP), John F. Kennedy, NY (JFK), Seattle-Tacoma, WA (SEA), Portland, OR (PDX), Raleigh-Durham, NC (RDU), Dallas Love Field, TX (DAL) and Memphis, TN (MEM)).
- Develop documentation and data sources for new NPS information including any new metrics.
- Complete update of metrics and success stories in the NextGen Performance Snapshots website.
- Complete annual NSIP update to aid the planning, deployment, and monitoring of NextGen portfolio in the mid-term and far-term timeframes.

Program Plans FY 2018 – Performance Output Goals

NIEC:

- Provide engineering support for the infrastructure and NextGen research.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the necessary licenses, maintenance agreements, and equipment of the laboratory.
- Install upgrades to the laboratory infrastructure to support a NextGen research platform.
- Provide a near real time data analysis 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 licenses, leases, utilities, equipment, and maintenance necessary to maintain the laboratory at a high level of readiness to respond to emergent needs.
- Complete the installation of upgrades to the laboratory infrastructure to support a NextGen integration platform.
- Add new scenario development and analysis tools.

NextGen Operational Assessment – Performance:

- Evaluate the operational performance impacts of NextGen technologies and procedures, and publish an annual report. 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 (PBN) 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)).
  - Established on Required Navigation Performance (RNP) (EoR) for Widely Spaced Operations – national standard enabling EoR operations at eligible locations throughout the NAS.
- Develop documentation and data sources for new NPS information including any new metrics.
- Complete annual NSIP update to aid the planning, deployment, and monitoring of NextGen portfolio in the mid-term and far-term timeframes.

Program Plans FY 2019-2021 – Performance Output Goals

NIEC:

- Provide engineering support for the infrastructure and NextGen research.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the necessary licenses, maintenance agreements and equipment of the laboratory.
- Install upgrades to the laboratory infrastructure to support a NextGen research platform.

FTB:

- Provide engineering support for the infrastructure and capabilities to support NextGen demonstrations.
- Provide for services to ensure the operational capabilities of the laboratory.
- Provide the licenses, leases, utilities, equipment, and maintenance necessary to maintain the laboratory at a high level of readiness to respond to emergent needs.
- Complete the installation of upgrades to the laboratory infrastructure to support a NextGen integration platform.

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 NPS information including any new metrics.
- Complete annual NSIP update to aid the planning, deployment, and monitoring of NextGen portfolio in the mid-term and far-term timeframes.

1A11, NEXTGEN – PERFORMANCE BASED NAVIGATION & METROPLEX PORTFOLIO

FY 2017 Request $17.5M

- A, NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP), G05N.01-01
- B, Concept Development for Integrated NAS Design & Procedure Planning, G05A.02-04
- X, NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP) - Future Plans, G05N.01-03

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 procedures development 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;
- Decoupling conflicting operations to and from primary and secondary/satellite airports serviced by the same complex terminal airspace; and if needed,
- Developing high altitude routes through congested airspace to create more efficient routes between major metropolitan areas.

Development of RNAV and RNP routes and procedures will address the RTCA Task Force 5 recommendations, maximize benefits, and accelerate NextGen concepts.

Optimization of airspace and procedures using quantitative and qualitative metrics will 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 12 Metroplexes. The Metroplex approach began in FY 2010 and will be completed at the selected locations by FY 2019. These can be located in unique metropolitan areas such as North Texas which includes Dallas/Fort-Worth (DFW), Dallas Love Field Airport (DAL), and other regional airports or by combining Metropolitan areas, such as the Central and Southern Florida Metroplex which includes Orlando (MCO), Miami (MIA), Tampa (TPA), Palm Beach (PBI), Fort Lauderdale (FLL) and other regional airports. 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 location. Study Team results guide the design and implementation of those procedures that have the highest benefits. Design and Evaluation Team efforts include analyses and simulations, assessment of alternatives, and modeling of projected airspace and procedures benefits. These efforts include:

- <u>Study and Scoping:</u> 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 carrier representatives. The result of this phase is a set of conceptual designs, with a high-level assessment of benefits, costs, and risks.

- <u>Design and Procedure Development:</u> The Design Phase is where the detailed Integrated Airspace and Procedures design work is conducted. 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 carrier representatives. When appropriate and justified, Human-in-the-Loop simulations and other design analyses are performed.

- <u>Evaluation:</u> 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 carrier representatives. If analyses are conducted during the Design Phase, they may carry over into the Evaluation Phase.

- <u>Implementation and Training:</u> The Implementation Phase is the last part of the Optimization of Airspace and Procedures in the Metroplex (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 carrier representatives.

- <u>Post Implementation Review and Modifications:</u> 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 2017 – Performance Output Goals

- Complete the Evaluation Phase of three Metroplex projects (e.g. Denver, Florida, and Las Vegas).
- Complete Implementation Phase at four Metroplex sites (e.g. Charlotte, Southern California, Cleveland/Detroit, and Phoenix).
- Complete Post Implementation Phase activities at three Metroplex sites (e.g. Charlotte, Atlanta, and Southern California).

Program Plans FY 2018 – Performance Output Goals

- Complete Implementation Phase of three Metroplex projects (e.g. Denver, Florida, and Las Vegas).
- Complete Post Implementation Review and Modifications activities for three Metroplex projects (e.g. Cleveland/Detroit, Phoenix, and Denver).

Program Plans FY 2019 – Performance Output Goals

- Complete Post Implementation Review and Modifications activities for last two remaining Metroplex projects (e.g. Florida and Las Vegas).
- Provide comprehensive lessons learned for archives.

Program Plans FY 2020-2021 – Performance Output Goals

- None.

B, Concept Development for Integrated NAS Design & Procedure Planning, G05A.02-04

Program Description

The Integrated NAS Design and Procedure Planning (INDP) program is currently analyzing the Performance Based Navigation (PBN) strategy for initiatives to prepare for the future NAS-wide implementation of PBN procedures with the initial focus on Established-on-Required Navigation Performance (RNP) Instrument Approach Procedures (IAPs). Established-on-RNP (EoR) will allow air traffic controllers to clear aircraft on an RNP approach with a curved turn to final without providing standard radar separation between it and another aircraft that is established on an approach to a parallel runway. In addition, EoR is expected to provide opportunities for increased efficiency including reduced track length, fuel burn, environmental footprint, and noise exposure. Furthermore, EoR may be able to provide opportunities for increased efficiency through the use of more repeatable and predicable operations. After the initial implementation of EoR at developmental sites, additional data will be collected to support final safety and benefits validation.

Human Factors activities will focus on the interaction between the air and ground domains to document and disseminate lessons learned that will provide guidance for future PBN procedure implementations and support the refinement and revisions of published procedures. This work will provide insights into the factors affecting the successful implementation of RNAV (Area Navigation) /RNP routes under NextGen objectives and enable the operational deployment of navigation requirements and operational acceptance. To achieve these goals, human factors work will analyze the PBN strategy and assess the NextGen automation systems and Decision Support Tools (DSTs) supporting PBN procedures, and how they contribute to increasing the efficiency and performance of the workforce. The focus of the research aligns actions and behaviors occurring on the flight deck and in air traffic control operations to increase usage of PBN procedures.

This program supports RTCA Task Force 5 recommendations and integrates industry and agency efforts to improve efficiency by taking advantage of aircraft performance capabilities, Standard Terminal Arrivals (STARs) and Optimum Profile Descents (OPDs). The primary focus of the program is to safely design and implement various EoR IAPs in an effort to provide shorter, repeatable and stabilized paths to the runway for RNP aircraft. In addition, concept development activities will validate concepts that increase capacity and improve efficiency and throughput, while leveraging PBN technologies. 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. Although there are no current commitments and further direction depends on the PBN NAS Strategy Document, additional PBN initiatives that might be studied are Advanced RNP, RNP to ILS capture, and Established on Departure Operations (EDO).

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 57,975, 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 2017 – Performance Output Goals

- Initiate modeling and safety analysis of one new RNP approach scenario. Develop modeling and safety analysis and data collection plan.
- Conduct initial implementation of EoR scenarios at developmental site(s) to validate EoR operational concept.
- Complete Safety Risk Management artifacts to support separation standard change to allow for EoR operations in the NAS.
- Develop operational requirements and other documents required for technical transfer for validated concepts for implementation in 2020-2022 and beyond.
- Complete final report on control structure for PBN operations to FAA stakeholders and industry partners.
- Consolidate the identified PBN implementation issues and refine the evaluation criteria gained from interviews with RNAV/RNP procedure design specialists and draft report.
- Conduct Lab Activity to support preliminary PBN Route Coordination and Deconfliction analysis.
- Define model attributes and develop procedures/tool requirements to assess optimal arrival/departure routing options and implementation strategies that support PBN Route Optimization.
- Leverage existing research to develop human performance metrics and criteria for the analysis of EoR operations on ATC workload and safety.
- Apply human performance metrics during human-in-the-loop simulations for the initial implementation of EoR.

Program Plans FY 2018 – Performance Output Goals
- Complete modeling and safety analysis of one RNP approach scenario.
- Conduct initial implementation of EoR scenarios at developmental site(s) to validate EoR operational concept.
- Complete Safety Risk Management artifacts to support separation standard change to allow for EoR operations in the NAS.
- Conduct concept validation studies based on the PBN strategy and document findings to reduce risk/uncertainties of NextGen Mid Term Operational Concepts.
- Initiate investigation of integration issues associated with the integration of RNAV/OPD arrivals and Time Based Flow Management (TBFM).
- Develop Concept of Operations supporting PBN Route Coordination and Deconfliction analysis.
- Provide initial integration analysis of the PBN strategy to assess optimal arrival/departure routing options and implementation strategies for PBN Route Optimization.
- Apply human performance metrics during human-in-the-loop simulations for the initial implementation of EoR.
- Based on the PBN strategy, provide a report on measures of workload and safety impact of EoR operations for inclusion in the Safety Risk Management Decision.
- Develop white paper to identify current wake recategorization impacts on EoR procedure design and efficiency when considering multiple runway operations.
- Document analysis conclusions for possible inclusion into the PBN strategy update.

Program Plans FY 2019 – Performance Output Goals
- Initiate modeling and safety analysis of one new RNP approach scenario. Develop modeling and safety analysis and data collection plan.
- Conduct initial implementation of EoR scenarios at developmental site(s) to validate EoR operational concept.
- Complete Safety Risk Management artifacts to support separation standard change to allow for EoR operations in the NAS.
- Document procedures to decrease workload/increase reliance on automation for routine tasking, to increase efficiency of the NAS.
- Develop criteria necessary to assess the integration issues associated with RNAV/OPD and TBFM from both the air traffic and flight deck perspectives.
- Develop Automation Requirements supporting PBN Route Coordination and Deconfliction analysis.
- Develop preliminary operational and functional requirements for incorporating PBN Route Optimization with TBFM/Terminal Sequencing and Spacing.
- Analyze identified wake recategorization impacts and provide recommendations for future PBN procedure design when considering multiple runway operations.
- Provide updates to the PBN strategy based on operational testing of improved PBN capabilities.

Program Plans FY 2020 – Performance Output Goals
- Complete modeling and safety analysis of one RNP approach scenario.
- Conduct initial implementation of EoR scenarios at developmental site(s) to validate EoR operational concept.
- Complete Safety Risk Management artifacts to support separation standard change to allow for EoR operations in the NAS.
- Utilizing the PBN strategy, develop operational methods document to address future growth in demand and reduce gate-to-gate transit time.
- Validate the assessment criteria and begin the evaluation and assessment of current RNAV/OPD procedures in relation to TBFM operations and constraints.
- Deliver analysis supporting PBN Route Coordination and Deconfliction analysis to include technical transfer package, prototype requirements, operational requirements and final Concept of Operations.
- Develop technical transfer package for PBN Route Optimization.
- Provide human factors recommendations for the consideration of human factors guidance in the Performance Based Navigation Implementation Process (7100.41) and procedure design review.

Program Plans FY 2021 – Performance Output Goals
- Conduct Advanced RNP (A-RNP) assessment in support of PBN Strategy.
- Initiate modeling and safety analysis of one new RNP approach scenario. Develop modeling and safety analysis and data collection plan.
- Conduct initial implementation of EoR scenarios at developmental site(s) to validate EoR operational concept.
- Complete Safety Risk Management artifacts to support separation standard change to allow for EoR operations in the NAS.
- Execute technical transfer of validated concepts for implementation.
- Develop and provide final technical documentation to support NAS operational criteria development and changes in air traffic control regulations and operating manuals related to the FY 2017-2020 performance outputs.
- Develop and provide final documentation for the identification of human factors requirements applied to NextGen automation systems and decision support tools (DSTs) supporting PBN procedures.
- Conduct and participate in field site surveys to evaluate the implementation of the human factors recommendations to the PBN procedure implementation and revision process and development of new PBN procedures.

X, NextGen Performance Based Navigation (PBN) – Metroplex Area Navigation (RNAV)/Required Navigation Performance (RNP) - Future Plans, G05N.01-03

Program Description

NextGen Performance Based Navigation (PBN) – RNAV/Required Navigation Performance (RNP) will develop procedures to structure traffic and flows to Service Group (SG) 1 as defined by the PBN NAS Navigation Strategy locations to improve airspace efficiency. Procedures may be designed for SG 2 locations for key site implementation, or to compliment SG1 activity. The Airspace Optimization Group integrates airspace design and associated activities, including traffic flow analysis, arrival and departure route design and procedures optimization in preparation for, and/or in response to new controller tools, such as Ground-based Interval Management-Spacing (GIM-S) and Terminal Sequencing and Spacing (TSAS)), that provide a framework for developing PBN initiatives. Optimizing airspace use and associated procedures development 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;
- Decoupling conflicting operations to and from primary and secondary/satellite airports serviced by the same complex terminal airspace; and if needed;
- Developing high altitude routes through congested airspace to create more efficient routes between major metropolitan areas;
- Introducing new PBN capabilities, e.g. Established on RNP (EoR) procedures and Advanced-RNP (A-RNP); and
- Removing legacy procedures/infrastructure not in alignment with the PBN Strategy or supported by other defined program activity.

Development of RNAV and RNP routes and procedures will address the RTCA Task Force 5 recommendations, maximize benefits, and accelerate NextGen concepts. The previous Metroplex program developed a collaborative 5-stage process to deliver PBN capabilities to the NAS. This process will be reviewed and revised based upon lessons learned; incorporation of the new PBN capabilities (e.g. EoR, A-RNP); and in preparation for, and/or in response to, new controller decision support tools (e.g. GIM-S, TSAS).

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 SG1 locations will allow more efficient use of airspace and improve arrival and departure flows. PBN Strategy implementation will continue optimizing procedures and traffic flows, and may include airspace structure changes to support optimized routings, new PBN capabilities, and utilization of new controller decision support tools. Specific operational changes include adding new PBN capabilities (e.g. EoR, A-RNP), and optimizing operations to enable/support use of new controller decision support tools (e.g. GIM-S, TSAS). Methods may include converting or removing conventional procedures; 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 these changes.

Program Plans FY 2017-2019 – Performance Output Goals
- None.

Program Plans FY 2020 – Performance Output Goals
- Apply lessons learned through Metroplex program to develop a revised process to deliver new PBN capabilities to SG 1 locations (procedures may be designed for SG 2 locations for key site and/or to compliment implementation at SG1 locations).
- Begin execution: deliver PBN capabilities at a key site.

Program Plans FY 2021 – Performance Output Goals
- Initiate subsequent phases defined at key site.
- Deliver PBN capabilities at second location.

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 2017 Request $78.0M

- A, En Route Automation Modernization (ERAM) Technology Refresh, G01A.01-10
- B, En Route Automation Modernization (ERAM) Sector Enhancements, G01A.01-04

A, En Route Automation Modernization (ERAM) Technology Refresh, G01A.01-10

Program Description

Technology refresh of the ERAM system will be accomplished by a series of programs. In FY 2016, the System Enhancements and Technology Refresh program, G01A.01-05, will complete the replacement a subset of ERAM system equipment that has become obsolete.

This program, ERAM Technology Refresh, G01A.01-10, will replace another subset of ERAM system equipment that is at, or near the end of, its service life, or is otherwise contributing to increased ERAM sustainment risk due to increasing failure rates or degraded performance.

A Final Investment Decision (FID) for ERAM Technology Refresh will occur in Q4 FY 2016 with an expected period of performance of five years from FY 2017 through FY 2021. The program will be baselined by the FID, including the scope of the technology refresh, extent of the annual capabilities rollout (i.e., waterfall) and annual budget.

The current scope of the ERAM Technology Refresh program, pending the final scope to be defined by FID, includes:

- Refresh the existing analog tactical position, i.e., the R-Side, display; approximately 1,500 units;
- Refresh the Keyboard/Video/Mouse (KVM) accessories 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 D-Side positions; approximately 2,500 units;
- Migrate the tactical, R-side, and strategic, D-Side, positions processors' operating system (O/S) from IBM's AIX to Linux Open Source O/S; approximately 2,500 licenses;
- Refresh the Display capture and recording technology for R and D-Sides; approximately 3,000 recorders;
- Refresh the display graphics adaptor for displays; approximately 3,000 units; and
- Add operational supplemental processors to the existing backroom processors farm to mitigate emerging increased demand for ERAM system processing capacity.

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

ERAM Technology Refresh will update the ERAM system by refreshing a subset of ERAM equipment that is in critical need of replacement during the FY 2017 through FY 2021 time frame at the 20 Air Route Traffic Control Centers (ARTCC) sites. The benefit of this upgrade is the continued use of ERAM to control air traffic in the en route domain. The upgrade will maintain the ERAM system's ability for en- route controllers at each center to track 1,900 aircraft at a time; critical for meeting the FAA's Strategic Priority 2. The upgrade will also enable the ERAM system to meet its operational availability and performance requirements; critical for meeting the FAA's Performance Metric 1.

Program Plans FY 2017 – Performance Output Goals
- Complete final engineering design plan for ERAM technology refresh system.
- Complete the procurement of technology refresh equipment for the key site.

Program Plans FY 2018 – Performance Output Goals
- Complete the procurement of technology refresh equipment for two additional sites.
- Deploy ERAM technology refresh at key site and two additional sites (3 of 20, 15%).

Program Plans FY 2019 – Performance Output Goals
- Complete the procurement of technology refresh equipment for five additional sites.
- Deploy ERAM technology refresh at five additional sites (8 of 20, 40%).

Program Plans FY 2020 – Performance Output Goals
- Complete the procurement of technology refresh equipment for six additional sites.
- Deploy ERAM technology refresh at six additional sites (14 of 20, 70%).

Program Plans FY 2021 – Performance Output Goals
- Complete the procurement of technology refresh equipment for six additional sites.
- Deploy ERAM technology refresh at six sites (20 of 20, 100%).

B, En Route Automation Modernization (ERAM) Sector Enhancements, G01A.01-04

Program Description

ERAM Sector Enhancements 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 tactical (R Side) and strategic (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 Sector Enhancements will develop and implement improvements to en route automation and procedures, building upon existing ERAM capabilities and leveraging previous NextGen pre-implementation activities.

The Investment Analysis Readiness Decision was made in July of 2014, and the Final Investment Decision (FID) is planned for the fourth quarter of FY 2016. Prime contractor system engineering, software development, and implementation activities are planned to begin in FY 2017 and complete in FY 2022.

A baseline for the planned allocation of enhancements to a specific ERAM release will be part of the program's FID baseline. The specific enhancements under analysis as a part of FID activities are listed below and will be deployed as a series of ERAM releases throughout the program lifecycle.

- Trajectory Modeling Enhancements - Improve the Flight Plan Trajectory Modeling to consistently identify the next sector for handoff and flight data distribution;
- Flight Plan Trajectory - Improve the accuracy of Aircraft Trajectory Modeling;

- 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 (NM) separation standard and wake turbulence procedure (whichever is larger) in the 3-NM separation airspace and transition airspace;
- Conflict Probe Enhancements - Provide Conflict Probe at the Radar Controller's display (R-Side) to facilitate the use of Conflict Probe information, especially when the sector is staffed with one controller;
- Flight Plan Processing - Improve controller access to modern aircraft flight data and equipage information that is available in the International Civil Aviation Organization (ICAO) flight plan;
- ERAM Enhancements to Support 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, Cuban and Dominican Republic Air Navigation Service Providers (ANSP);
- 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 (M&C) 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

The ERAM Sector Enhancements program will improve trajectory modeling, enhance conflict probe processing and detection, and leverage ICAO 2012 Flight Plan data, among other improvements. These improvements will enable implementation of NextGen capabilities which will allow for increased efficiency and capacity benefits.

Program Plans FY 2017 – Performance Output Goals
- Complete requirements, engineering and design of the first release of ERAM Sector Enhancements.
- Complete the requirements document of the second release of ERAM Sector Enhancements.

Program Plans FY 2018 – Performance Output Goals
- Complete development, test and deployment of the first release of ERAM Sector Enhancements.
- Complete engineering and design of the second release of ERAM Sector Enhancements.
- Complete the requirements document of the third release of ERAM Sector Enhancements.

Program Plans FY 2019 – Performance Output Goals
- Complete software development, test and deployment of the second release of ERAM Sector Enhancements.
- Complete engineering and design of the third release of ERAM Sector Enhancements.
- Complete the requirements, engineering and design of the fourth release of ERAM Sector Enhancements.

Program Plans FY 2020 – Performance Output Goals
- Complete development, test and deployment of the third release of ERAM Sector Enhancements.
- Complete development, test and deployment of the fourth release of ERAM Sector Enhancement.
- Complete requirements, engineering and design of the fifth release of ERAM Sector Enhancements.
- Complete requirements, engineering and design of the sixth release of ERAM Sector Enhancements.

Program Plans FY 2021 – Performance Output Goals
- Complete development, test and deployment of the fifth release of ERAM Sector Enhancement.
- Complete development, test and deployment of the sixth release of ERAM Sector Enhancement.
- Complete requirements, engineering and design of the seventh release of ERAM Sector Enhancements.
- Complete requirements, engineering and design of the eighth release of ERAM Sector Enhancements.

2A02, EN ROUTE COMMUNICATIONS GATEWAY (ECG)
FY 2017 Request $2.7M

En Route Communications Gateway (ECG) – Technology Refresh, 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 (ERAM) and the Enhanced Backup Surveillance System at the Air Route Traffic Control Centers. 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 Technology Refresh.

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.

Technology Refresh:
Based on input from ECG OA, STEP, and the evolving operational needs of the NAS, the ECG Technology Refresh 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: Interface Processor, Magma Chassis and Intelligent Communication Adapter cards. The deployment of these components will begin in FY 2017. Technology Refresh deployment will be completed in FY 2017.

The next phase of ECG technology refresh will begin in FY 2018. It will address EOL and EOS issues for the LAN Based Random Access Plan Position Indicator (RAPPI) (LBR) Surveillance Gateway System (SGS). 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 Technology refresh 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 and keep the system up-to-date to avoid failures and system outages. This will insure the ECG system maintains its availability and reliability. Quarterly ECG Operational Analysis Reports indicate an operational availability of 100% from first site Operational Readiness Demonstration (ORD) in 2004 through June 30, 2015.

Program Plans FY 2017 – Performance Output Goals
Performance Monitoring:
- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Technology Refresh:
- Achieve Key-site and National deployment of ECG-074 Software Release.
- Complete deployment of Interface Processor, Expansion Chassis and Serial Communications Adapter Card Technology Refresh.
- Complete Technology Refresh deployment for RAPPI.
- Start engineering analysis for the SGS.

Program Plans FY 2018 – Performance Output Goals
Performance Monitoring:
- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Technology Refresh:
- Start Technology Refresh deployment for the SGS.

Program Plans FY 2019 – Performance Output Goals
Performance Monitoring:
- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Technology Refresh:
- Complete Technology Refresh deployment for the SGS.
- Complete engineering analysis of ECG Technology Refresh utilizing monthly STEP EOL and quarterly OA Reports.

Program Plans FY 2020-2021 – Performance Output Goals
Performance Monitoring:
- Deliver monthly STEP EOL Reports.
- Deliver quarterly OA Reports.

Technology Refresh:
- Complete engineering analysis of ECG Technology Refresh utilizing monthly STEP EOL and quarterly OA Reports.

2A03, Next Generation Weather Radar (NEXRAD)
FY 2017 Request $6.3M

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. This weather information helps determine the location, time of arrival, and severity of weather conditions to determine the best routing for aircraft. The National Weather Service (NWS) collects and redistributes NEXRAD weather data from the radars they operate and some of the 12 FAA operated radars to create forecasts that are used in all phases of flight. NEXRAD products and services are processed by FAA's Weather and Radar Processor, Integrated Terminal Weather System, and the Corridor Integrated Weather System.

With NWS as the lead agency, there are currently 160 NEXRAD systems used by the Tri-Agency partners consisting of NWS, FAA, and DOD. The FAA owns and operates 12 of the NEXRAD systems; seven are located in Alaska, four in Hawaii, and one in Puerto Rico.

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 (MOA). 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 for use 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):
Program office will support NWS NPI Science Evolution and Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) in 2021 and will initiate business case for NEXRAD SLEP Phase 2; IARD is scheduled in 2023. 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 2017 – Performance Output Goals

NEXRAD – SLEP Phase 1 (W02.02-02):

- Fund FAA's pro-rata share of NPI Science Evolution costs.
- Deliver upgraded Icing algorithm to Radar Operations Center (ROC).
- Complete one Signal Processor replacement (1 of 12, 8%).

NEXRAD – SLEP Phase 2 (W02.02-03):

- None.

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 three Signal Processor replacements (4 of 12, 33%).
- Complete one Transmitter refurbishment (1 of 12, 8%).
- Deliver upgraded Icing algorithm to 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 four Signal Processor replacements (8 of 12, 67%).
- 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 Signal Processor replacements (12 of 12, 100%).
- 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

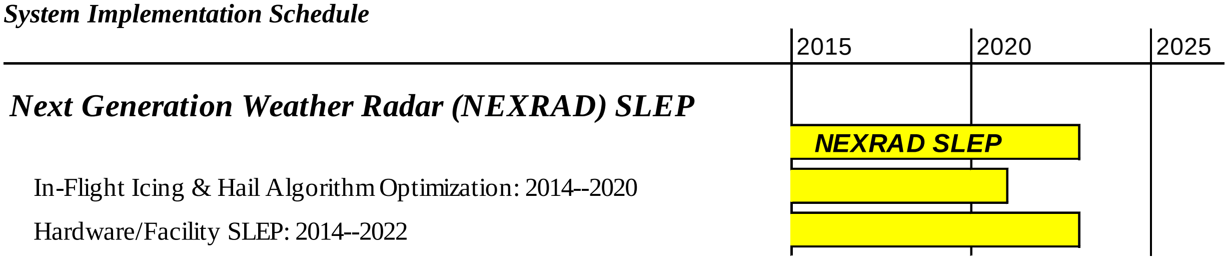
NEXRAD – SLEP Phase 1 (W02.02-02):

- 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.
- Support NWS Routine Technology Refresh.
- 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 2017 Request $74.9M

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 is the space used to house NAS systems. This project renovates portions of the control wing basement by replacing or modernizing old and obsolete mechanical and electrical systems as well as fire detection and suppression systems.
- Major Mechanical Systems projects 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 projects replace aging Direct Digital Control Systems (DDCS) that monitor and control the facility environmental systems, such as heating, ventilation, air conditioning (HVAC), chillers, cooling towers, pumps, air handlers, computer room air conditioners, and monitoring systems for water leak detection. The new Building Automation Controls Network "BACnet" replacement system will be an open communication standard protocol, developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), 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 Alarm Replacement Project –** This project will replace the fire detection and annunciation systems at each facility. It includes demolition of the existing system and installation of a new system to include a fire alarm control panel, fire alarm annunciation panels, visual and audible annunciation devices, smoke and heat detectors, manual pull stations, addressable control devices, fire alarm conduit and fire alarm wiring.
- **Central Plant and Power Service Building Modernization Project** – This project includes the continued modernization of the facility central cooling and heating plant along with the modernization of the Power Service Building. The work in the Central Heating and Cooling Plant includes replacement of facility chillers, boiler systems, hot water heaters, lighting and electrical panel board, and Motor Control Center (MCC) replacement. The work in the Power Services 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, 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, replacement of building electric distribution systems including panel boards, and branch circuits. The area for this project is the facility 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 site adapted for each of the ARTCCs and CCFs.

Many of these structures were built in the 1960's and have been expanded several times since then. As of FY 2014 there was a $104.5 million facility backlog of needed repairs or upgrades which includes all building systems such as HVAC components, all piping, plumbing, control systems, and both exterior and interior of the building. This backlog increases the risk of outages and may result in increased maintenance costs. This program modernizes and sustains these buildings to meet air traffic service requirements and to reduce the backlog. 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 approximately 2019. A catastrophic failure of a chiller plant could ultimately result in the loss of Air Traffic services at an ARTCC.

Program Plans FY 2017 – Performance Output Goals

- Award construction contract for the M1 Build Out project at Miami ARTCC.
- Award construction contracts for Control Wing Basement/Major Mechanical projects at Los Angeles, Salt Lake City, Atlanta, and Seattle ARTCCs.
- Award contracts for Building Automation Controls System Replacement projects at Anchorage ARTCC.
- Award design contracts for Building Automation Controls Systems Replacement for Atlanta, Minneapolis and Guam CCF.
- Provide funding to all ARTCCs and CCFs for mission critical infrastructure and miscellaneous sustainment needs.
- Update the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award contracts for three Facility Assessment Surveys, one for each service area.

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 Oakland, Cleveland, Washington, and Los Angeles ARTCCs.
- Award design contracts for Building Automation Controls Systems Replacement for Salt Lake, Seattle and Denver ARTCCs.
- Award design contract for Dewatering project at Minneapolis ARTCC.
- Provide funding to all ARTCCs and CCFs for mission critical infrastructure and miscellaneous sustainment needs.
- Update the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award contracts for three Facility Condition Surveys, one for each service area.

Program Plans FY 2019 – Performance Output Goals

- Award construction contracts for Building Automation Controls System Replacement project at Atlanta, Guam, Minneapolis, Salt Lake, Seattle and Denver ARTCCs.
- Award construction contract for Dewatering project at Minneapolis ARTCC.
- Renovate and upgrade ARTCCs and CCFs Mechanical Systems, Fire Protection Systems, and Power Service Building infrastructure based on facility condition survey.
- Provide funding to all ARTCCs and CCFs for mission critical infrastructure and miscellaneous sustainment needs.
- Update the national Facility Condition Assessment database for all other ARTCCs and CCFs.
- Award contracts for three Facility Condition Surveys, one for each service area.

Program Plans FY 2020 – Performance Output Goals

- Renovate and upgrade ARTCCs and CCFs Mechanical Systems, Fire Protection Systems, and Power Service Building infrastructure based on facility condition survey.
- Provide funding to all ARTCCs and CCFs for mission critical infrastructure and miscellaneous sustainment needs.
- Update the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award contracts for three Facility Condition Surveys, one for each service area.

Program Plans FY 2021 – Performance Output Goals

- Renovate and upgrade ARTCCs and CCFs Mechanical Systems, Fire Protection Systems, and Power Service Building infrastructure based on facility condition survey.
- Provide funding to all ARTCCs and CCFs for mission critical infrastructure and miscellaneous sustainment needs.
- Update the national Facility Condition Assessment database for all ARTCCs and CCFs.
- Award contracts for three Facility Condition Surveys, one for each service area.

2A05, AIR TRAFFIC MANAGEMENT (ATM) – TRAFFIC FLOW MANAGEMENT (TFM)

FY 2017 Request $20.0M

- A, Traffic Flow Management (TFM) Infrastructure – Field/Remote Site Technology Refresh, A05.01-13
- B, Traffic Flow Management (TFM) Infrastructure – TFM Service Enhancements, A05.01-14
- C, Commercial Space Integration Into The NAS, M55.01-01

A, Traffic Flow Management (TFM) Infrastructure – Field/Remote Site Technology Refresh, A05.01-13

Program Description

The TFM System 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 (DoD), U.S. Department of Homeland Security, and appropriate foreign Air Traffic Control entities.

TFM Infrastructure Field/Remote Site Technology Refresh will replace Traffic Flow Management System (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

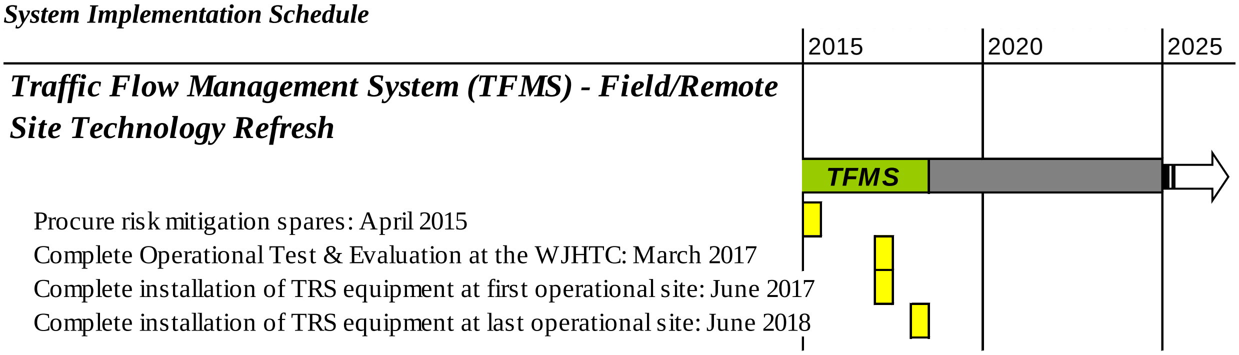
When the NAS is impacted by severe weather, congestion and/or outages, TFM predicts chokepoints and facilitates the development and execution of mitigation initiatives and collaboration with stakeholders, using common information displays and tools to minimize NAS delays. The TFM Infrastructure program 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. Keeping the TFMS fully mission capable also serves as an enabling function for the NextGen Collaborative Air Traffic Management Technologies Work Package 3 & 4 efforts, and in the future WP5, as they all reside and operate on TFMS.

Program Plans FY 2017 – Performance Output Goals
- Complete Operational Test & Evaluation at the William J. Hughes Technical Center. (APB milestone)
- Complete initial remote site replacements.
- Complete installation of TFM Infrastructure Field/Remote Site (TRS) equipment at first operational site. (APB milestone)

Program Plans FY 2018 – Performance Output Goals
- Complete installation of TRS equipment at last operational site. (APB milestone)

Program Plans FY 2019-2021 – Performance Output Goals
- None.

System Implementation Schedule



B, Traffic Flow Management (TFM) Infrastructure – TFM Service Enhancements, 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 ATO Standard Operating Procedure and coordinated with applicable stakeholders. Capability areas will be explored, developed, and executed over a multi-year period.

Enhancements made through this program will align with several TFM-oriented NextGen Operational Improvements (OIs) including:

- OI 105302 – Continuous Flight Day Evaluation;
- OI 105207 – Full Collaborative Decision Making; and
- OI 105208 – Traffic Management Initiatives with Flight Specific Trajectories.

Potential capability areas include:

- Improved NAS State Awareness. Current human-computer-interface 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 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 info with users and flying public is based on old technology and is not conducive "machine to machine" exchange;
- Better use of existing TFMS surface data. Use surface data already contained in TFMS to automatically calculate airport delay information and post to the Operational Information System (OIS). 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Target

Traffic Flow Management System (TFMS) automation enhancements will upgrade decision support tools to help traffic managers implement more efficient TMIs. Enhancements to both the Time-Based Flow Management and TFMS will assist traffic managers in more efficiently utilizing airport and airspace resources to increase arrival and departure capacity.

Program Plans FY 2017-2020 – 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.

Program Plans FY 2021 – 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.

C, 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 launch sites.

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 and real time monitoring processes necessary to safely integrate these missions into the National Airspace System (NAS). AST personnel are stationed at the Air Traffic Control System Command Center 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 Commercial Space enabling NAS automation and decision support tools. The number of licensed and permitted commercial space operations and their complexity has increased significantly over the past few years. For each commercial space operation, AST and ATO must work together to safely minimize the effect on the capacity and efficiency of the NAS while providing opportunities for commercial space operators to accomplish their mission objectives. No real-time vehicle information is available to the FAA and the work to support operations is currently manual in nature, time consuming, error-prone, and unable to respond to dynamic conditions. FAA systems were not designed to support commercial space purposes and interfaces to ingest telemetry and planning data do not exist. A small team of AST and ATO personnel manually transfer data across tools, phone hotlines, 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 a capability that can provide commercial space data to FAA decision support tools in the strategic, tactical, and automation environments is essential to the FAA's ability to safely minimize the effects of these operations on NAS capacity and efficiency without impeding industry progress. This 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 more timely manner during a mission, and quickly release airspace back to the system as the mission progresses.

The FAA requires a data integration capability to support upcoming operational scenarios, including those associated with NASA's Commercial Crew Program, fly back boosters, inland reentries from orbit, and other complex mission designs that must share the airspace with aviation. A prototype has been developed and installed at the Command Center where a series of prototype demonstrations of this capability are scheduled to take place in shadow mode during upcoming commercial space operations. These demonstrations were developed in close collaboration with NextGen, ATO System Operations Support, and ATO Mission Support in support of the Administrator's Strategic Initiative for the NAS. This prototype will be applied to specific missions to assist in the development of requirements and demonstrate the benefits that integrating commercial space data into the NAS can provide to the Command Center, En Route and Terminal environments. The initial phase of this program will develop a data integration capability to process real-time vehicle data and aircraft hazard area data and then interface with the Traffic Flow Management System (TFMS) at the Command Center. This will allow the FAA to dynamically modify aircraft hazard areas by releasing airspace that is no longer at risk as a mission progresses. Continued use of the prototype system and engineering assessments will allow the extension this capability to an En Route Automation Modernization and Terminal environments in future phases.

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 Target

During commercial launch and reentry operations, highly manual procedures are currently followed due to the inability of the NAS to ingest real-time telemetry and planning data. This produces large, static hazard areas that close large amounts of airspace for extended periods of time. While these expanded hazard areas ensure the safety of all NAS users, they do so at the expense of system efficiency; increasing reroute mileage and delays, and reducing on-time arrival rates.

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 and utilize a system that integrates real-time mission data, allowing for a more dynamic use of the NAS. Using precise and upgraded 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. 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 2017 – Performance Output Goals

- Develop the following products in support of the IARD:
  - Enterprise Architecture Artifacts;
  - Investment Analysis Plan; and
  - Final Shortfall Analysis.
- Achieve JRC IARD.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of the IID:
  - Initial Program Requirements documentation;
  - Enterprise Architecture Artifacts;
  - Initial Business Case documentation;
  - Initial Implementation Strategy and Planning Document (ISPD)
- Achieve JRC IID.

Program Plans FY 2019 – Performance Output Goals

- Initiate transition to Long-Term NextGen Concept of Operations.
- Develop the following products in support of the FID:
  - Final Program Requirements documentation
  - Acquisition Program Baseline

Program Plans FY 2020-2021 – Performance Output Goals

- Output goals will be determined at FID, to include deployment of primary capability and follow on enhancements.

2A06, AIR/GROUND COMMUNICATIONS INFRASTRUCTURE
FY 2017 Request $8.8M

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 will also provide dual control functionality with the option to toggle control of a remote communications facility between two towers; allowing 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 2017 – Performance Output Goals

Radio Control Equipment – Sustainment (C04.01-01):

- Procure RCE Intellectual Property from vendor.
- Redesign and test prototype of identified obsolete modules.
- Prepare Screening Information Request package for power supply replacement.
- Complete RCE test bed upgrade.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of nine CFE sites.

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):

- None.

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):

- None.

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):

- None.

Communications Facilities Enhancement – Expansion (C06.01-00):

- Complete the Establish/Replace/Upgrade of four CFE sites.

2A07, AIR TRAFFIC CONTROL EN ROUTE RADAR FACILITIES IMPROVEMENTS

FY 2017 Request $5.8M

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 (Mode Select and Air Traffic Control Beacon Interrogator (ATCBI)); both standalone and those co-located with the long-range primary radars. Secondary radars typically have their antennas mounted above the long-range primary radar antennas, and the processors for both radars are typically installed in facilities constructed in the 1950's and 1960's. 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 includes:

- Upgrade of existing lightning protection, grounding, bonding, and shielding (LPGBS) systems;
- Upgrade of existing power distribution systems;
- Upgrade of radar structural components to support LRR Service Life Extension Program (SLEP) 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 (ACM), 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, 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 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 2017-2021 – 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. 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 2017 Request $11.3M

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) controls the switching mechanisms that allow controllers to select the communication channel they need to communicate with pilots, other controllers, other air traffic facilities, and commercial telephone contacts. Controllers need to be able to quickly select the proper channel, so they can communicate with pilots, coordinate with other controllers and/or contact emergency services as necessary.

VSCS – Technology Refresh – Phase 3 (C01.02-04):
The VSCS Technology Refresh program will replace and upgrade hardware and software components for the voice switching systems in all 21 en route air traffic control centers. The real time Field Maintenance/Testing System at the FAA William J. Hughes Technical Center (WJHTC) and the Training System at the FAA Academy will also be upgraded to perform the same as an operational site. 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 replaced the VSCS Timing and Traffic Simulation Unit at the FAA WJHTC. This WJHTC test bed is being used to test the capabilities of the upgraded systems to determine if they meet the formal baseline requirements established for VSCS performance before they are deployed to operational field facilities.

VSCS Technology Refresh Phases 1 and 2 included funding for Work Station Upgrades, VSCS Display Module Replacement, VSCS Integrated Test Suite Replacement, Maintenance Test Set Replacements – Functional At Speed Tester, Power Supply upgrades, VSCS Training and Backup Switch (VTABS), VSCS Test Controller Replacement, as well as some software code conversion from Programming Language for Microcomputers (PLM) to C.

VSCS Technology Refresh Phase 3 will be dependent upon engineering analysis which will include Ground-to-Ground (G/G) node reduction efforts (approximately 10 nodes), Fiber Optic Tie Trunk (FOTT) power supply replacements (approximately 500 supplies), Local Area Network (LAN) Transceiver retrofits (approximately 7,000), and the PLM to C software conversion for the Air-to-Ground (A/G) switch. A Final Investment Decision for VSCS Technology Refresh Phase 3 was approved in November 2012.

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. Based on analysis, this program will replace or upgrade VSCS components to sustain VSCS and will be a stand-alone effort starting 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

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 Phase 3 is required to sustain both the operational availability of the VSCS/VTABS switches and the ability of the VSCS Depot to support site requisitions.

Program Plans FY 2017 – Performance Output Goals
VSCS – Technology Refresh – Phase 3 (C01.02-04):
- Complete FOTT power supply replacement. (APB milestone)
- Complete VSCS Local Area Network (LAN) Transceiver Retrofit. (APB milestone)

VSCS – Technology Refresh – Level of Effort (C01.02-05):
- None.

Program Plans FY 2018 – Performance Output Goals

VSCS – Technology Refresh – Phase 3 (C01.02-04):
- Complete A/G PLM to C software conversion. (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.

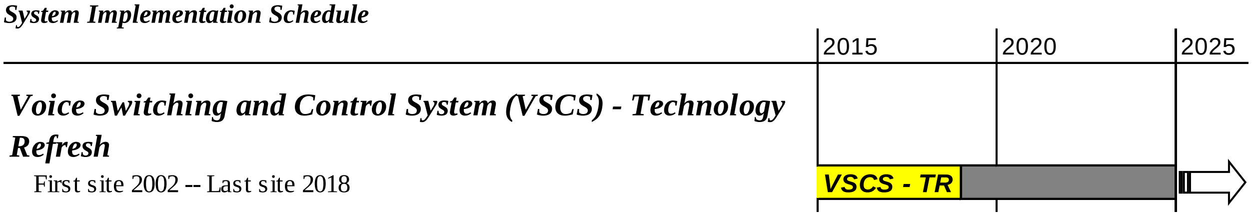
VSCS – Technology Refresh – Level of Effort (C01.02-05):
- Complete quarterly VSCS / VTABS System Technology Evolution Process database update needed for DMSMS analysis.
- Recover, replace or upgrade VSCS components as identified in the DMSMS analysis.

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.

System Implementation Schedule



2A09, OCEANIC AUTOMATION SYSTEM (OAS)

FY 2017 Request $24.0M

- A, Advanced Technologies and Oceanic Procedures (ATOP) – Technology Refresh, A10.03-01
- B, Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Service Enhancements, A10.03-03
- C, Oceanic Separation Standards Development and Analysis, A10.06-01
- X, Advanced Technologies and Oceanic Procedures (ATOP) – ATOP Enhancements (Work Package 1), A10.03-02

A, Advanced Technologies and Oceanic Procedures (ATOP) – Technology Refresh, A10.03-01

Program Description

The ATOP program replaced the original oceanic air traffic control system, updated procedures and modernized the Oakland, New York, and Anchorage ARTCCs, which house the oceanic automation systems. Full operational capability was achieved at all three centers in 2007. A support system was installed at the William J. Hughes Technical Center (WJHTC). ATOP fully integrates flight and radar data processing, detects conflicts between aircraft, provides data link and surveillance capabilities, and automates the previous manual processes for oceanic air traffic control.

ATOP Technology Refresh program will define engineering requirements for replacing the hardware and operating system, and procure and integrate the new hardware and operating system with the baseline ATOP applications. ATOP Technology Refresh reduces maintenance and logistics costs and supports incorporation of software changes and new capabilities to support future NextGen, Surveillance and Broadcast Service (SBS), and other NAS improvements.

Investment Analysis Readiness Decision (IARD) was completed in FY 2015 and Final Investment Decision (FID) is planned in FY 2016.

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 Target

ATOP Technology Refresh 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 2017 – Performance Output Goals
- Complete the procurement of the hardware for Technology Refresh 2 for the three ATOP sites; Anchorage, New York, Oakland, and the support system at the WJHTC.

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 technical refresh.

Program Plans FY 2019 – Performance Output Goals
- Complete software porting from AIX 5.3 to Linux and provide a technology refresh hardware and software release for operational use.
- Complete the implementation of the technology refresh configuration at the first ATOP site.
- Initiate software development of a software release which will improve ATOP system performance in the NAS.

Program Plans FY 2020 – Performance Output Goals
- Complete the implementation of the technology refresh at the last two ATOP sites. (Prior year funding)
- Complete development of ATOP T28 improved performance software release. (Prior year funding)
- All three ATOP sites operational on T28 improved performance software release. (Prior year funding)

Program Plans FY 2021 – Performance Output Goals
- None.

B, Advanced Technologies and Oceanic Procedures (ATOP) – Oceanic Service Enhancements, 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. ATOP full operational capability was achieved at all three centers in 2007. The scope of these NAS enhancements is limited to operational changes that do not require significant capital investments, nor involve significant systems complexity or interdependencies, but do require an expedited solution. The identification, management, documentation, and overall governance of these NAS changes will be articulated in an ATO Standard Operating Procedure and will use the ATOP NAS Change Proposal (NCP) 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 Target

This program will improve the flexibility, reliability, and efficiency of oceanic air traffic control by providing a capability to more frequently accommodate user's preferred flight trajectories and requests for altitude changes which will increase the likelihood of on-time arrivals.

Program Plans FY 2017– Performance Output Goals

- Complete operational and engineering analysis activities for prioritized ATOP system enhancements to deliver improved oceanic air traffic service for its users.

Program Plans FY 2018-2020 – Performance Output Goals

- Complete operational and engineering analysis, solution development, and solution implementation activities for prioritized ATOP system enhancements to deliver improved oceanic air traffic service for its users.

Program Plans FY 2021 – Performance Output Goals

- None.

C, Oceanic Separation Standards Development and Analysis, A10.06-01

Program Description

The Oceanic Separation Standards Development and Analysis Program will provide specialized technical expertise to the International Civil Aviation Organization (ICAO) Separation and Airspace Safety Panel (SASP), and help to form FAA-recommended standards for ICAO regional planning groups in the North Atlantic and Asia Pacific regions, where the U.S. is responsible for significant delegated international airspace. This program contributes towards the development and implementation of separation minima and procedures in the form of data-driven safety studies, mathematical modeling, and collision risk estimation. Separation minima are predicated on the equipage of aircraft with performance-based navigation (PBN) and performance-based communication and surveillance (PBCS) capabilities along with air navigation service providers (ANSPs) having the required automation capabilities.

The FAA provides specialized technical expertise to ICAO technical panels and develops recommended standards for ICAO regional planning groups that develop proposed changes to existing standards. This approach ensures coordination of international standards with U.S. recommended standards and improves efficiency of operations for U.S. air carriers and air traffic control systems. Specialized collision risk modeling and safety training will be provided to foreign governments and ANSPs to ensure the safe implementation of separation minima.

The program supports the development of ICAO SASP technical information and working papers including recommendations for new separation minima and procedures. These recommendations support amendments to the appropriate ICAO Standards and Recommended Practices (SARPs), requirements, and documentation.

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 Target

The Oceanic Separation Standards Development and Analysis Program is linked to the AOA Strategic Priority of "Making Aviation Safer and Smarter" through FAA's participation in the development work of new separation minima and procedures performed within the ICAO SASP. This development work conducted within the ICAO SASP assures that separation minima and procedures introduced for application in oceanic and procedural airspace will meet safety requirements established by ICAO.

Program Plans FY 2017 – Performance Output Goals

- Deliver the 30/30 Cross Boundary between New York Oceanic and Santa Maria airspace report.
- Deliver the PBCS report to ICAO SASP.
- Deliver analysis report for the North Atlantic Data Link Mandate, Phase 2B.
- Deliver analysis report on North Atlantic Minimum Navigation Performance Specification to PBN.

Program Plans FY 2018-2021 – Performance Output Goals

- None.

X, 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 installed at the William J. Hughes Technical Center. 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 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 nine planned enhancements to address the nine 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;
- Degraded operations from server and workstation failures;
- Data handling and processing limitations in stratified surveillance sectors;
- Lack of support for automatic user request processing; and

- Lack of automation-generated alternatives aligned with preferred flight trajectories.

The nine 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;
- Service Continuity Enablers;
- ATOP in Stratified Surveillance ATC Sectors;
- NextGen: Approval of User Requests in Oceanic Airspace (Auto Re-Probe); and
- NextGen: Approval of User Requests in Oceanic Airspace (Conflict Resolution Advisory).

Investment Analysis Readiness Decision (IARD) is planned for second quarter FY 2017. Final Investment Decision (FID) is planned for second 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 Target

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 2017 – Performance Output Goals

- Develop the following products in support of the IARD: (prior year funds)
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operations;
  - Functional Hierarchy;
  - Enterprise Architecture Products; and
  - Preliminary Program Requirements.

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 (ISPD); and
  - Acquisition Program Baseline (Execution Plan).
- Achieve FID and initiate development of enhancements.

Program Plans FY 2019-2021 – Performance Output Goals

- Output goals will be developed at FID.

2A10, NEXT GENERATION VERY HIGH FREQUENCY AIR/GROUND COMMUNICATIONS SYSTEM (NEXCOM)

FY 2017 Request $50.5M

Next-Generation VHF and UHF A/G Communications (NEXCOM) – Segment 2 – Phase 1 of 2, C21.02-01 / X, 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 capability grows to meet the projected U.S. air traffic requirements of the future. New Very High Frequency (VHF) radios can handle both the existing 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 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). The radios will support Voice over Internet Protocol (VoIP) and meets 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. The NEXCOM program is currently reviewing and finalizing the requirements and Screening Information Request package for the upcoming procurement. The program expects contract award in FY 2017, and should start deploying the Emergency Transceivers in FY 2018.

Segment 1a of the NEXCOM program finished replacing all 25,000 en route radios with Multimode Digital Radios (MDRs) in FY 2013.

The NEXCOM Segment 2 program began replacing radios at terminal and flight services in FY 2009, under an existing contract, with completion scheduled in FY 2027. 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. The Final Investment Decision for Phase 2 is planned for the 4th quarter of FY 2016.

<u>NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):</u>
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.

<u>NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):</u>
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 (FY 2019 to FY 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

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 2017 – Performance Output Goals

NEXCOM – Segment 2 – Phase 1 of 2 (C21.02-01):

- Deploy 3,000 new Terminal Air Traffic Control Radios.
- Purchase 3,300 Radios.
- Initiate transition from Phase One to Phase Two.
- Award contract for VHF/UHF Emergency Transceivers.

NEXCOM – Segment 2 – Phase 2 of 2 (C21.02-02):

- None.

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.
- Purchase 3,300 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):

- Purchase 1200 Radios.

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.
- Purchase 4,500 Radios.
- Deploy 300 Emergency Transceivers operationally.

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.
- Purchase 4,700 Radios.
- Deploy 300 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.
- Purchase 4,700 Radios.
- Deploy 300 Emergency Transceivers.

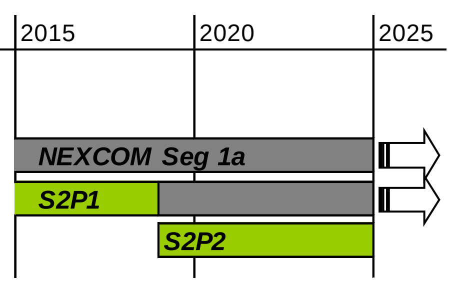
System Implementation Schedule

Next-Generation VHF A/G Communications System (NEXCOM) – Segment 2 - Phase 1/2

First site: July 2003 -- Last site: September 2013

First site: 2009 -- Last site: September 2018

First site: 2019 -- Last site: August 2024



2A11, NEXTGEN – SYSTEM-WIDE INFORMATION MANAGEMENT (SWIM)

FY 2017 Request $28.8M

- 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

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:

- 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. Further, 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:

- Continued ramping of programs onto the NAS Enterprise Messaging Service (NEMS) that provides a reliable messaging infrastructure to be leveraged by SWIM producers and consumers;
- Identity and Access Management (IAM) Phase 2: A Service Oriented Architecture (SOA) core service that provides security controls for access to SWIM. Deploys strong authentication and authorization using Private Key Infrastructure (PKI) 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 (O&M) 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 (STDDS) 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 (NEMS). 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017 – Performance Output Goals
- Complete SOA suitability assessments for NAS programs entering the FAA investment analysis processes.
- Complete Development Testing for Strong Authentication using digital certificates for internal connections between NAS systems (IAM Phase 2).
- Complete ESM Phase 2 Operational Testing at WJHTC, which enables ESM to accept status messages from a Communication, Information & Network Programs (CINP) SWIM producer. (APB milestone)

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 STDDS 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 STDDS Phase 2 Release 4 IOC. (APB milestone)
- Complete ESM Phase 3 Development Testing, which enables ESM to accept status messages from a Non-CINP SWIM producer. (APB milestone)
- Complete NCR Operational Testing at WJHTC. (APB milestone)

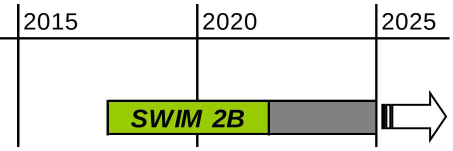
Program Plans FY 2020 – Performance Output Goals
- Complete SOA suitability assessments for NAS programs entering the FAA investment analysis processes.
- Complete ESM Phase 3 IOC. (APB milestone)
- Complete STDDS Phase 2 Release 5 IOC. (APB milestone)
- Complete IOC for Attribute Based Access Control (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)

System Implementation Schedule

System Wide Information Management (SWIM) – Seg 2B

First site IOC: October 2017 -- Last site IOC: September 2021



B, System Wide Information Management (SWIM) – Common Support Services Weather (CSS-Wx) Work Package 1, G05C.01-06

Program Description

Common Support Services-Weather (CSS-Wx) Work Package 1 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. Consolidating several legacy weather dissemination systems, 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 Operating Capability (IOC) in FY 2019.

The CSS-Wx System will:

- Provide weather information via Web Coverage Service (WCS) for gridded data, Web Feature Service (WFS) for non-gridded data, and Web Map Service (WMS) 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 (NetCDF) 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 (NOAA) NextGen Web Services, and other weather sources available to FAA and NAS users.

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) CERAPs, and one (1) at the ATCSCC.

The CSS-Wx program Work Package 1 (WP1) is in the AMS Solution Implementation phase. The program achieved Final Investment Decision (FID) for WP1 in March 2015. FID for CSS-Wx WP1 occurred with FID for NWP WP1.

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 57,975, 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 replans 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 2017 – Performance Output Goals
- Complete site surveys planned in FY 2017.

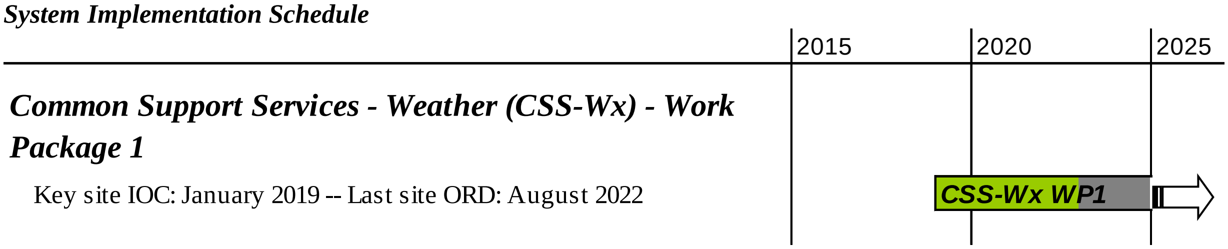
Program Plans FY 2018 – Performance Output Goals
- Complete CSS-Wx WP1 Factory Acceptance Testing (FAT). (APB Milestone)

Program Plans FY 2019 – Performance Output Goals
- 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)

Program Plans FY 2020 – Performance Output Goals
- Achieve CSS-Wx WP1 First Site Operational Readiness Date (ORD). (APB Milestone)
- Achieve CSS-Wx WP1 ORD at 13 sites (13 of 60, 22%).

Program Plans FY 2021 – Performance Output Goals
- Achieve CSS-Wx WP1 ORD at 36 sites (49 of 60, 82%).

System Implementation Schedule



2A12, NEXTGEN – AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B) NAS WIDE IMPLEMENTATION

FY 2017 Request $31.1M

- A, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01 / X, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications, Future Segment, G02S.03-04
- B, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Future Segments, G02S.01-02

A, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications (Service Volume), G02S.03-01 / X, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Baseline Services & Applications, Future Segment, G02S.03-04

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 new 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 Common Automated Radar Tracking System (CARTS), Standard Terminal Automation Replacement System (STARS), Microprocessor En Route Automated Radar Tracking System (MicroEARTS), En Route Automation Modernization (ERAM), and Advanced Technologies and Oceanic Procedures (ATOP).

In addition to the ground-based ADS-B receivers, nearby aircraft within range of the broadcast which are equipped with ADS-B In avionics may also receive and process the surveillance information of nearby ADS-B equipped aircraft for display 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.

ADS-B NAS Wide Implementation – Baseline Services & Applications (G02S.03-01):
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. The program has two activities: Baseline Services and Applications and In Trail Procedures. The In Trail Procedures activity will be completed in FY 2017.

Baseline Services and Applications:
This activity continues implementation of baseline ADS-B applications and enables: Ground-based Interval Management-Spacing (GIM-S); 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 (CAVS); Weather; and NAS Situation Awareness.

Nine airports in the NAS will receive Airport Surface Surveillance Capability (ASSC): a surface multilateration system which will receive 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.

See ADS-B Lease Services portion of the program under G02S.03-05.

In Trail Procedures:
In Trail Procedures (ITP) allows air traffic control to approve ADS-B equipped aircraft to perform oceanic flight level changes when there is less than standard separation. Using oceanic procedural separation standards, ITP allows ATC to approve these flight level change requests between properly equipped aircraft with ADS-B using reduced separation during the flight level change maneuver. This will allow aircraft to more easily access more efficient altitudes in oceanic airspace. This activity develops the operational standards, provides for operational testing, and develops supporting automation software.

ADS-B—NAS Wide Implementation – Baseline Services & Applications, Future Segment (G02S.03-04):
The Future Segment program plans to introduce new scope to Baseline Services & Applications by implementing a surveillance backup strategy, infrastructure upgrades, new mitigations for spectrum congestion, and re-competing service contracts. The scope of this program is expected to be fully defined in May 2016 with an Investment Analysis Readiness Decision. In 2018, a Final Investment Decision (FID) is planned to request funding for the FY 2020 – FY2025 timeframe. Future Segment may continue to pay subscription fees for Alaska surveillance services, CONUS Surface services (including ADS-B service at ASSC sites), and CONUS Terminal and En Route surveillance services. The Future Segment will also provide: program management to support ongoing security updates; dedicated support for Gulf of Mexico platform owner's 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.

The objective of the ADS-B ITP is to enable aircraft that desire flight level changes in procedural airspace to more easily achieve these changes. ADS-B ITP achieves this objective by permitting a climb-through or descend-through maneuver between properly equipped aircraft, using a new separation standard that utilizes ADS-B data. The ITP limits the instances of an aircraft being held at a non-optimal flight level when conflicting traffic is present between the existing flight level and a more efficient flight level requested by the pilot.

Program Plans FY 2017 – Performance Output Goals

ADS-B NAS Wide Implementation – Baseline Services & Applications (G02S.03-01):

- Baseline Services and Applications:
  - Achieve Initial Operating Capability (IOC) of Terminal ATC Separation Services at 39 sites (119 of 160, 74%).
  - Achieve IOC of Surface Advisory Services at three ASSC site (5 of 9, 56%).
  - Complete Service Volume (SV) design at three ASSC sites.
- In Trail Procedures:
  - Achieve ATOP Oceanic ITP operational at Oakland, New York and Anchorage Centers. (APB milestone)

ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment (G02S.03-04):

- None.

Program Plans FY 2018 – Performance Output Goals

ADS-B NAS Wide Implementation – Baseline Services & Applications (G02S.03-01):

- Baseline Services and Applications:
  - Achieve IOC of Terminal ATC Separation Services at 28 sites (147 of 160, 92%).
  - Achieve IOC of Surface Advisory Services at four ASSC sites (9 of 9, 100%).
  - Achieve FID for next ADS-B investment segment.

ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment (G02S.03-04):

- None.

Program Plans FY 2019 – Performance Output Goals

ADS-B NAS Wide Implementation – Baseline Services & Applications (G02S.03-01):

- Baseline Services and Applications:
  - Achieve IOC of Terminal ATC Separation Services at 13 sites (160 of 160, 100%).
  - Complete 218 ATC Service Delivery Points.

ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment (G02S.03-04):

- None.

Program Plans FY 2020 – Performance Output Goals

ADS-B NAS Wide Implementation – Baseline Services & Applications (G02S.03-01):

- Baseline Services and Applications:
  - Provide and maintain baseline services and applications through September 2020. (APB milestone)

ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment (G02S.03-04):

- None.

Program Plans FY 2021 – Performance Output Goals

ADS-B NAS Wide Implementation – Baseline Services & Applications (G02S.03-01):

- None.

ADS-B NAS Wide Implementation – Baseline Services & Applications, Future Segment (G02S.03-04):

- Output goals will be determined at FID.

B, Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Future Segments, G02S.01-02

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 inter-aircraft spacing (e.g., achieve a precise interval between aircraft in a stream of traffic). 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 the Flight Interval Management avionics to provide speed guidance to a flight crew to achieve and maintain a relative spacing interval from another aircraft. Changes to ERAM, STARS, and TBFM automation systems will be needed to support the initiation and monitoring of IM operations. Interval Management-Spacing (IM-S) Arrivals, Approach, & Cruise (AA&C) supports IM operations for arrival and approach applications for independent runway operations and for cruise operations to provide spacing during en route metering and Miles-in-Trail operations. Advanced-IM (A-IM) will extend the capabilities developed as a part of IM-S AA&C to dependent runway and departure operations, Pairwise Trajectory Management (PTM) operations in oceanic airspace, and will support changes to the current separation standards to enable additional benefits.

The Surveillance and Broadcast Services Office is maturing the requirements definition of a suite of ADS-B In IM applications and will pursue a series of Final Investment Decisions (FID) as each application or set of applications are deemed suitably defined for implementation. Pre-implementation activities and AMS milestones through FID for ADS-B In Applications – IM are funded under G01S.02-01.

Post FID implementation activities will be funded and executed under this program, G02S.01-02. The first set of ADS-B In Applications will be IM-S AA&C.

IM-S AA&C is applicable to oceanic, en route, and terminal airspace and will require investments in both air traffic management and decision support automation systems, as well as flight deck avionics. Significant implementation activities under this program include:

- Developing ground-based automation software for implementation of IM-S AA&C capability into ERAM, STARS, and TBFM;
- Completing Safety Case for IM-S AA&C Initial Operating Capability;
- Completing Operational Benefits Validation for Flight-deck based Interval Management Minimum Operational Performance Standards (FIM MOPS) v2 avionics; and
- Installing and deploying IM-S AA&C capability in the NAS.

A-IM dependent runway, departure and oceanic operations, and other future concepts along with the associated avionics standards will be developed with RTCA and the user community. Pre-implementation activities for these future concepts will be conducted under G01S.02-01.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Interval management 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 FID.

Program Plans FY 2017 – Performance Output Goals

- None.

Program Plans FY 2018 – Performance Output Goals

- Complete Preliminary Design and Review with automation vendors for ERAM, STARS and TBFM.
- Complete Critical Design and Review with automation vendors for ERAM, STARS, and TBFM.
- Initiate software development with TBFM automation vendor.

Program Plans FY 2019 – Performance Output Goals

- Initiate software development with ERAM and STARS automation vendors.

Program Plans FY 2020 – Performance Output Goals

- Develop plan for vendor testing of ERAM, STARS and TBFM software.

Program Plans FY 2021 – Performance Output Goals

- Complete software development with STARS and TBFM vendors.
- Award contract for FIM MOPS v2-compliant avionics.

2A13, WINDSHEAR DETECTION SERVICE (WDS)

FY 2017 Request $4.5M

- 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. The 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 2017 – Performance Output Goals
- Install WSP site upgrade at 16 sites (17 of 34, 50%).
- Install WME site upgrade at 30 sites (30 of 60, 50%).
- Install LLWAS site upgrade at 25 sites (25 of 50, 50%).
- First WME/LLWAS site upgrade complete. (APB milestone)

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 2019-2021 – 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 (COTS) 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 (NCAR) 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 2017-2018 – 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 Investment Analysis Readiness Decision (IARD).

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the FID:
  - Final Program Requirements (fPR) Document;
  - Enterprise Architecture Products;
  - Business Case documentation;
  - Final Implementation Strategy and Planning Document (ISPD); and
  - Acquisition Program Baseline (Execution Plan).
- Achieve FID.

Program Plans FY 2021 – Performance Output Goals

- Award contract.
- Other output goals will be developed at FID.

2A14, NEXTGEN – COLLABORATIVE AIR TRAFFIC MANAGEMENT PORTFOLIO

FY 2017 Request $13.8M

- A, Strategic Flow Management Application, G05A.01-01
- B, Strategic Flow Management Engineering Enhancement (SFMEE), G05A.01-02
- C, 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

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

Program Description

Strategic Flow Management Application (SFMA) will identify operational shortfalls and gaps for rerouting of the airborne and pre-departure flights which 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.

SFMA program will help resolve air traffic flow problems, reduce delays and 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. Capabilities developed through SFMA, together with those developed through the Advanced Methods program (G05A.02-02), will provide the concepts and requirements to the Strategic Flow Management Engineering Enhancements program (SFMEE) (G05A.01-02) to progress them through the AMS process as part of future investments for CATMT.

SFMA will collaborate with NASA on their Airspace Technology Demonstration Project (ATD); 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 SFMA program will benefit from, and leverage capabilities development from 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.

In FY 2018, this program will also begin service analysis activities to capitalize on future data communications capabilities, further integrate traffic flow management and metering operations, and support advanced trajectory-based 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

This program addresses the CATM performance objectives of increased capacity and flexibility. Increased capacity is achieved by the integration of strategic flow management with trajectory based operations (TBO) 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 2017 – Performance Output Goals

- Conduct concept engineering activities including Human-in-the-Loop to develop the following products:
    - HITL execution and report for Integration of SFMA with Strategic Traffic Management Initiatives
    - HITL execution and report for Integration of SFMA with new weather products
    - SFMA updated solution Concept of Operations (ConOps)
    - SFMA updated preliminary requirements
- Conduct concept engineering activities, e.g. analysis, tabletop, and validation and develop products for SFMA capabilities in support of targeted AMS IARD investment:
    - Updated ConOps
    - Updated preliminary program requirements
- Complete and deliver a report summarizing collaboration with NASA's ATFM activity. Support technical transfer activities from NASA to the FAA to mature advanced rerouting capability.
- Conduct service analysis activities to capitalize on future data communications capability, further integrate traffic flow management and metering operations, and support advanced trajectory-based operations; complete an initial shortfall analysis.

Program Plans FY 2018 – Performance Output Goals

- Complete and deliver a report summarizing collaboration with NASA's ATFM activity. Support technical transfer activities from NASA to the FAA to mature advanced rerouting capability.
- Conduct concept engineering activities, e.g. analysis, tabletop, and validation, and develop products for SFMA capabilities in support of targeted AMS IID/FID investment artifact generation:
    - Updated ConOps
    - Updated program requirements
    - Updated cost analysis
    - Updated benefit analysis
- Conduct engineering activities, e.g. analysis, HITL evaluation and simulation, to validate shortfalls and new capabilities, and develop products for the next segment of improved strategic flow services and capabilities that will capitalize on future data comm capabilities, further integrate traffic flow management and metering operations, and support advanced trajectory-based operations:
    - Preliminary Shortfall Analysis for traffic management services and capabilities
    - Preliminary ConOps
    - Initial prototyping, HITL evaluation, and report
    - Quantitative Shortfall Analysis
    - Preliminary Functional Analysis

Program Plans FY 2019 – Performance Output Goals

- Complete Technical Transfer of applicable capabilities developed under NASA's ATFM to program office.
- Conduct engineering activities, e.g. analysis, HITL evaluation and simulation, and develop products for the next segment of improved strategic flow services and capabilities that will capitalize on future data comm capabilities, further integrate traffic flow management and metering operations, and support advanced trajectory-based operations:
  - Prototyping, HITL evaluation, and report
  - Updated Preliminary ConOps
  - Operations Requirements
  - Updated Preliminary Functional Analysis
  - Updated Quantitative Shortfall Analysis

Program Plans FY 2020 – Performance Output Goals

- Conduct engineering activities, e.g. analysis, HITL evaluation and simulation, and develop products for the next segment of improved strategic flow services and capabilities that will capitalize on future data comm capabilities, further integrate traffic flow management and metering operations, and support advanced trajectory-based operations:
  - Prototyping, HITL evaluation, and report
  - Solution ConOps
  - Refined Preliminary Functional Analysis
  - Preliminary Program Requirements

Program Plans FY 2021 – Performance Output Goals

- Conduct engineering activities, e.g. analysis, HITL evaluation and simulation, and develop products for the next segment of improved strategic flow services and capabilities that will capitalize on future data comm capabilities, further integrate traffic flow management and metering operations, and support advanced trajectory-based operations:
  - Updated Solution ConOps
  - Updated Preliminary Program Requirements
  - Cost and benefit analysis and estimate

B, 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 conducts concept development to address operational TFM shortfalls and progresses these concepts through the Acquisition Management System (AMS) process as part of Collaborative Air Traffic Management Technologies (CATM-T) 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 on the Traffic Flow Management System and will be available to Traffic Managers at ARTCCs, TRACONs and the 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 Equipage 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.

As systems and capabilities in TFM evolved, there was little attention paid to their integration. The Traffic Management Units of today provide piecemeal operational information and tools but 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 Traffic Management Initiatives (TMIs) may not be apparent until after the initiative is implemented. Traffic Managers currently estimate potential impact by gathering data and relying on personal experience of how an initiative has performed in the past. This process is cognitively demanding, workload-intensive, and the outcome dependent upon an individual's skill 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.

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 57,975, 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 2017 – Performance Output Goals

- Develop the following products in support of the Concept & Requirements Definition Readiness Decision (CRDRD) for CATM-T Work Package 5 (WP5):
  - Preliminary Shortfalls Analysis.
  - Concept & Requirements Definition Plan.
- Develop the following products in support of the Investment Analysis Readiness Decision (IARD) for CATM-T WP5:
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operation;
  - Functional Analysis;
- Achieve CRDRD for targeted AMS investment.

Program Plans FY 2018 – Performance Output Goals

- Develop the following products in support of IARD for CATM-T WP5:
  - Enterprise Architecture Products;
  - Preliminary Program Requirements;
  - Updated Functional Analysis; and
  - Safety Assessment.
- Achieve IARD for targeted AMS investment.

Program Plans FY 2019 – Performance Output Goals

- Develop the following products in support of the Initial Investment Decision (IID) for CATM-T WP5:
  - Initial Program Requirements;
  - Business Case Analysis Report (BCAR);
  - Enterprise Architecture Products;
  - Initial Implementation Strategy and Planning Document (ISPD); and
  - Final Investment Analysis Plan (IAP).
- Develop the following products in support of the Final Investment Decision (FID) for targeted AMS investment:
  - Final Program Requirements (fPR) Document;
  - Enterprise Architecture Artifacts;
  - Business Case documentation;
  - Final ISPD; and
  - Acquisition Program Baseline (Execution Plan).
- Achieve IID/FID for targeted AMS investment.

Program Plans FY 2020 – Performance Output Goals

- Develop the following products in support of the Concept & Requirements Definition Readiness Decision (CRDRD) for targeted AMS investment for the next segment of traffic flow management improvements (which will be developed via the SFMA and AM programs):
  - Preliminary Shortfalls Analysis;
  - Concept & Requirements Definition (CRD) Plan.
- Develop the following products in support of the Investment Analysis Readiness Decision (IARD) for targeted AMS investment:
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operation;
  - Functional Analysis;
  - EA products; and
  - Preliminary Program Requirements.
- Achieve CRDRD for targeted AMS investment.

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 (which will be developed via the SFMA and AM programs):
  - Updated Functional Analysis;
  - Updated Enterprise Architecture Products;
  - Updated Preliminary Program Requirements; and
  - Safety Assessment.
- Achieve IARD for targeted AMS investments.

C, 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 is the primary automation system used by the Air Traffic Control System Command Center (ATCSCC) and the nationwide Traffic Management Units that assist the ATCSCC in management of air traffic flow and planning for future air traffic demand. The TFMS is the nation's primary source for capturing and disseminating air traffic information and is the key information source for coordinating air traffic in the NAS. TFMS hosts the software decision support systems that assist in managing and metering air traffic to reduce delays and make maximum use of system capacity to dynamically balance growing flight demands with NAS capacity. The FAA also uses the information from this system to collaborate with aviation users to develop and implement airspace management programs that reduce delays and ensure smooth and efficient traffic flow. TFM benefits passengers, the airlines, general aviation, the Department of Defense, the Department of Homeland Security, industry, and partner countries.

CATMT Work Package 4 (G05A.05-03):
CATMT Work Package 4 (WP4) is a future segment that when approved by the FAA Joint Resource Council (JRC) will provide NextGen Midterm TFM/CATM capabilities between FY 2017 and FY 2020. CATMT WP4 is currently in final investment analysis to identify possible CATMT WP4 capabilities for Final Investment Decision (FID) consideration. Capabilities being considered include:

- Improving Demand Predictions (IDP) – a set of several enhancements aimed at improving the TFMS predictions of demand for NAS resources.
- Integrated Departure Route Planner (IDRP) – a tool that provides strategic/tactical forecast of departure route and fix status due to convective weather and volume for specific terminals. Provides traffic managers with semi-automated resolution algorithm to "solve" departure constraints.

CATMT WP4 FID is planned for 4th quarter FY 2016. Business case analysis to support FID is being performed under Strategic Flow Management Engineering Enhancement (G05A.01-02).

CATMT Work Package 5 (G05A.05-04):
CATMT Work Package 5 (WP5), a future segment, when approved by the FAA Joint Resource Council (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.

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 2017 – Performance Output Goals
CATMT WP4 (G05A.05-03):
- Pending JRC FID and contract award, complete contract transition activities and begin the system design review for the IDP capability.

CATMT WP5 (G05A.05-04):
- None.

Program Plans FY 2018 – Performance Output Goals
CATMT WP4 (G05A.05-03):
- Complete System Design Review for the IDP Capability.
- Start the system engineering work for the IDRP capability.

CATMT WP5 (G05A.05-04):
- None.

Program Plans FY 2019 – Performance Output Goals
CATMT WP4 (G05A.05-03):
- Complete Detailed Design Review and Site Acceptance Testing for the IDP capability.
- Complete System Design Review for the IDRP capability.

CATMT WP5 (G05A.05-04):
- None.

Program Plans FY 2020 – Performance Output Goals
CATMT WP4 (G05A.05-03):
- Complete Operational Testing for the IDP capability.
- Achieve In-Service Decision for the IDP capability.
- Complete the Detailed Design Review for the IDRP capability.

CATMT WP5 (G05A.05-04):
- None.

Program Plans FY 2021 – Performance Output Goals
CATMT WP4 (G05A.05-03):
- None.

CATMT WP5 (G05A.05-04):
- Output goals will be determined at FID.

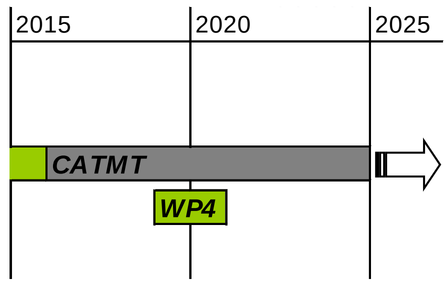
System Implementation Schedule

Collaborative Air Traffic Management Technologies (CATMT) – Work Package 4 and 5

First Operational Capability (OC): June 2008 -- Last OC: TBD

WP4 First Software Release: 2019 -- Last: 2020

WP5 - Pending final investment decision



2A15, NEXTGEN – TIME BASED FLOW MANAGEMENT (TBFM) PORTFOLIO
FY 2017 Request $50.6M

Time Based Flow Management (TBFM) Work Package 3, G02A.01-06 / Time Based Flow Management (TBFM) Technology Refresh, G02A.01-07 / 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 Portfolio concepts. TBFM Work Packages 3 and 4 will continue the modernization and enhancement of the existing TBFM system.

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 Performance Based Navigation (PBN) procedures such as Required Navigation Performance (RNP). Also in WP3 is the expansion of the Integrated Departure/Arrival Capability (IDAC) to additional locations. The design, development and deployment of these concepts will occur during the 2015-2022 timeframe. These enhancements 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 2018-2020 time frame. The current hardware will begin to reach its end of service and maintenance by 2017. The program office is currently working towards FID in FY 2017 to replace this hardware. The FID allows TBFM to maintain one hardware baseline with Technology Refresh and WP3 procurements.

TBFM Work Package 4 (G02A.01-08):
TBFM Work Package 4 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 targeted capabilities are listed below:

- Path Stretch: An automation-based, advisory that will enable aircraft to absorb assigned delay, laterally, while continuing to execute an optimized profile descent (OPD). This will enhance flight efficiency, reduce emissions and noise, and increase system predictability.
- Fleet Prioritization: Dynamically incorporate, and where feasible, use airspace user preferences when assigning time-based metering slots and associated delay. This will improve collaborative decision making and user efficiency.
- Terminal Sequencing & Spacing (TSAS) Improvements: Improved management of TSAS operations through the use of a dynamic dashboard to alert Traffic Management Coordinators of operational trends that may warrant adjustments to TSAS parameters and operations; and through the use of a TBFM-system wide "what if" aid that will improve the tactical management of arrival operations. These improvements will optimize the use of TSAS and in turn, further ensure aircraft can fly OPDs while optimizing arrival throughput.
- Improved TBFM-Traffic Flow Management System (TFMS) Data Integration: Increase the sharing of data between TBFM and TFMS systems to enhance demand capacity prediction and the integration of time-based metering, allowing for more coordinated Traffic Management Initiatives (TMI) strategy implementation and minimize unintended and disruptive TMI interactions. This will improve collaborative decision making, user efficiency, and increase system predictability.
- TSAS Expansion: Deploy TSAS to additional sites, beyond the sites that will receive TSAS via TBFM WP3. This geographical expansion will improve flight efficiency and system predictability at additional locations in the NAS and increases the utilization of PBN procedures.
- IDAC Expansion: Deploy IDAC to additional sites, beyond the sites that will receive IDAC via TBFM WP2 and WP3. This geographical expansion will reduce departure release coordination time/effort, improve flight efficiency, and enhance system predictability.
- Weather Source Migration: Obtain weather data, via System Wide Information Management (SWIM), from the FAA's Common Support Service-Weather system (CSS-Wx). This will decrease FAA operating costs while minimizing future costs associated with incorporating new weather products into TBFM.

This work package will also include the award of a new contract for the prime vendor, as the existing contract will expire in 2020.

TBFM WP4 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Target

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 2017 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Complete factory acceptance testing (FAT) for TSAS. (APB milestone)
- Conduct TSAS Software development.
- Conduct Integrated Test planning.
- Complete IDAC Site Surveys.
- Complete IDAC hardware procurement.

TBFM Technology Refresh (G02A.01-07):

- Complete the following documentation required for FID:
  - Final Program Requirements (fPR) Document;
  - Enterprise Architecture Products;
  - Business Case documentation;
  - Final Implementation Strategy and Planning Document (ISPD); and
  - Acquisition Program Baseline (Execution Plan).
- Achieve FID.
- Pending FID approval:
  - Award contract.

TBFM Work Package 4 (G02A.01-08):

- Initiate development of draft documentation required for the Investment Analysis Readiness Decision (IARD):
  - Preliminary Program Requirements (pPR) documentation;
  - Initial Benefits and Cost documentation;
  - Safety Documentation; and
  - Enterprise Architecture documentation.

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%).

TBFM Technology Refresh (G02A.01-07):

- Pending FID approval:
  - Conduct Site Surveys.
  - Procure hardware.
  - Complete 25% of the hardware installations.

TBFM Work Package 4 (G02A.01-08):

- Complete the documentation required for IARD:
  - Preliminary Program Requirements (pPR) documentation;
  - Initial Benefits and Cost documentation;
  - Safety Documentation; and
  - Enterprise Architecture documentation.
- Achieve IARD.
- Initiate development of draft documentation required for FID:
  - Final Requirements document (fPR);
  - Business Case;
  - Implementation Strategy and Planning Document (ISPD); and
  - Acquisition Program Baseline (APB).
- Conduct market survey for new prime TBFM contract.
- Develop and release new prime TBFM Screening for Information Request (SIR).

Program Plans FY 2019 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Complete Integration and Test at WJHTC. (APB Milestone)
- Deploy first TSAS site. (APB milestone)
- Complete deployment of TSAS to 1 site (1 of 9, 11%).
- Deploy last (5th) IDAC site. (APB milestone)
- Complete deployment of IDAC to 4 sites (5 of 5, 100%).

TBFM Technology Refresh (G02A.01-07):

- Pending FID approval:
  - Complete 50% hardware installations.

TBFM Work Package 4 (G02A.01-08):

- Complete development of final documentation required for FID:
  - Final Requirements document (fPR).
  - Business Case.
  - Implementation Strategy and Planning Document (ISPD).
  - Acquisition Program Baseline (APB).
- Achieve FID.
- Award TBFM WP4 contract.
- Complete evaluation of prime contractor proposals received in response to new prime TBFM SIR.
- Award new prime TBFM contract.

Program Plans FY 2020 – Performance Output Goals

TBFM Work Package 3 (G02A.01-06):

- Achieve TSAS In-Service Decision. (APB milestone)

TBFM Technology Refresh (G02A.01-07):

- Complete hardware installations.
- Begin disposal activities.

TBFM Work Package 4 (G02A.01-08):

- Complete System Requirements Review (SRR) for TBFM WP4.
- Complete Preliminary Design Review (PDR) for TBFM WP4.

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):

- Complete disposal activities.

TBFM Work Package 4 (G02A.01-08):

- Complete Critical Design review (CDR) for TBFM WP4.
- Begin incremental software and hardware development for TBFM WP4.

2A16, ATC BEACON INTERROGATOR (ATCBI) - TECHNOLOGY REFRESH

FY 2017 Request $1.0M

ATC Beacon Interrogator Model-6 (ATCBI-6) – Technology Refresh, S02.03-03

Program Description

The ATCBI-6 Technology Refresh Program will replace and upgrade obsolete ATCBI-6 original equipment manufacturer peculiar and Commercial Off-The-Shelf (COTS) hardware and software to ensure the continued reliable and cost effective operation of the radar system through its designated lifecycle. The original ATCBI-6 program procured 139, Monopulse Secondary Surveillance Radar (MSSR) with Selective Interrogation to replace 132 of the old model 4/5's, and seven support systems for training, testing, logistics, and operational support.

The ATCBI-6 provides air traffic controllers with a more selective interrogation capability not available in the older systems 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 Center Radar Approach Control (CERAP) surveillance service to numerous TRACON facilities in the event terminal radar services are lost. The ATCBI-6 program commissioned the first system in FY 2002 and commissioned the last system in FY 2013.

The Technology Refresh Program is in the planning and investment analysis phase. The business case analysis will identify parts obsolescence, operational performance deficiencies, and other areas requiring technology refresh to ensure continued reliable and cost effective operation of the radar system through its designated lifecycle. The Investment Analysis Readiness Decision (IARD) is planned for June 2018 and the Final Investment Decision (FID) is planned for June 2020. This activity will determine the retrofit requirement for the 132 operational and seven support ATCBI-6 systems in the FAA inventory.

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 is necessary to ensure the continued reliable and cost effective operation of the ATCBI-6 Secondary Surveillance system through its designated lifecycle. A business case analysis will be prepared to identify parts obsolescence, operational performance deficiencies, or other areas requiring technology refresh to ensure continued reliable and cost effective operation of the radar system through its designated lifecycle.

Program Plans FY 2017 – Performance Output Goals

- Develop the following products in support of the Investment Analysis Readiness Decision (IARD):
  - Shortfall Analysis/Quantification;
  - Solution Concept of Operation;
  - Functional Analysis;
  - Enterprise Architecture Products;
  - Program requirements; and
  - Safety Assessment

Program Plans FY 2018-2021 – Performance Output Goals
- None.

2A17, NEXTGEN – NEXT GENERATION WEATHER PROCESSOR (NWP)
FY 2017 Request $27.8M

NextGen Weather Processor (NWP), Work Package 1, G04W.03-02

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 (DSTs). NWP will also provide improved aviation safety related windshear products. Collectively, these program features will help reduce rising operations and maintenance costs by consolidating the following weather systems:

- Corridor Integrated Weather System (CIWS): Provides 0-to-2 hour aviation weather predictions and information to the Traffic Flow Management System (TFMS) and associated users of heavily traveled air corridors.
- Weather and Radar Processor (WARP): Provides weather information to en route air traffic controllers, supervisors, traffic management coordinators, and Center Weather Service Unit meteorologists.
- Integrated Terminal Weather System (ITWS): Provides weather information to terminal air traffic supervisors and controllers.

The NWP program 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 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 (AWDs) will be deployed at 117 designated facilities.

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.

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 (OPSNET), 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. Estimates of projected cost savings to airlines and passengers attributable to these advanced en route weather applications, including fuel costs and downstream connection delays for passengers, exceed $110 million per year.

Program Plans FY 2017 – Performance Output Goals
- Complete NWP WP1 Critical Design Review (CDR). (APB milestone)

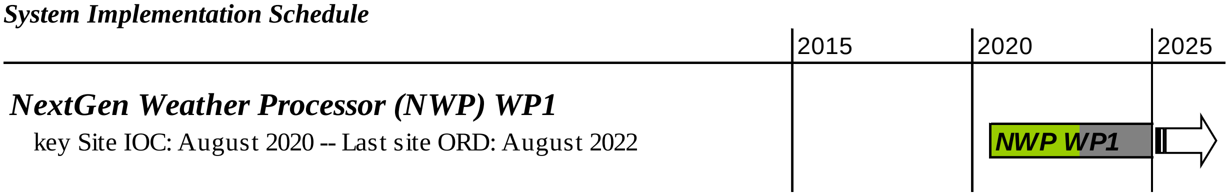
Program Plans FY 2018 – Performance Output Goals
- Conduct NWP WP1 Test Capability Accreditation Procedures by Prime Contractor.

Program Plans FY 2019 – Performance Output Goals
- Complete NWP WP1 Factory Acceptance Test (FAT). (APB milestone)

Program Plans FY 2020 – Performance Output Goals
- Complete NWP WP1 Operational Testing (OT). (APB milestone)
- Achieve NWP WP1 Key Site Initial Operational Capability (IOC). (APB milestone)

Program Plans FY 2021 – Performance Output Goals
- 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%)

System Implementation Schedule



2A18, AIRBORNE COLLISION AVOIDANCE SYSTEM X (ACAS X)

FY 2017 Request $8.9M

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 RTCA in order 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 (RAs) in US airspace and better support 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 (TSO) and Advisory Circular (AC) 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 identified in the legacy 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 (UAS) 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 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 RAs if used. An example of such an operation would be Closely-spaced Parallel Operations (CSPO). 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 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 2017 – Performance Output Goals

- Safety Risk Management – Complete System Safety Hazard Analysis. (APB milestone)

Program Plans FY 2018 – Performance Output Goals

- 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 TSO and AC. (APB milestone)

Program Plans FY 2021 – Performance Output Goals

- Publish ACAS X Operational Assessment / Validation Report. (APB milestone).

2A19, NEXTGEN – DATA COMMUNICATION IN SUPPORT OF NEXTGEN

FY 2017 Request $232.0M

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 2 Full En Route Services, G01C.01-10 / X, Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services, G01C.01-07 / X, Data Communications – Aeronautical Telecommunications Network (ATN) Gateway, G01C.01-08 / X, Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application, G01C.01-09

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 direct 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 will be delivered by Data Comm in two 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 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.

Segment 2 will further build upon CPDLC DCL and En Route services by supporting the delivery of services to enable more advanced NextGen operations not possible using voice communications, such as four-dimensional trajectories and advanced flight interval management. 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.

Data Communications – Segment 1 Phase 1 (G01C.01-05):
In S1P1, the Data Comm program will deliver DCL to 56 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 Critical Design Review: March 2012
- Final Investment Decision (FID): May 2012
- Data Comm Integrated Services contract award: September 2012
- Data Comm Network Services award (contract modification to DCIS): July 2013
- TDLS Critical Design Review: July 2013
- ERAM Initial Test Release: April 2014
- Operational Test (OT&E): March 2015
- First-Site Initial Operational Capability (IOC): August 2015
- Operational Readiness Decision (ORD): September 2015
- In-Service Decision (ISD): December 2015

<u>Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):</u>
S1P2 will leverage the S1P1 infrastructure to deliver both initial and full 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.

The FID for S1P2 Initial En Route Services was achieved in October 2014. In March of 2015 Data Comm achieved ERAM Contract Definitization, which is an APB milestone.

<u>Data Communications – Segment 1 Phase 2 Full En Route Services (G01C.01-10):</u>
S1P2 Full En Route Services will extend the service offerings in En Route domain to include more complex services including full controller initiated reroutes, full direct-to-fix messages, and full crossing restrictions.

The major element of the S1P2 Full En Route Services implementation is:
- ERAM software enhancements for En Route CPDLC applications.

The FID for S1P2 Full En Route Services is planned for FY 2016.

<u>Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):</u>
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.

<u>Data Communications – ATN Gateway (G01C.01-08):</u>
Initial Data Comm services will be delivered to FANS 1/A compliant avionics and ground system. FANS 1/A is currently certified and many airlines have FANS 1/A equipped aircraft. An ATN compliant ground system will be implemented to support ATN avionics. The ATN ground system will mirror the FANS ground system, to include

addition of an ATN Protocol Gateway and Ground Data Processor. This additional hardware and software will allow the Data Comm system to support both FANS and ATN equipped aircraft. The addition of ATN will support the implementation of more advanced NextGen services such as advanced Trajectory Based Operations (TBO), advanced Flight Interval Management (FIM), Optimized Profile Descents (OPD), and dynamic Required Navigation Performance (RNP). This will also provide the infrastructure to support advanced capabilities and additional research and development in the Data Comm Segment 2 timeframe. To support the Data Comm ATN implementation, RTCA Special Committee 214 (SC-214) standards work must be completed. These standards are expected to be completed and coordinated in 2016.

The FID for ATN Gateway is planned for FY 2020.

Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application (G01C.01-09):
The addition of more advanced NextGen services in Segment 2 will require that Baseline 2 avionics are installed in aircraft. The Baseline 2 applications will make use of the more capable ATN avionics to support the development of advanced services such as TBO, advanced FIM, OPD, and dynamic RNP. This program will provide enhancements to En Route and Terminal ground automation systems software to support message exchange with these advanced avionics.

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 57,975, 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 air traffic control communications workload which will reduce air traffic delay and increase efficiency through an increase in controller flexibility. Data Communications will allow complex routing communications that make better 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 TBO, OPDs, Advanced FIM, Enhanced Surface Movement, and Dynamic RNP. Data Communication will also reduce operational errors, enhancing the safety and efficiency of the NAS.

Program Plans FY 2017 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):
- Complete deployment of DCL services to 12 airports (18 of 56, 32%).

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):
- Contractor detailed design complete. (APB Milestone)

Data Communications – Segment 1 Phase 2 Full En Route Services (G01C.01-10):
- Complete high level requirements and design.

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):
- None.

Data Communications – ATN Gateway (G01C.01-08):
- None.

Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application (G01C.01-09):
- None.

Program Plans FY 2018 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- Complete deployment of DCL services to 20 airports (38 of 56, 68%).

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.
- Order DCNS service volume for S1P2 Initial En Route service key site. (APB Milestone) (This activity is required to expand the air-ground comm network to provide En Route services.)

Data Communications – Segment 1 Phase 2 Full En Route Services (G01C.01-10):

- Complete Engineering Design Reviews.

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 – ATN Gateway (G01C.01-08):

- None.

Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application (G01C.01-09):

- None.

Program Plans FY 2019 – Performance Output Goals

Data Communications – Segment 1 Phase 1 (G01C.01-05):

- Complete deployment of DCL Services to 18 airports (56 of 56, 100%).
- Achieve last site IOC for Tower Services. (APB milestone)

Data Communications – Segment 1 Phase 2 Initial En Route Services (G01C.01-06):

- Complete Operational Evaluation.
- Achieve IOC for En Route Services. (APB Milestone)

Data Communications – Segment 1 Phase 2 Full En Route Services (G01C.01-10):

- Complete detailed design.

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 – ATN Gateway (G01C.01-08):

- Complete draft requirements document for ATN Gateway and FANS/ATN dual stack.

Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application (G01C.01-09):

- 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 En Route Services. (APB Milestone)

Data Communications – Segment 1 Phase 2 Full En Route Services (G01C.01-10):

- Complete software development.

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 – ATN Gateway (G01C.01-08):

- Complete applications analysis for high level requirements.
- Achieve the FID for ATN Gateway.

Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application (G01C.01-09):

- 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 Initial Operational Capability. (APB milestone)

Data Communications – Segment 1 Phase 2 Full En Route Services (G01C.01-10):

- Complete development test and evaluation.

Data Communications – S1P1 and S1P2 Data Comm Integrated Services (DCIS) Network Services (G01C.01-07):

- Provide and maintain air-ground VDL-2 network services.

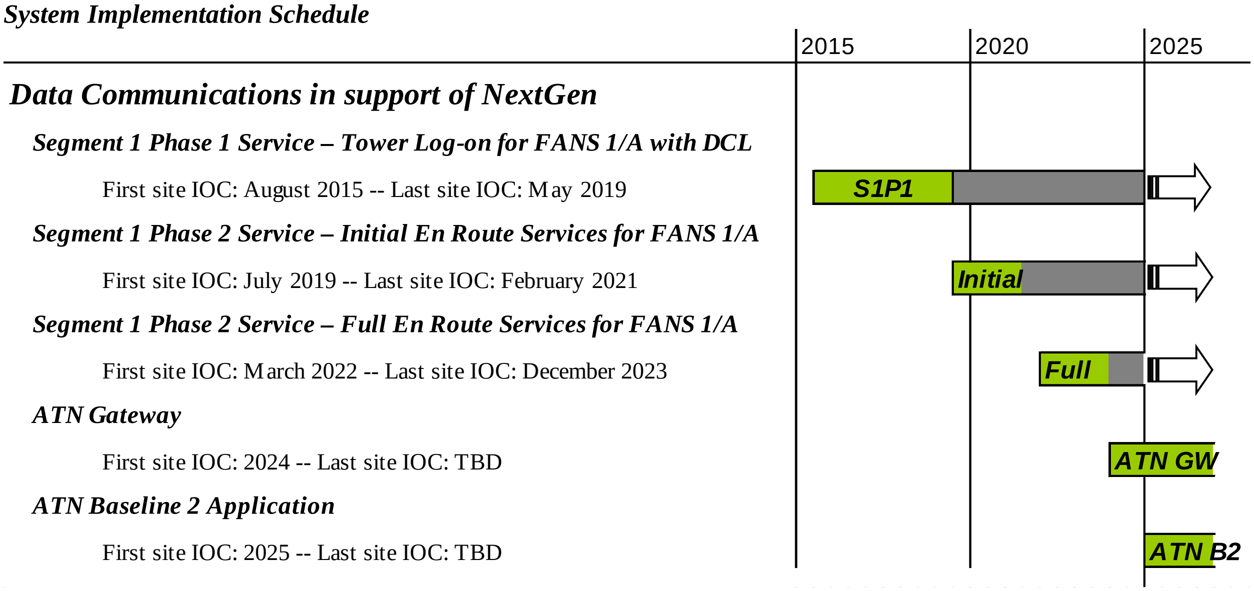
Data Communications – ATN Gateway (G01C.01-08):

- Finalize detailed requirement document for ATN Gateway.

Data Communications – Aeronautical Telecommunications Network (ATN) Baseline 2 Application (G01C.01-09):

- Develop system requirements document for Baseline 2 applications.

System Implementation Schedule



2A20, OFFSHORE AUTOMATION

FY 2017 Request $3.0M

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. Specifically, 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 possible 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 are neither CONUS (Terminal, domestic En Route) or Oceanic (ATOP) sites. These are known as the offshore sites and consist of Anchorage Air Route Traffic Control Center (ARTCC) (ZAN), Honolulu Control Facility (HCF), Guam Combined En Route/Radar Approach Facility (CERAP) (ZUA), and San Juan CERAP (ZSU). These facilities all use the same Radar Data Processor (RDP) and Microprocessor En Route Automated Radar Tracking System (Micro-EARTS); the Flight Data Processors (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. The server hardware at this ARTCC is obsolete and parts of this system are no longer covered by a maintenance contract.

The Offshore Flight Data Processing System (OFDPS) at Honolulu is a Host-based FDP 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 obsolete connectivity requirements of OFDPS. Once this new mainframe reaches end of life, a replacement system for the entire OFDPS will be required. The ERAM program has successfully replaced all of the Host-based systems at CONUS ARTCCs and the OFDPS program will now have to cover the cost of maintaining the non-standard FDP system at Honolulu. In addition, the Job Shop system at the Technical Center, which had been providing support for the entire HOST effort as part of the second-level engineering organization, will also have to be paid for by the OFDPS alone; further increasing the support costs for this system.

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 cut 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 an inconvenient and a safety sensitive situation. Due to shared hardware, the same end of life and sustainment issues affecting the OFDPS system in Hawaii also affects Guam.

The San Juan facility has an FDIO-feed from the ERAM system at Miami ARTCC using special software called the "San Juan Patch." As a result, San Juan is dependent on Miami Center to make any airspace or sector changes which can often result in delays. Due to the limitations of the patch and foreign airspace between Miami and San Juan, flight information for incoming flights often does not get to San Juan controllers before the aircraft enters San Juan airspace. In addition, there is limited functionality between the Micro-EARTS and the ERAM system at Miami. Data sharing is only minimally supported between the two systems or, in some cases, requires making duplicate entries in both the Micro-EARTS and the ERAM FDIO equipment.

These diverse automation systems are becoming increasingly expensive to maintain, and have end-of-life sustainability issues which may have efficiency and safety implications due to loss of coverage (i.e. Guam and San Juan), and will be difficult to upgrade to meet NextGen required capabilities.

Alternatives are being evaluated to address the automation systems at these four offshore locations. An Initial Investment Decision is planned in FY 2016 and Final Investment Decision (FID) 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 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 aging legacy systems with modern NAS automation; significantly reducing the potential for system outages. This investment will also resolve the ongoing maintenance and supportability limitations at the offshore sites and improve overall system availability and reliability.

Program Plans FY 2017 – 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 (ISPD); and
    - Acquisition Program Baseline (Execution Plan).
- Achieve FID.

Program Plans FY 2018-2019 – Performance Output Goals

- Output goals will be developed at FID.

Program Plans FY 2020-2021 – Performance Output Goals

- None.

B: Terminal Programs

2B01, Airport Surface Detection Equipment - Model X (ASDE-X)

FY 2017 Request $8.4M

Airport Surface Detection Equipment - Model X (ASDE-X) – Technology Refresh & Disposition, S09.01-01

Program Description

The ASDE-X Technology Refresh program provides for the replacement and upgrade of hardware and software to ensure the continued operation of the surface surveillance system through its designated lifecycle. The ASDE-X program baseline included costs for the periodic replacement of Commercial Off-The-Shelf (COTS) system components; e.g., processors, displays, computer operating systems and Commercially Available Software (CAS).

Deployment of the 35 planned ASDE-X systems was completed in FY 2011. The first ASDE-X system was delivered in 2002. Some of the equipment has reached the end of its service life and is no longer supportable without a technology refresh of the ASDE-X system.

The ASDE-X team completed a study in FY 2012 to determine the equipment and software that needs to be upgraded, updated, or replaced as part of the ASDE-X Technology Refresh effort.

The following three technology refresh projects were approved:

- Obsolescence/Spare Parts Procurement will increase the depot stock of components that are projected to be depleted from the ASDE-X depot prior to the end of the ASDE-X lifecycle;
- ASDE-X Processor Replacement replaces the obsolete ASDE-X processors with Linux based processors running applications updated via the Airport Surface Surveillance Capability (ASSC) Program; and
- The Universal Access Transceiver Receiver (UATR) Upgrade modifies the existing UATR in each remote unit to the updated UATR2 to address existing UATR performance shortfalls. The UATR Upgrade also supports the projected increase in ADS-B message traffic over the ASDE-X lifecycle.

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 0.395 per million operations, and maintain or improve through FY 2018.*

Relationship to Performance Metric

ASDE-X enables air traffic controllers to track surface movement of aircraft and vehicles. It was developed to aid in preventing surface collisions and in reducing critical Category A and B runway incursions. ASDE-X provides air traffic controllers with a visual representation of the traffic situation on the airport movement area and arrival corridors. It improves the ability of controllers to maintain awareness of the operational environment and to anticipate contingencies that could result in potential runway incursions. ASDE-X Safety Logic enhances the situational awareness for air traffic controllers. It uses 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 safety logic predicts a collision.

The ASDE-X Technology Refresh Program will ensure the continued operation of ASDE-X systems through its designated lifecycle. Completing the technology refresh effort will help keep the number of Category A&B runway incursions at the reduced levels attained during ASDE-X system deployment. Since the program inception in FY 2004, the cumulative number of Category A&B runway incursions at the 35 ASDE-X airports was projected to be 77 out through FY 2011 (baseline). This number of runway incursions is a cumulative number over 8 years from FY 2004 through FY 2011. The target was to reduce the cumulative number of Category A&B runway incursions to 59.18 and the actual number determined through FY 2011 was 42. This downward trend of Category A & B runway incursions has continued and for the eight years from FY 2007 through FY 2014, there were 37 A & B incursions.

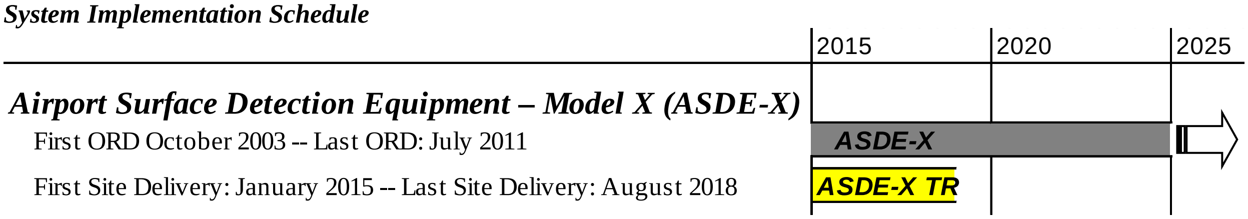
Also, the Runway Status Lights (RWSL) system requires ASDE-X data to function. The RWSL benefits are not achievable without a reliable and available ASDE-X system.

Program Plans FY 2017 – Performance Output Goals
- Complete installation of the ASDE-X Technology Refresh processor solution at 10 of the 35 airports, 66 % complete.
- UATR certify for operational use 50% complete.

Program Plans FY 2018 – Performance Output Goals
- Complete installation of the ASDE-X Technology Refresh processor solution at the remaining 12 airports, 100% complete. (Prior year funds)
- Complete last site certified for operational use (100% complete). (Prior year funds)

Program Plans FY 2019-2021 – Performance Output Goals
- None.

System Implementation Schedule



2B02, Terminal Doppler Weather Radar (TDWR) – Provide

FY 2017 Request $5.0M

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 (MMAC) 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.

Final Investment Decision was approved by the Joint Resources Council (JRC) 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'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 2017 – Performance Output Goals

- Complete the Procurement of 100 Circuit Card Assemblies (100%).
- Complete the Grounding System Refurbishment at 15 sites (15 of 47, 32%).

Program Plans FY 2018 – Performance Output Goals

- Complete the Ground System Refurbishment at 16 sites (31 of 47, 66%).

Program Plans FY 2019 – Performance Output Goals

- Complete the Grounding System Refurbishment at 16 sites (47 of 47, 100%).
- Complete the First Article Testing for the Wind Shear Ribbon Display, Direct Digital Controller and Antenna Controller.
- Complete installation of the Direct Digital Controller at 15 sites (15 of 47, 32%)
- Replenish 100 Wind Shear Ribbon Displays at Depot (100 of 600, 17%).

Program Plans FY 2020 – Performance Output Goals

- Replenish 200 Wind Shear Ribbon Displays at Depot (300 of 600, 50%).
- Installation of the Direct Digital Controller at 16 sites (31 of 47, 66%).
- Installation of the Antenna Controller at 16 sites (16 of 47, 34%).
- Complete the First Article Testing for the Transmitter Microwave Assembly.

Program Plans FY 2021 – Performance Output Goals

- Replenish 300 Wind Shear Ribbon Displays at Depot (600 of 600, 100%).
- Complete the Direct Digital Controller installations at 16 sites (47 of 47, 100%).
- Complete installation of the Antenna Controller at 22 sites (26 of 47, 55%).
- Complete installation of the Transmitter Microwave Assembly at 15 sites (28 of 47, 60%).

2B03, STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM (STARS) (TAMR PHASE 1)

FY 2017 Request $64.2M

Standard Terminal Automation Replacement System (STARS) – Technology Refresh (TAMR Phase 1), A04.01-01 / X, Standard Terminal Automation Replacement System (STARS) – Infrastructure Modernization Program, A04.01-03

Program Description

The STARS program is a joint Department of Defense and Department of Transportation (DOT) 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.

STARS – Technology Refresh (TAMR Phase 1) (A04.01-01):
TAMR Phase 1 is the Technology Refreshment of the STARS automated radar processing and display systems at 47 TRACONs and their associated ATCTs. The technology refresh provides hardware updates including new high-resolution Liquid Crystal Display (LCD) color displays, processors, storage devices and enhanced memory. The program also provides a software update with the hardware technology refresh to support NextGen initiatives and to maintain, correct, or improve system performance, efficiency, safety, and security vulnerabilities.

STARS – Infrastructure Modernization Program (A04.01-03):
The STARS Infrastructure Modernization Program will provide engineering that will enable the FAA to replace key elements of STARS that have reached their end of life (EOL) and/or that are no longer compatible with current commercial offerings. Two significant engineering activities include engineering required to upgrade the present Solaris Operating System, which reaches end of life in FY 2018 and end of vendor support in FY 2021, and engineering required to support transition from the present time division multiplex (TDM) protocol to Internet Protocol (IP).

A return to the JRC in FY 2017 with requested funding for these activities was an action item from the August 2015 Baseline Change Decision (BCD) conducted for TAMR P3S1.

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 (COTS) components that have a life expectancy of 10 to 15 years. Current STARS equipment has been in the NAS since 1999 and is in need of equipment upgrades.

Program Plans FY 2017 – Performance Output Goals

STARS – Technology Refresh (TAMR Phase 1) (A04.01-01):

- Procure hardware for upgrades from G1 to G4 configuration at 11 operational sites.
- Complete IOC at 15 sites (22 of 47 sites, 47 %).
- Implement mandatory software security and safety enhancements, new functionality and upgrades needed for enhanced performance and capacity in support of NextGen initiatives.

STARS – Infrastructure Modernization Program (A04.01-03):

- None.

Program Plans FY 2018 – Performance Output Goals

STARS – Technology Refresh (TAMR Phase 1) (A04.01-01):

- 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 IOC at 10 sites (32 of 47 sites, 68%).
- Complete IOC at 26th site. (APB milestone)

STARS – Infrastructure Modernization Program (A04.01-03):

- Complete identification of "Gaps" between standards on existing Prime contract and the FY18 FAA standards for FAA-G-2100 and FAA-STD-019.
- Complete engineering plans for transition of STARS OS from Solaris to Red Hat Linux (RHL).
- Finalize requirements for transition of TRACON - ATCT communications conversion to Virtual Local Area Network (VLAN) to provide the network segmentation services traditionally provided only by routers in LAN configurations.
- Complete engineering design for STARS Lightweight Data Access Protocol (LDAP), a set of protocols for accessing information directories.
- Finalize requirements for X4000 Processor/Digital Recording Device for continuous data recording.
- Finalize requirements for new STARS Trackball.

Program Plans FY 2019 – Performance Output Goals

STARS – Technology Refresh (TAMR Phase 1) (A04.01-01):

- Complete IOC at 9 sites (41 of 47 sites, 87%).
- Complete IOC at 39th site. (APB milestone)

STARS – Infrastructure Modernization Program (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.
- Complete STARS engineering change proposals for transition of TRACON - ATCT communications conversion to VLAN.
- Complete testing of STARS LDAP at Key Site.
- Deploy new STARS Trackballs to Sites 1-5.
- Deploy STARS to Sites 1 and 2 (Technology Refresh of G1/G2 systems).

Program Plans FY 2020 – Performance Output Goals

STARS – Technology Refresh (TAMR Phase 1) (A04.01-01):

- Complete IOC at 6 sites (47 of 47, 100%). (Prior year funds)
- Complete IOC at last site. (APB milestone) (Prior year funds)

STARS – Infrastructure Modernization Program (A04.01-03):

- Deploy new STARS Trackballs to Sites 6 – 10.
- Deploy STARS to Sites 3, 4, and 5 (Technology Refresh of G1/G2 systems).

Program Plans FY 2021 – Performance Output Goals

STARS – Technology Refresh (TAMR Phase 1) (A04.01-01):

- None.

STARS – Infrastructure Modernization Program (A04.01-03):

- Output goals will be established at FID.

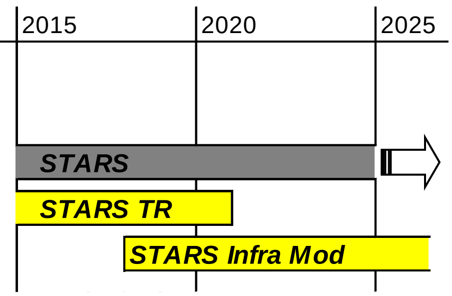
System Implementation Schedule

Standard Terminal Automation Replacement System (STARS)

First site IOC: October 2002 -- Last site IOC: September 2007

STARS Technology Refresh: 2012 -- 2020

STARS Infrastructure Modernization Program: 2018 -- TBD



2B04, Terminal Automation Modernization/ Replacement Program (TAMR Phase 3)

FY 2017 Request $108.9M

- A, Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 1, A04.07-01
- B, Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 2, A04.07-02
- C, Terminal Automation Modernization – Replacement (TAMR) – Post Operational Readiness Demonstration (ORD) Enhancements, A04.07-04

A, Terminal Automation Modernization – Replacement (TAMR) – Phase 3, Segment 1, A04.07-01

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 Standard Terminal Automation Replacement System (STARS) to 47 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.

On April 21, 2010 the JRC divided the TAMR Phase 3 program into a short term and long term segment to better address planning objectives. TAMR Phase 3 Segment 1 program will address infrastructure improvements essential for the adoption of Automatic Dependent Surveillance-Broadcast (ADS-B) at 11 Common Automated Radar Terminal (CARTS) IIIE sites. TAMR Phase 3 Segment 2 will address the remaining 97 Automated Radar Terminal System (ARTS) sites. On December 21, 2011, the JRC approved the Final Investment Decision for Segment 1.

TAMR Phase 3 Segment 1 will replace 11 existing CARTS IIIE facilities with STARS hardware and software components. In particular, TAMR Phase 3 Segment 1 will:

- Replace the IIIE facility with STARS at Dallas (D10) (completed in 2014).
- Replace remaining 10 IIIE facilities with STARS by 2017 to complete the convergence of the IIIE's to a single Terminal Automation hardware and software baseline (Northern California (NCT), Atlanta (A80), Southern California TRACON (SCT), Potomac TRACON (PCT), Louisville (SDF), Denver (D01), Minneapolis (M98), St Louis (T75), Chicago (C90) and New York (N90)).

TAMR Phase 3 Segment 1 supports ADS-B requirements and continues FAA's original plan for terminal convergence into a single automation platform. Once completed, convergence of terminal automation will streamline the need to sustain CARTS and also eliminate redundant software development activities.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Improvements to the NAS can reduce flight delays and increase system efficiency. The TAMR Phase 3 Segment 1 program modernizes the 11 IIIE facilities in alignment with near-term NextGen requirements including support for ADS-B.

Program Plans FY 2017 – Performance Output Goals

- Complete IOC at last site (11th site IOC: APB date, October 2016).
- Achieve continuous operations and ORD at 7th-10th sites.

Program Plans FY 2018 – Performance Output Goals

- Complete ORD at last site (11th site ORD: APB milestone October 2017). (Prior year funding)

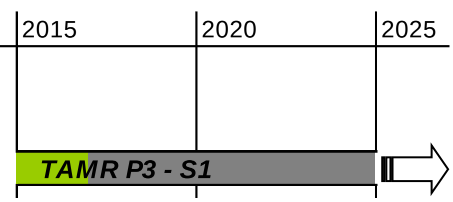
Program Plans FY 2019-2021 – Performance Output Goals

- None.

System Implementation Schedule

Terminal Automation Modernization/Replacement (TAMR) Phase 3 - Segment 1

First site IOC: October 2012 -- Last site IOC: October 2016



- Final Investment Decision for Segment 1 – December 2011.

B, 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 Standard Terminal Automation Replacement System (STARS) to 47 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 Local Integrated Tower Equipment (LITE) 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.

TAMR Phase 3 Segment 2 supports ADS-B requirements and continues FAA's original plan for terminal convergence into a single automation platform. Once completed, convergence of terminal automation will eliminate the need to sustain Common Automated Radar Terminal System (CARTS) and 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 57,975, 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 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 system capacity.

Program Plans FY 2017 – Performance Output Goals
- Procure 12 ELITE operational systems.
- Deliver 34 additional operational systems.
- Complete IOC at 34th ARTS IIE site. (APB milestone)
- Achieve IOC at 35 sites (71 of 97, 73%).

Program Plans FY 2018 – Performance Output Goals
- Procure 4 ELITE operational systems.
- Procure 6 LITE systems (4 operational and 2 support).
- Deliver 12 additional systems (11 operational and 1 support).
- Complete IOC at 65th ARTS IIE site. (APB milestone)
- Achieve IOC at 18 sites (89 of 97, 91%).

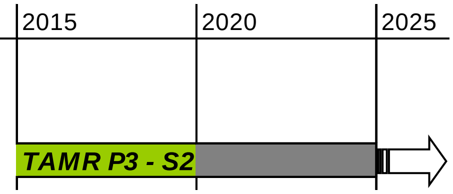
Program Plans FY 2019 – Performance Output Goal
- Deliver 4 additional operational systems. (Prior year funds)
- Achieve IOC at 8 sites (97 of 97, 100%). (Prior year funds)
- Complete IOC at last site, 91st (ARTS IIE). (APB Milestone) (Prior year funds)
- Complete ORD at last site (ARTS IIE). (APB Milestone) (Prior year funds)
- Complete ORD at last site (ARTS IE). (APB Milestone) (Prior year funds)

Program Plans FY 2020-2021 – Performance Output Goal
- None.

System Implementation Schedule

Terminal Automation Modernization/Replacement (TAMR) Phase 3 - Segment 2

First site IOC: August 2014 -- Last site IOC: August 2019



C, Terminal Automation Modernization – Replacement (TAMR) – Post Operational Readiness Demonstration (ORD) Enhancements, A04.07-04

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 Standard Terminal Automation Replacement System (STARS) to 47 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.

On April 21, 2010 the JRC divided the TAMR Phase 3 program into a short term and long term segment to better address planning objectives. TAMR Phase 3 Segment 1 program will address infrastructure improvements essential for the adoption of Automatic Dependent Surveillance-Broadcast (ADS-B) at 11 Common Automated Radar Terminal (CARTS) IIIE sites. TAMR Phase 3 Segment 2 will address the remaining 97 Automated Radar Terminal System (ARTS) sites. On December 21, 2011, the JRC approved the Final Investment Decision for Segment 1.

The TAMR Post ORD Enhancements Variable Quantity (VQ) Program consists of both hardware and software additions to STARS deployed to replace existing STARS and ARTS IE, IIE, and IIIE systems. The hardware includes additions of small quantities of items that are already part of the STARS Baseline that have been requested by sites via the Needs Assessment Program (NAP) and approved by the FAA Mission Support Organization, AJV. The software capabilities are those requested by Phase 3 sites to provide capabilities existing in ARTS at the time of transition to STARS. They represent no new capabilities to the NAS, but may be new capabilities to STARS, or may be perfective and/or corrective changes to existing STARS functionality. As requests are identified, validated, prioritized, and approved for implementation, the TAMR Program Office will use existing, mature processes for the engineering, design, development, testing, integration and delivery of these hardware and software additions to Phase 1 and Phase 3 sites. The VQ program was approved at JRC in August 2015.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

As TAMR Programs have deployed STARS to replace ARTS IE, IIE, and IIIE systems, users have identified gaps in STARS capabilities – namely, instances where the predecessor ARTS provided a capability that is either implemented differently than in STARS, or not implemented at all. The TAMR Post ORD Enhancements Program will meet the need of users, to fill the "gaps" between ARTS and STARS capabilities.

Program Plans FY 2017 – Performance Output Goals

- Complete development of the first release of enhancements.
- Begin test and delivery of the first release of enhancements.
- Begin system engineering of the second release of enhancements.

Program Plans FY 2018 – Performance Output Goals

- Begin development of second release of enhancements.

Program Plans FY 2019 – Performance Output Goals

- Complete development of the second release of enhancements. (Prior year funding)
- Begin test and delivery of the second release of enhancements. (Prior year funding)

Program Plans FY 2020-2021 – Performance Output Goals

- None.

2B05, TERMINAL AUTOMATION PROGRAM

FY 2017 Request $7.7M

- A, Flight Data Input/Output (FDIO) Replacement, A01.11-01
- B, Terminal Work Package 1, A04.08-01

A, Flight Data Input/Output (FDIO) Replacement, A01.11-01

Program Description

The FDIO system provides standardized flight plan data, weather information, safety related data, and other information to air traffic controllers at more than 650 Terminal NAS facilities. The FDIO system is mainly comprised of computers, servers, monitors, keyboards, printers, and circuit cards that are commercially available. The FDIO system collects data from the En Route Automation Modernization (ERAM) system and provides flight data information to NAS Terminal facilities. The FDIO system prints this information on paper strips for controllers at FAA Terminal Radar Approach Control (TRACON), Air Traffic Control Tower (ATCT), and Radar Approach Control (RAPCON) facilities. This information assists controllers both in tracking aircraft and anticipating the arrival of aircraft in the sector under their control. The FDIO system also receives data from the TRACON, ATCT, and RAPCON facilities and relays this data back to ERAM.

The FDIO Replacement 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 5 year replacement cycle for the various components to maintain system operational availability and will also provide a common Internet Protocol infrastructure to support future ERAM and System Wide Information Management (SWIM) architectures.

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.*

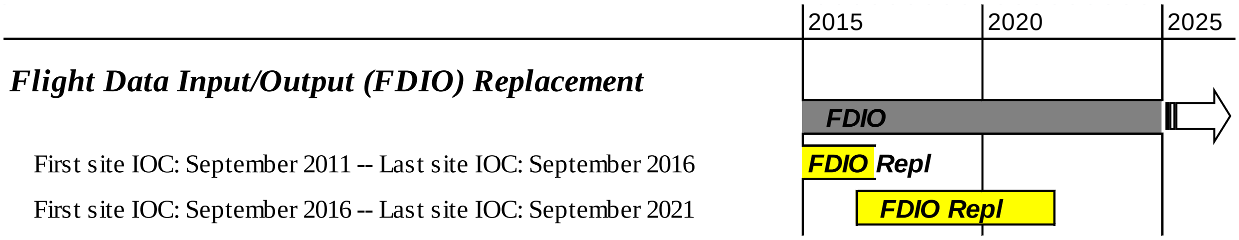
Relationship to Performance Metric

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 and reportable facilities.

Program Plans FY 2017-2021 – Performance Output Goals

- Procure and field replacement FDIO system components (terminal server, keyboard, printer and monitor) at approximately 100 FAA and DoD ATC facilities.

System Implementation Schedule



B, Terminal Work Package 1, A04.08-01

Program Description

Building upon previous investments, Terminal Work Package 1 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.

Terminal Work Package 1 is the first of multiple work packages that contribute to TRACON evolution. The program will refine proposed concepts and validate them as viable additions to the NAS to support NextGen goals. Concept engineering activities include analysis, evaluation, and assessments to develop and mature concepts for changes to TRACON automation as well as identifying the associated procedure changes.

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 Terminal Work Package 1 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

The Terminal Work Package 1 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 (PBN) procedures and aircraft capabilities, support Trajectory Based Operations (TBO), and provide support for other NextGen concepts.

Program Plans FY 2017 – 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.

Program Plans FY 2018-2021 – Performance Output Goals

- Milestones will be developed at FID.

2B06, TERMINAL AIR TRAFFIC CONTROL FACILITIES - REPLACE

FY 2017 Request $58.8M

Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Replacement, F01.02-00

Program Description

The 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 replaces some of these buildings to meet current and future operational requirements. The average age of control towers is approximately 30 years, and some towers are 60 years old. As the volume and complexity of terminal air traffic control increases, so does the need to have additional positions in the ATCT/TRACON facilities. Control towers built more than 20 years ago often do not have the space to meet today's operational requirements. In addition, some terminal facilities must be upgraded to conform to current building codes and design standards. This program is included in the ATC Facilities Sustainment Strategic Plan.

Tower and TRACON replacements are large capital investments and, given constrained resources, the FAA is focusing on risk-based analysis to ensure those facilities in greatest need are replaced first. Each year, the FAA will conduct analysis on facilities within its inventory of Tower and TRACONs 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. A project typically spans a period of 5-10 years from inception to completion depending on the size of the project. Each segment of a project is fully funded in the year requested but it may take more than one year to complete that segment.

At this time, the FAA is committed to completing a facility replacement for the New York TRACON (N90). The facility's FY 2014 condition index was at 87.9 percent, characterized as poor condition, with $5.12M of deferred maintenance costs. Due to its condition, the building structure and systems are vulnerable to failure, which could cause air traffic control outages. The FAA is still in the early stages of re-planning this investment, but the outyear funding tentatively supports the current schedule and assumes that the N90 replacement will cost less than an integrated 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 Terminal Air Traffic Control Facilities program contributes to the FAA Strategic Priority of Deliver 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 2017 – Performance Output Goals

- Complete Land Acquisition for one site (Teterboro, NJ (TEB)).
- Initiate Design activities for two sites (Teterboro, NJ (TEB) and New York, NY (N90)).
- Purchase and Installation of long lead equipment for one site (Charlotte, NC (CLT)).

Program Plans FY 2018 – Performance Output Goals

- Award a design contract for three sites (Baltimore, MD (BWI), Tulsa-Riverside, OK (RVS), and Charleston, SC (CHS)).
- Award construction contracts for three sites (Teterboro, NJ (TEB), Peoria, IL (PIA), and Greensboro, NC (GSO)).
- Complete equipment procurement and / or installation at one site (Charlotte, NC (CLT)).

Program Plans FY 2019 – Performance Output Goals

- Award a design contract for three sites.
- Award two construction contracts.
- Purchase and installation of long lead equipment for one site.
- Complete Disposition at one site.

Program Plans FY 2020 – Performance Output Goals

- Award a design contract for three sites.
- Award a construction contract for one site.
- Complete equipment procurement and / or installation at four sites.

Program Plans FY 2021 – Performance Output Goals

- Award a design contract for one site.
- Award construction contracts for two sites.
- Complete equipment procurement and / or installation at five sites.

2B07, ATCT/TERMINAL RADAR APPROACH CONTROL (TRACON) FACILITIES - IMPROVE
FY 2017 Request $47.7M

- A, Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization, F01.01-00
- B, Facility Realignment Planning, F02.10-01 / X, Facility Realignment Implementation, F02.10-02

A, Air Traffic Control Tower (ATCT)/Terminal Radar Approach Control (TRACON) Modernization, F01.01-00

Program Description

The 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 such as:

- Waterproofing – Replace/ Renovate building envelop components (e.g., siding, roof, windows, major sealants, parapets, etc.);
- HVAC and Electrical/Mechanical – Replace/Repair HVAC (e.g., replace handling units, condensing units, controls, pumps, boilers, chillers, and roof top units);
- Electrical/Mechanical – (e.g., replacement/repair of electrical power cable, branch circuits and distribution wiring, light fixtures, outlets, etc.);
- Elevators – Replacement/Major refurbishment of elevators;
- Plumbing – Replacement/Repair of facility plumbing system and components;
- Specialties in Operations Areas – Major Replacement/Repair of Tower Cab or TRACON consoles, major renovation of interior spaces, reconfiguration of operational areas;
- Exterior (Civil Components) – Establishment of new access road/parking, major replacement of access road/parking lot, refurbishment of facility grounds, replacement of curbs, walkways, step, railing, etc.; and
- Interior Finishes – Replacement/Repair 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 bring the facilities up to a level to withstand a seismic event by complying with the Interagency Committee on Seismic Safety in Construction standards and the "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 will enable facilities to meet current operational, environmental, seismic, and safety needs more economically than replacing or relocating the entire facility. This effort will result in a smooth and orderly transition of new equipment into FAA terminal facilities, minimizing disruption of the operating system. This program will improve the operational efficiency and environmental systems of obsolete and deteriorated ATCT/TRACON facilities. The 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 would delay air traffic. Facility Condition Index (FCI) values are based on independent facility assessments or extrapolations. The FAA utilizes the FCI to gain insight into the physical plant condition of our facilities and to help us prioritize facility sustainment, modernize and replacement efforts. In FY 2014, FCI ranged from 81 percent to 100 percent for FAA maintained towers and TRACONs.

Program Plans FY 2017-2021 – Performance Output Goals

- Conduct up to 18 planning activities annually (e.g. Life Cycle Assessments, Condition Assessments, etc.) to determine requirements.
- Initiate an average of 50 Improvement projects per year.
- Complete on average 50 Improvement projects per year that were initiated in previous years.

B, Facility Realignment Planning, F02.10-01 / X, Facility Realignment Implementation, F02.10-02

Program Description

These 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):
The 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 Facility Realignment Planning program operates collaboratively with the Air Traffic Organization (ATO), Federal Aviation Administration (FAA), and labor leadership to draft the National Facilities Realignment and Consolidation reports with the facility realignment recommendations, publish the reports in the Federal Register, and submit the reports and public comments to Congress for review.

Facility Realignment Implementation (F02.10-02):
The Facility Realignment Implementation program manages and executes the implementation of facilities and service realignment recommendations by conducting transition planning, and coordinating with ATO and 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

Facility realignments are expected to deliver cost savings, cost avoidance, and operational efficiencies upon implementation and continue to accrue 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 2017 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- Develop and present preliminary findings of FY 2017 analysis to ATO and FAA leadership.
- Prepare report containing the FY 2017 recommendations of the Administrator on realignment and consolidation of facilities and services with public comments as appropriate.

Facility Realignment Implementation (F02.10-02):

- None.

Program Plans FY 2018 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- Develop and present preliminary findings of FY 2018 analysis to ATO and FAA leadership.
- Prepare report containing the FY 2018 recommendations of the Administrator on realignment and consolidation of facilities and services with public comments as appropriate.

Facility Realignment Implementation (F02.10-02):

- None.

Program Plans FY 2019 – Performance Output Goals

Facility Realignment Planning (F02.10-01):

- Develop and present preliminary findings of FY 2019 analysis to ATO and FAA leadership.
- Prepare report containing the FY 2019 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 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.

2B08, TERMINAL VOICE SWITCH REPLACEMENT (TVSR)

FY 2017 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 air traffic control (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 continue to 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 model IIA, Voice Switch Bypass System, and Interim Voice Switch Replacement. 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 replacing aging electronic switches with modern digital equipment to improve system reliability of terminal voice communications; reducing outages and preventing delays.

Program Plans FY 2017 – Performance Output Goals
- Deliver 1 terminal voice switch to Dallas Fort Worth, TX (DFW).
- Recover, refurbish, and / or cannibalize all associated legacy systems for spare parts.

Program Plans FY 2018 – Performance Output Goals
- Deliver approximately 5 terminal voice switches to various FAA facilities.
- Recover, refurbish, and / or cannibalize all associated legacy systems for spare parts.

Program Plans FY 2019 – Performance Output Goals
- Deliver approximately 5 terminal voice switches to various FAA facilities.
- Recover, refurbish, and / or cannibalize all associated legacy systems for spare parts.

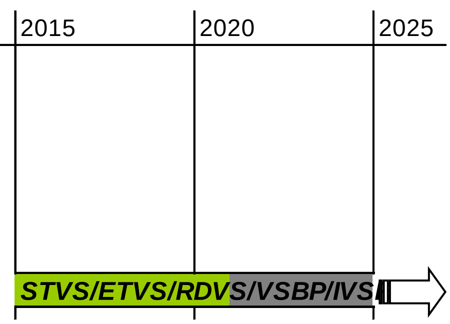
Program Plans FY 2020 – Performance Output Goals
- Deliver approximately 8 terminal voice switches to various FAA facilities.
- Recover, refurbish, and / or cannibalize all associated legacy systems for spare parts.

Program Plans FY 2021 – Performance Output Goals
- Deliver approximately 4 terminal voice switches to various FAA facilities.
- Recover, refurbish, and / or cannibalize all associated legacy systems for spare parts.

System Implementation Schedule

Small-Tower Voice Switches (STVS), Enhanced Terminal Voice Switches (ETVS), Rapid Deployment Voice Switches (RDVS) model IIA, Voice Switch Bypass Systems (VSBP), and Interim Voice Switch Replacement (IVSR).

First site IOC: 1994 (2006) -- Last site ORD: TBD



2B09, NAS FACILITIES OSHA AND ENVIRONMENTAL STANDARDS COMPLIANCE

FY 2017 Request $42.7M

NAS Facilities Occupational Safety and Health Administration (OSHA) & Environmental Standards Compliance, 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. The EOSH Program efforts ensure employee health and safety and environmental protection initiatives are founded upon and promote compliance with regulations, internal/external standards, and Collective Bargaining Agreements.

EOSH Program risk management 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 Goal 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. The EOSH Program risk management initiatives result in making the FAA a safer and more healthful place to work, enhancing employee morale and contributing to placing the FAA in the top 25 percent of best places to work in the federal government.

Program Plans FY 2017 – Performance Output Goals

- Fall Protection: Upgrade 280 of the 2500 total identified fall protection systems; total remaining 1720/2500.
- Fire Life Safety (FLS): Upgrade 5 of 369 Air Traffic Control Tower FLS Systems; total remaining 16/369.
- FLS: Develop list of Certificate of Occupancy (COO) for all FAA Control facilities; evaluate 20.
- Electrical Safety: Complete assessment of 100 of 457 NAS Facilities; total remaining 289/457.
- Environmental Compliance: Complete environmental compliance evaluations at 9 facilities; total remaining 1325/1334.

Program Plans FY 2018 – Performance Output Goals

- Fall Protection: Upgrade 280 of the 2500 total identified fall protection systems; total remaining 1440/2500.
- FLS: Upgrade 5 of 369 Air Traffic Control Tower FLS Systems; total remaining 11/369.
- FLS: Complete COO for 20 of 314 FAA control facilities; total remaining 294/314.
- Electrical Safety: Complete assessment of 10 of 457 NAS Facilities; total remaining 279/457.
- Environmental Compliance: Complete environmental compliance evaluations at 9 facilities; total remaining 1316/1334.

Program Plans FY 2019 – Performance Output Goals

- Fall Protection: Upgrade 280 of the 2500 total identified fall protection systems; total remaining 1160/2500.
- FLS: Baseline adjustment ATCT FLS upgrades (369) to Fire Protection Systems Technology Refresh list (250).
- FLS: Complete 10 of 250 Fire Protection System Technology Refreshes; total remaining 240/250.
- FLS: Complete COO for 30 of 314 FAA control facilities; total remaining 264/314.
- Electrical Safety: Complete assessment of 10 of 457 NAS Facilities; total remaining 269/457.
- Environmental Compliance: Complete environmental compliance evaluations at 9 facilities; total remaining 1307/1334.

Program Plans FY 2020 – Performance Output Goals

- Fall Protection: Upgrade 280 of the 2500 total identified fall protection systems; total remaining 880/2500.
- FLS: Complete 15 of 250 Fire Protection System Technology Refreshes; total remaining 210/250.
- FLS: Complete COO for 50 of 314 FAA control facilities; total remaining 214/314.
- Electrical Safety: Complete assessment of 10 of 457 NAS Facilities; total remaining 259/457.
- Hearing Conservation: Achieve 95% enrollment of identified employees with potential work area greater than 85 dBA.
- Environmental Compliance: Complete environmental compliance evaluations at 9 facilities; total remaining 1298/1334.

Program Plans FY 2021 – Performance Output Goals

- Fall Protection: Upgrade 280 of the 2500 total identified fall protection systems; total remaining 600/2500.
- FLS: Complete 15 of 250 Fire Protection System Technology Refreshes; total remaining 210/250.
- FLS: Complete COO for 50 of 314 FAA control facilities; total remaining 164/314.
- Electrical Safety: Complete assessment of 10 of 457 NAS Facilities; total remaining 249/457.
- Environmental Compliance: Complete environmental compliance evaluations at 9 facilities; total remaining 1289/1334.

2B10, AIRPORT SURVEILLANCE RADAR (ASR-9)

FY 2017 Request $4.5M

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 2025. 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, and Radar Data Access Point (RDAP), 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 it can be displayed on the controller’s screen. The ASR-9 also provides data to the Airport Movement Area Safety System (AMASS) and to the Airport Surface Detection Equipment – model X (ASDE-X) to aid in the prevention of accidents resulting from runway incursions. The sustainment of the ASR-9 aligns with the NAS Enterprise Architecture Surveillance Roadmap, and the Surveillance and Broadcast Services (SBS) / Automatic Dependent Surveillance Broadcast (ADS-B) backup strategy.

The SLEP Phase 2 Final Investment Decision (FID) was approved on June 27, 2012 to address obsolescence and supply/support issues of system Lowest Replaceable Units (LRUs) 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 99.3 percent, which does not meet the FAA Performance Metric. Also, the current operational availability of 99.34 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 2017 – Performance Output Goals

- Complete installation of DRSR units at 40 TRACONs (130 of 154, 84%).
- Complete installation of the Transmitter Backplanes in 66 ASR-9 systems (100 of 135, 74%).

Program Plans FY 2018 – Performance Output Goals

- Complete installation of DRSR units at 24 TRACONs (154 of 154, 100%).
- Complete installation of the Transmitter Backplanes in 35 ASR-9 systems (135 of 135, 100%).

Program Plans FY 2019 – Performance Output Goals

- Installation at last site completed, September 2019. (APB Milestone) (Prior year funding)

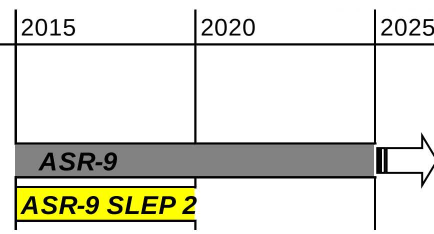
Program Plans FY 2020-2021 – Performance Output Goals

- None.

System Implementation Schedule

Airport Surveillance Radar-Model 9 (ASR-9) Service Life Extension Program (SLEP) Phase 2

First Site Install: 2015 -- Last Site Install: September 2019



2B11, TERMINAL DIGITAL RADAR (ASR-11) TECHNOLOGY REFRESH AND MOBILE AIRPORT SURVEILLANCE RADAR (MASR)

FY 2017 Request $6.1M

- A, 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
- B, Airport Surveillance Radar Model-11 (ASR-11) – Mobile Airport Surveillance Radar (MASR), S03.02-06

A, 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 (COTS) hardware and software to ensure the continued reliable and cost effective operation of the radar system through its designated lifecycle. This is an ongoing program to address obsolescence and maintenance issues and will be accomplished in sequential 5-year segments.

<u>ASR-11 Technology Refresh Segment 2 (S03.02-05):</u>
The ASR-11 Technology Refresh Segment 2 is structured to address the following shortfalls identified in the Segment 2 Shortfall Analysis Report:

- Site Control Data Interface (SCDI) /Operator Maintenance Terminal (OMT) obsolescence
- Uninterruptible Power Supply (UPS) capacitor at end of life expectancy

The objective of the Segment 2 program is to insure continued reliable and cost effective operation of the radar system through its designated lifecycle. The Segment 2 Investment Analysis Readiness Decision (IARD) was approved in November 2012 and the Final Investment Decision (FID) was achieved in December 2013.

<u>ASR-11 Technology Refresh Segment 3 (S03.02-07):</u>
The ASR-11 Technology Refresh Segment 3 will address parts obsolescence, operational performance deficiencies, or other areas requiring technology refresh to ensure continued reliable and cost effective operation of the radar system through its designated lifecycle. The Segment 3 IARD is planned for September 2019 and the FID is planned for September 2020. Future ASR-11 Technology Refreshes are dependent on decisions for Next Generation Surveillance and Weather Radar Capability (NSWRC), which has a planned FID in December 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

Currently ASR-11 systems are 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 resolve the problem of loss of operational availability when a repair or replacement is needed.

Program Plans FY 2017 – Performance Output Goals
<u>ASR-11 Technology Refresh Segment 2 (S03.02-05):</u>

- Complete Operational Test & Evaluation (OT&E). (APB milestone)
- Certify first site for operational use for SCDI replacement. (APB milestone)
- Achieve In-Service Decision. (APB milestone)
- Certify for operational use for SCDI replacement, 25% complete.

<u>ASR-11 Technology Refresh Segment 3 (S03.02-07):</u>

- None.

Program Plans FY 2018 – Performance Output Goals
<u>ASR-11 Technology Refresh Segment 2 (S03.02-05):</u>

- Certify for operational use for SCDI replacement, 50% complete.

<u>ASR-11 Technology Refresh Segment 3 (S03.02-07):</u>

- 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 draft Implementation Strategy and Planning Document (ISPD).
- Complete draft Business Cases Analysis Report (BCAR).
- 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)

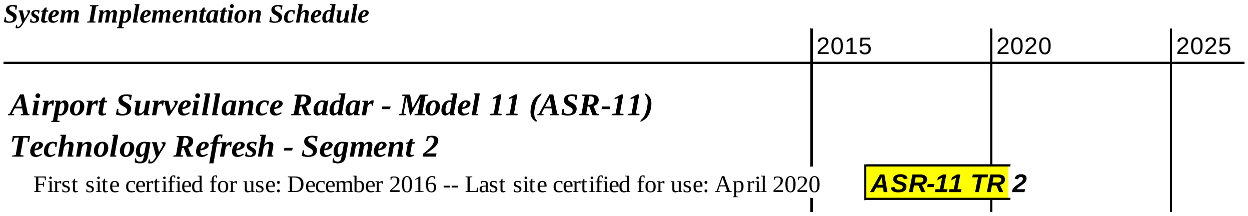
ASR-11 Technology Refresh Segment 3 (S03.02-07):
- Complete final BCAR.
- Complete final ISPD.
- Achieve FID.
- Award contract.

Program Plans FY 2021 – 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



B, Airport Surveillance Radar Model-11 (ASR-11) – Mobile Airport Surveillance Radar (MASR), S03.02-06

Program Description

The 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. This system includes both primary and secondary radar systems that will have the performance capabilities of existing systems and be compatible with all ATCTs, TRACONs, ARTCCs, and their associated automation systems. Loss of primary and secondary surveillance products due to either catastrophic events or long term outages would have a negative impact on FAAs mission capabilities; specifically in the areas of controller situational awareness, safety and capacity. The MASR can be transported by truck, rail, or ship, and installed and certified operational in as few as five days.

The MASR system architecture will support a reusable, service-oriented capability providing terminal surveillance efficiently and quickly. The system will have interfaces for power, mechanical, data, and remote monitoring and control. It will be designed to function as an existing ASR-8, ASR-9 or ASR-11 terminal radar as needed and be interoperable with each of their associated automation interfaces.

The program will be refurbishing two ASR-9 and two Mode S systems and will procure two mobile ASR-11 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 MASR investment will provide a capability that can be installed quickly to maintain operational availability at the goal levels during periods of planned or unplanned outages of terminal surveillance radars.

Program Plans FY 2017 – Performance Output Goals
- In Service Decision for Mobile ASR-11 by December 2016. (APB milestone)

Program Plans FY 2018-2021 – Performance Output Goals
- None.

2B12, RUNWAY STATUS LIGHTS (RWSL)
FY 2017 Request $4.8M

Runway Status Lights (RWSL) – Implementation – Phase 1, S11.01-02 / X, Runway Status Lights (RWSL) – Technology Refresh & Disposition, 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 in 2010 from the JRC for 23 operational and three support sites. In July 2013, the FAA re-scoped the program to 17 airports. Additional airports will be considered in the near future for runway safety enhancements. 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 2017.

Runway Status Lights (RWSL) – Technology Refresh & Disposition (S11.01-04):
The RWSL Technology Refresh program will assess the need to replace and upgrade obsolete Commercial Off-the-Shelf (COTS) hardware and software to ensure the continued reliable and cost effective operation of the system through its designated lifecycle. The RWSL was procured in late 2008, fielded between 2009 and 2017, 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 Final Investment Decision (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 0.395 per million operations, and maintain or improve through FY 2018.*

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 17 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 2017 – Performance Output Goals
<u>Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):</u>
- Achieve IOC at two of 17 (100%) operational sites.
- Achieve Operational Readiness Date (ORD) at three, including 17th and last, operational sites. (APB Milestone)
- Complete ORD at San Francisco International Airport.

<u>Runway Status Lights (RWSL) – Technology Refresh & Disposition (S11.01-04):</u>
- None.

Program Plans FY 2018 – Performance Output Goals
<u>Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):</u>
- Conduct contract close-out activities.

<u>Runway Status Lights (RWSL) – Technology Refresh & Disposition (S11.01-04):</u>
- None.

Program Plans FY 2019 – Performance Output Goals
<u>Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):</u>
- None.

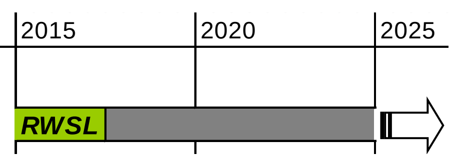
<u>Runway Status Lights (RWSL) – Technology Refresh & Disposition (S11.01-04):</u>
- None.

Program Plans FY 2020-2021 – Performance Output Goals
<u>Runway Status Lights (RWSL) – Implementation – Phase 1 (S11.01-02):</u>
- None.

<u>Runway Status Lights (RWSL) – Technology Refresh & Disposition (S11.01-04):</u>
- Milestones will be developed at FID.

System Implementation Schedule

Runway Status Lights (RWSL)
First site IOC: July 2011 -- Last site IOC: June 2017



2B13, NEXTGEN – NATIONAL AIRSPACE SYSTEM VOICE SYSTEM (NVS)
FY 2017 Request $48.4M

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 both En Route and Terminal facilities. It will be a critical component of the ATC infrastructure providing connectivity for efficient communications between air traffic controllers, pilots, and ground personnel by connecting both incoming and outgoing communication lines to the controller's workstation. Using a panel at their workstation, controllers will be able to select the lines needed to communicate with pilots, other controllers, 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, dynamic resectorization (expanding or contracting a controller's volume of airspace electronically), and off-loading selected sector control to other facilities during non-peak operations, e.g., at night. 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. The focus of NVS will be on designing a replacement system that can be scaled to facility size using standardized components that will reduce both maintenance and parts inventory costs.

The NVS program will be implemented in two segments; Demonstration and Qualification (formerly referred to as Segment 1), and Deployment (formerly referred to as Segment 2). This approach will minimize risk and ensure the new switches will comply with agency requirements.

<u>NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):</u>
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 2017 to request FID for deployment funding at operational facilities beyond key sites.

<u>NAS Voice System (NVS) – Deployment (G03C.01-02):</u>
The Deployment segment consists of NVS deployments at operational facilities beyond key sites. The NVS deployment schedule will be finalized for the FY 2017 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 57,975, 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, dynamic resectorization 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 2017 – Performance Output Goals
<u>NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):</u>
- Complete Factory Acceptance Test (FAT) of test article systems.
- Complete Training Development Plan.
- Achieve FID for deployment funding at operational facilities beyond key sites.

<u>NAS Voice System (NVS) – Deployment (G03C.01-02):</u>
- None.

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).

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 Operational Test and Evaluation of test systems at WJHTC and MMAC. (APB milestone)
- Deliver key site systems and initiate key site testing. (APB milestone)
- Complete Initial Operating Capability (IOC) at first key site. (APB milestone)

NAS Voice System (NVS) – Deployment (G03C.01-02):

- Order NVSs in accordance with the FY 2017 FID deployment schedule.

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 2017 FID.

Program Plans FY 2021 – Performance Output Goals

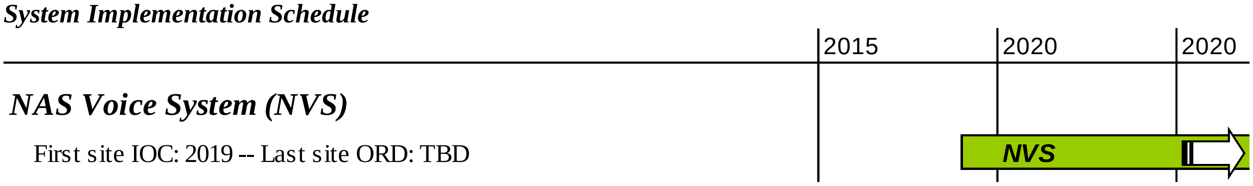
NAS Voice System (NVS) – Demonstration & Qualification (G03C.01-01):

- None.

NAS Voice System (NVS) – Deployment (G03C.01-02):

- Order, deliver and install NVSs in accordance with the FY 2017 FID.

System Implementation Schedule



2B14, INTEGRATED DISPLAY SYSTEM (IDS)

FY 2017 Request $7.7M

- A, Integrated Display Systems (IDS) – Replacement, A03.05-01 / Integrated Display Systems (IDS) – Replacement – Technology Refresh, A03.05-02
- B, Enterprise Information Display System (E-IDS), A03.05-03

A, Integrated Display Systems (IDS) – Replacement, A03.05-01 / Integrated Display Systems (IDS) – Replacement – Technology Refresh, A03.05-02

Program Description

The Integrated Display Systems (IDS) program provides rapid retrieval and display of a wide range of weather, operational support, and administrative information for air traffic controllers and other required users in the terminal environment. IDS consolidates operational information to provide a tool for the exchange of information that impacts control of air traffic. The presentation of multiple sources of data on a single display allows for decision making by controllers which increases operational efficiency. The FAA currently has 2,230 IDS-4 workstations located at approximately 390 FAA facilities nationwide. Recent obsolescence issues and loss of proprietary software support make it necessary to replace this system to sustain its functionality.

IDS Replacement (A03.05-01):
The IDS Replacement program modernizes the IDS-4 system with current technology at 71 existing IDS-4 networks including 1,944 IDS-4 workstations at 256 sites. The prime contract was awarded in May 2010 and design efforts were completed in late 2011. The program was rebaselined in March 2013. The first deployment occurred in 2013 and the last will be in 2017.

IDS Replacement – Technology Refresh (A03.05-02):
The IDS-4 is being replaced with a state-of-the-art system comprised mainly of Commercial-Off-The-Shelf (COTS) components. As with most COTS based systems, a technology refresh of the replacement components is required to sustain system services. The FAA plans to perform a system analysis in FY 2016, approximately 5 years after original COTS components were acquired, to identify affected components before they are no longer replaceable due to obsolescence.

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 IDS-4 is experiencing supportability issues with the existing stock levels of motherboards within the IDS-4 computers. The current rate of motherboards beyond economic repair being returned to the FAA Logistics Center is 21%. Commercial sources for IDS-4 compatible computers/motherboards for long term support are not available. By replacing the legacy IDS-4 systems with state-of-the-art equipment, outages are reduced, thereby reducing delays at the 390 FAA facilities nationwide, including 30 core airports.

Program Plans FY 2017 – Performance Output Goals
IDS Replacement (A03.05-01):
- Achieve Initial Operating Capability (IOC) at 21 networks by end of FY 2017 (71 of 71, 100%).
- Achieve Last Site ORD. (APB milestone)

IDS Replacement – Technology Refresh (A03.05-02):
- Complete system analysis for technology refresh of hardware to replace obsolete components.

Program Plans FY 2018 – Performance Output Goals
IDS Replacement (A03.05-01):
- Begin In-Service Management transition.

IDS Replacement – Technology Refresh (A03.05-02):
- None.

Program Plans FY 2019 – Performance Output Goals
IDS Replacement (A03.05-01):
- Complete In-Service Management transition.

IDS Replacement – Technology Refresh (A03.05-02):
- None.

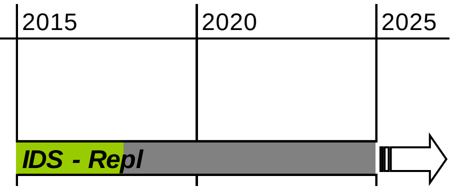
Program Plans FY 2020-2021 – Performance Output Goals
IDS Replacement (A03.05-01):
- None.

IDS Replacement – Technology Refresh (A03.05-02):
- None.

System Implementation Schedule

Integrated Display System (IDS) - Replacement - Technology Refresh*

First site IOC: September 2013 – Last site ORD: July 2017



B, Enterprise Information Display System (E-IDS), A03.05-03

Program Description

The Enterprise Information Display System (E-IDS) will replace obsolete standalone Information Display System (IDS) workstations. These displays are separate from the controller primary displays, and their purpose is to provide controllers with supplemental but operationally essential information for controlling aircraft. Other operators who also rely on IDSs include Front Line Managers, Traffic Management Coordinators, and Technical Operations personnel. There are 6 different types of information display systems currently installed at controller and traffic management positions in large FAA Terminal Radar Approach Control (TRACON), Tower, and Air Route Traffic Control Center (ARTCC) facilities. E-IDS will replace the legacy systems in all these facilities and will add E-IDS system displays at Oceanic controller positions in ARTCCs. Additionally, E-IDS will be provided for administrative use by the TechOps maintenance technicians in TRACONs and ARTCCs.

Access to trusted information sources varies from facility to facility depending upon the IDS model and whether the facility has a direct interface to source data. In some cases vendor supplied information may be the only source available. E-IDS will eliminate differences in the information displayed by obtaining it from trusted sources through the System Wide Information Management (SWIM) program. This information will include: (a) real-time weather, Notices to Airmen (NOTAM), and Pilot Reports, (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 to thousands of client displays in the field rather than require that each IDS collect, store and update its own 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 IDSs; and
- Provide efficient data access and data management that is not possible with aging IDS systems.

E-IDS will interface with and display data to the air traffic controller from legacy systems like Automated Surface Observing System (ASOS), Automated Weather Sensors System, Digital Altimeter Setting Indicator, Low Level Wind Shear Alert System, Terminal Doppler Weather Radar, and Wind Measuring Equipment. It will also provide the platform to display data from future programs and systems under development such as the Aeronautical Common Service and NextGen Weather Processor.

The scope of E-IDS includes the following:

- replace aging platforms with a central (cloud services) capability;
- create different Computer Human Interface capabilities for individual facilities based upon common functionality and training;
- consolidate information that appears on different sensor readouts onto the E-IDS display;
- integrate existing and future (NextGen FIXM, AIXM, WXXM) data formats;
- employ modern NAS interfaces, NextGen infrastructure, and trusted (authoritative) data sources; and
- reduce cost of training and maintenance by replacing multiple disparate legacy IDSs with a single system.

The following information is (or will be) displayed on E-IDS:

- Dynamic Information
    - NOTAM
    - Special Activity Airspace (SAA)-Schedule and Status
    - Pilot Reports (PIREPS)
    - Weather and Wind
    - Tower sensor data
    - Traffic Management Initiatives (Ground/Departure Stops, Snow Removal, Miles in Trail, etc.)
- Static Information
    - Charts
    - Approach Plates
    - Orders (e.g., FAA 7110.65-Controller's bible)
    - Standard Operating Procedures (SOPs)
    - Letters of Agreement (LOAs)

JRC approval of the Initial Investment Decision (IID) is planned for March 2017, and approval of Final Investment Decision (FID) is planned for March 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 57,975, or higher, arrivals and departures.*

Relationship to Performance Target

The E-IDS will 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. This will improve the use of airspace capacity by reducing voice coordination between operators to resolve differences in reported information.

Program Plans FY 2017 – Performance Output Goals

- Conduct site information surveys to verify the quantity of displays and their data sources/interfaces.
- Complete the following final products in support of the IID:
    - Revise Shortfalls Analysis
    - Alternatives Analysis
    - Initial Business Case Definition (each alternative)
    - Initial Program Requirements (update pPR)
    - Initial Implementation Strategy and Planning Document (ISPD)
    - Safety Assessment
    - Initial Affordability Analysis
    - NAS Enterprise Architecture Products
    - Concept Engineering execution (i.e., HF and technical analysis; prototyping)
- Achieve IID for E-IDS.
- Complete the following draft products in support of the FID:
    - Final Program Requirements documentation;
    - Enterprise Architecture Products;
    - Business Case documentation;
    - Implementation Strategy and Planning Document (ISPD); and
    - Acquisition Program Baseline (Execution Plan).

Program Plans FY 2018 – Performance Output Goals

- Complete the following final products in support of the FID:
  - Final Program Requirements documentation;
  - NAS Enterprise Architecture Products;
  - Business Case documentation;
  - Implementation Strategy and Planning Document (ISPD); and
  - Acquisition Program Baseline (Execution Plan).
- Complete preparations for Contract Award towards FID:
  - Assess vendor Request For Proposals;
  - Modify vendor proposal relative to cost, technical and management; and
  - Finalize vendor negotiations and obtain final proposal.
- Achieve FID for E-IDS.
- Award contract.
- Other output goals will be determined at FID.

Program Plans FY 2019 – Performance Output Goals

- Generate System Specification Document (SSD) based on Final PRD.
- Assess schedule dependency risks related to SWIM product services: ASOS Controller Equipment (ACS), Common Support Services-Weather (CSS-Wx), and Digital Pubs.
- Review and provide changes to vendor Detailed Specification and Plans, (Management Plan, Engineering Plan, Development Plan, Test Plan & Procedures).
- Complete review of preliminary design documents and attend Preliminary Design Reviews to assure satisfaction of Specifications.
- Collaborate with and conduct 1st tier site installation surveys at 20 of 511 sites scheduled for 2021 installation (3 TRACONs & 17 ATCT Key Sites).

Program Plans FY 2020 – Performance Output Goals

- Complete review of critical design documents and attend Preliminary Design Reviews to assure satisfaction of preliminary Design and Specifications.
- Review Factory Test results, problem reports and problem fixes.
- Conduct prototype testing at the FAA Technical Center.
- Review WJHTC test results, problem reports and problem fixes.
- Assess prototype performance risks and identify mitigations.
- Collaborate with and conduct 2nd tier site installation surveys at 60 of 511 sites scheduled for 2022 installations (3 ARTCC & 3 CERAP Key Sites plus 7 TRACONs & 47 ATCTs).

Program Plans FY 2021 – Performance Output Goals

- Deploy 1st tier systems and conduct Key Site testing: replace IDS-4s / ACE-IDSs at 3 TRACONs and 17 ATCTs.
- Review 1st tier Key Sites test results, problem reports and problem fixes.
- Prepare for readiness to deploy 2nd tier systems by reviewing 1st tier system release documentation to ensure differences in capabilities are satisfied (e.g., database, human factors, SWIM & direct interfaces).
- Install and conduct factory testing of the system release configuration for 2nd tier deployment in FY 2022.
- Assess 2nd tier system configuration risks and identify mitigations prior to deploying in FY 2022.
- Collaborate with and conduct 3rd tier site installation surveys at 96 of 511 sites scheduled for 2023 installations (7 ARTCCs, 15 TRACONs & 74 ATCTs).

2B15, Remote Monitoring and Logging System (RMLS)

FY 2017 Request $9.9M

- Remote Monitoring and Logging System (RMLS) – Technology Refresh, M07.04-02
- X, Automated Maintenance Management System (AMMS), M07.05-01

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 Center Radar Approach Control (CERAP) 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 (COTS) 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 2017 – Performance Output Goals

- Complete design, development, and testing at WJHTC Integration Testing/Operational Testing (IT/OT) for NLN implementation at OCCs.

Program Plans FY 2018 – Performance Output Goals

- Complete Operational Test & Evaluation (OT&E) for NLN. (APB milestone)
- Complete deployment of the following at NAS Enterprise Security Gateway (NESG) in Atlanta and Salt Lake City:
    - 12 presentation servers
    - 4 proxy servers
- Complete deployment of the following at POCC, MOCC, AOCC, NOCC:
    - Eight Database (DB) servers
    - Four Storage array
    - Eight DB switches
    - Sixteen presentation servers
    - Sixteen windows management servers
- Complete deployment of the following at POCC, MOCC, AOCC:
    - Twelve Monitor/Message Servers
    - Six DB Servers
    - Three Trace Servers
    - Six Preventive Maintenance Servers
    - Six FTI/OPS Switches
- Complete deployment of the following at POCC, MOCC, AOCC:
    - Six Management Servers
    - Six Load Balancers
    - Three 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 (IT/OT/OT2) for NRN implementation at ARTCCs.

Program Plans FY 2020 – Performance Output Goals

- Complete key site IOC for NLN at first OCC. (APB milestone)
- Complete Operational Test & Evaluation (OT&E) for NRN. (APB milestone)
- Complete deployment of the following at NOCC for the Data Repository (DR/OPS) and Oklahoma City (OKC Training):
    - Three DB Servers
    - Five Presentation Servers
    - Five Widows Management Servers
    - Three System Management Servers
    - Two Storage Array
    - Three DB Switches
    - Three Core Switches
    - Three Load Balancers
    - Three Firewall Appliances w/IDS
    - Two High Capacity Tape Library
    - Five Monitor/Message Servers
    - Three DB Servers
    - Two Trace Servers
    - Three Protocol Management Servers
    - Three FTI/OPS Switches
- Complete deployment of the following at NOCC for the Data Repository (DR/OPS):
    - Two Management Servers

- Complete deployment of the following at Oklahoma City (OKC Training):
  - Two Protocol Converter and Software Licenses
  - Four Protocol Converter Servers
  - Two Rack Management Server
  - Two Network Switches
  - Two Keyboard Video Mouse (KVM)/Terminal Switch
- Complete deployment of the following at Seattle ARTCC (ZSE):
  - Three Protocol Converter and Software Licenses
  - Four Protocol Converter Servers
  - One Rack Management Server
  - Four Network Switches
  - One 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):
  - Twelve Protocol Converter and Software Licenses
  - Eighteen Protocol Converter Servers
  - Six Rack Management Server
  - Twelve Network Switches
  - Six 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 the following at Los Angeles ARTCC (ZLA), Jacksonville ARTCC (ZJK), Memphis ARTCC (ZME), Miami ARTCC (ZMA), New York ARTCC (ZNY), Boston ARTCC (ZBW), Atlanta ARTCC (ZTL) and Washington ARTCC (ZDC):
  - Twenty Protocol Converter and Software Licenses
  - Twenty eight Protocol Converter Servers
  - Eight Rack Management Server
  - Twenty two Network Switches
  - Eight KVM/Terminal Switch

System Implementation Schedule

X, 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 environment utilizing 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 develop common enterprise data services for maintenance data. AMMS will deliver advanced automated maintenance tools that will provide improved data integrity and increased situational awareness and enable maintenance practices based upon Reliability Centered 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 focusing on services, systems, and equipment comprising of data related, but not limited to the following categories:

- Maintenance logging Information
- Event coordination Information
- Scheduling Information
- Logistics Information
- Administrative Information
- Safety Information
- Enterprise Monitored NAS Information

The first segment of AMMS will focus on improvements within the maintenance logging, event coordination, and scheduling functionality within 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 and event coordination tool.

AMMS 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

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.

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.

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 2017 – Performance Output Goals
- None.

Program Plans FY 2018 – Performance Output Goals
- Develop the following products in support of the IID:
    - Initial Program Requirements;
    - Business Case Analysis Report (BCAR);
    - Enterprise Architecture Artifacts;
    - Implementation Strategy and Planning Document (ISPD); and
    - Chief Financial Officer (CFO) Package.
- Achieve IID.

Program Plans FY 2019 – 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 (ISPD); and
    - Acquisition Program Baseline (Execution Plan).
- Achieve FID.

Program Plans FY 2020-2021 – Performance Output Goals
- Output goals will be developed at FID.

2B16, Mode S Service Life Extension Program (SLEP)

FY 2017 Request $37.9M

- A, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2, S03.01-08
- B, Airport Surveillance Radar Model-9 (ASR-9) and Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3 Planning, S03.01-11

A, Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 2, S03.01-08

Program Description

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 2025. The Mode S uses selective beacon detection technology to provide target data as digital formatted messages and analog video tailored for automation and display systems.

The Mode S is co-located with Airport Surveillance Radar Model 9 (ASR-9) and ASR-8, and Common Air Route Surveillance Radar (CARSR). The Mode S system and the co-located primary radars are capable of providing correlated radar and beacon reports to NAS en route and terminal automation systems at TRACON and ARTCC facilities, the U.S. Department of Defense (DoD), and other users.

The Joint Resources Council (JRC) approved the Final Investment Decision (FID) for the Phase 2 program on June 27, 2012. This program will replace the Beacon Video Reconstitutor (BVR) with more modern components. Critical Lowest Replaceable Units (LRUs) that process radar data will be assessed for sustainability in support of the Mode S SLEP Phase 3. To address obsolescence and supply/support issues, the following will be purchased for depot replenishment: 1) High Gain Open Planar Array (HGOPA) (or refurbishment of existing antennas); 2) Local, Remote and Radar Intelligent Tool (RIT) Maintenance Terminals; 3) Keyboard Cathode Ray Tube (KCRT); and 4) Non-Volatile Memory (NVMEM) chips. The sustainment of the Mode S system aligns with the NAS Enterprise

Architecture (EA) and the Surveillance and Broadcast Services (SBS) Automatic Dependent Surveillance Broadcast (ADS-B) back-up strategy.

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 98.86 percent which does not meet the FAA Performance Metric. Also, the current operational availability of 98.86 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 2017 – Performance Output Goals

- Production of 18 HGOPA or refurbishment of existing antennas and delivery to FAA Logistics Center.

Program Plans FY 2018 – Performance Output Goals

- Production of 18 HGOPA or refurbishment of existing antennas and delivery to FAA Logistics Center.

Program Plans FY 2019 – Performance Output Goals

- Complete Depot replenishment in September 2019. (APB Milestone) (Prior year funding)

Program Plans FY 2020-2021 – Performance Output Goals

- None.

B, Airport Surveillance Radar Model-9 (ASR-9) and Mode Select (Mode S) Service Life Extension Program (SLEP) – Phase 3 Planning, S03.01-11

Program Description

The ASR-9 and Mode S Service Life Extension Program (SLEP) Phase 3 will perform engineering studies to analyze Lowest Replaceable Units (LRUs) identified with major obsolescence issues and continue software development for the Data Communications Equipment (DCE) prototype. There are components of these radar systems that are not supportable through 2025 and analyses are needed to determine the extent of re-engineering and system modifications needed. The program will reduce the risk of unscheduled outages by providing in-service support to improve radar performance, provides engineering and planning to correct performance/operational and reliability issues and resolution of performance issues such as radar interference.

In addition, the ASR-9 and Mode S service life extension modifications will reduce the overall lifecycle operation costs by improving system reliability and maintainability. The sustainment of the ASR-9 and Mode S aligns with the Surveillance Roadmap Decision Points, and the Surveillance and Broadcast Services (SBS)/Automated Dependent Surveillance Broadcast (ADS-B) backup strategy.

ASR-9 and Mode S systems support aircraft separation standards, reduces delays, and improves safety at congested airports. During instrument meteorological conditions the radar provides air traffic controllers with aircraft position and weather information to allow continuation of aircraft operations.

The ASR-9 also provides data under Memoranda of Agreements (MOAs) to the Departments of Defense (DoD) and Homeland Security (DHS) through the Defense Radar Program and to the Department of Treasury and National Weather Service (NWS) through separate agreements. The DoD uses ASR-9 surveillance data to monitor and detect non-transponder equipped “intruders” in terminal airspace.

The Mode S system provides correlated radar and beacon reports and weather map reports to NAS En Route and Terminal Automation, U.S. Department of Defense (DoD) and Department of Homeland Security (DHS) through the Defense Radar Program, and to the Department of Treasury and National Weather Service (NWS) through separate agreements.

A Final Investment Decision (FID) for this program is planned for March 2017. All The ASR-9 and Mode S SLEP Phase 3 activities are currently scheduled for implementation between 2017 and 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

ASR-9 and Mode S systems are currently functioning at an operational availability of 99.14 and 98.80 percent respectively, which indicates the ASR-9 and Mode S are not meeting the FAA Performance Metric. Both the ASR-9 and Mode S current operational availability are also below the ASR-9 specifications of 99.999 and Mode S specifications of 99.9 percent. With SLEP modifications, operational availability for the ASR-9 and Mode S systems will improve.

Program Plans FY 2017 – Performance Output Goals

- Complete Final Program Requirements documentation.
- Complete Implementation Strategy and Planning Document (ISPD).
- Achieve Final Investment Decision (FID) by March 2017.

Program Plans FY 2018-2021 – Performance Output Goals

- Output goals will be established at FID.

2B17, SURVEILLANCE INTERFACE MODERNIZATION (SIM)

FY 2017 Request $26.8M

Surveillance Interface Modernization (SIM), S13.01-01

Program Description

The Surveillance Interface Modernization (SIM) program will modernize the interfaces between FAA surveillance radar and automation systems for Terminal, En route, and Oceanic Air Traffic Control operations. Surveillance data from today's radars is distributed using Common Digitizer format [version 2] (CD2) over point-to-point serial interfaces to the nearest one or two automation systems. The point-to-point connectivity and CD2 message formats have inherent limitations that restrict the ease in the distribution of surveillance information to users at other facilities and requires additional physical connections. Additionally, CD2 message format limits the amount and type of data that can be distributed to automation systems and limits data precision. The SIM program will implement a common industry standard communication architecture and data format.

SIM Program improvements are achieved by converting the radar and automation systems from the serial interfaces to flexible Internet Protocol (IP) addressable interfaces, over a secure network. Upgrading from serial to IP data transmission formats will simplify circuit management and provide a platform to better enforce security policies, ensure delivery to each customer, and provide direct performance metrics. Additionally, the CD2 data formats will be upgraded to All-Purpose Structure Eurocontrol Radar Information Exchange (ASTERIX) data format, which will be used to carry additional data fields to improve automation platform tracker, display, and safety logic performance, which includes Conflict Probe and Conflict Alert performance in Standard Terminal Automation System (STARS), and En Route Automation Modernization (ERAM), Microprocessor Enroute Automated Radar

Tracking System (MicroEARTS), and Advanced Technologies & Oceanic Procedures (ATOP) automation systems. SIM will upgrade the Operational Internet Protocol Network (OPIP) within the FAA Telecommunications Interface (FTI) network; modify all surveillance radars to output ASTERIX over IP; and modify automation system software to accept the expanded ASTERIX data sets via IP.

In the transition from serial connectivity to IP networks by SIM, the FAA owned Radio Communication Link (RCL) infrastructure related to backup communication from En Route radar sites to Air Route Traffic Control Centers (ARTCC) will be replaced with leased services and remove the aging RCL infrastructure. SIM will provide a more cost effective interface and will result in a large Operations cost reduction compared to the legacy RCL technology and aging RCL infrastructure.

An Initial Investment Decision was approved by the Joint Resources Council on June 17, 2015. A Final Investment Decision (FID) is planned for September 2016.

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

As part of NextGen, existing surveillance systems will be required to serve as independent sources of radar data and backup to ADS-B surveillance, and to provide surveillance data critical to other government agency missions (e.g. Department of Defense, Department of Homeland Security). In order to improve the transfer and distribution of existing radar data, these systems must be modernized to incorporate modern interface requirements. To align with future NextGen requirements, additional capabilities will be implemented into existing surveillance systems. These systems will be required to provide data distribution by other than point-to-point connections, using modern networking techniques and transition to standard interface message formats with higher reporting precision that can provide additional target information to support future operational improvements.

Program Plans FY 2017 – Performance Output Goals

- Establish platform Program Level Agreements (PLA) / Service Level Agreements (SLA) for ASR-8, ASR-9, ASR-11, ATCBI-6, Mode-S, ERAM, STARS/TAMR, MEARTS, and ATOP.
- Provide funding in support of planning, designing, and software coding for ATCBI-6 system changes to implement IP and ASTERIX capability.
- Contract award in support of planning, designing, and software coding for MEARTS automation system software changes to implement IP and ASTERIX capability.
- Contract award in support of planning, designing, and software coding for ERAM automation system software changes to implement IP and ASTERIX capability.
- Contract award in support of planning, designing, and software coding for STARS automation system software changes to implement IP and ASTERIX capability.
- Establish procurement request to start development and implementation of the OPIP network under existing FTI contract.

Program Plans FY 2018-2021 – Performance Output Goals

- Output goals will be established at FID.

2B18, NextGen – Terminal Flight Data Manager (TFDM)

FY 2017 Request $42.2M

Terminal Flight Data Manager (TFDM) – Segment 1, G06A.03-01

Program Description

The Terminal Flight Data Manager (TFDM) program will provide tower air traffic controllers and FAA traffic managers with NextGen decision support capabilities that integrate flight, surveillance, and traffic management information. TFDM will provide an integrated approach to maximize the efficient collection, distribution, and update of data including flight information in the terminal area, the status of airspace around an airport and airport surface data to improve access to information necessary for safe and efficient ATC. The use of Electronic Flight Data (EFD) will allow tower controllers to maintain an integrated view of the air traffic environment improving their situational awareness of airport operations. NextGen decision support capabilities will promote safe and efficient airport operations in managing airport surface traffic sequencing and scheduling. TFDM will automate manual flight data processes to enable enhanced data sharing between the Tower, En Route, Approach Control, Traffic Flow Management (TFM) and Flight/Airline Operations Centers (FOC/AOC).

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 TFMS/Time Based Flow Management (TBFM) information.

As part of the agency's commitment to the RTCA Task Force 5 and the NextGen Advisory Committee, TFDM is deploying some initial capabilities early to select NAS facilities. This achieves a number of benefits for TFDM development, including early industry engagement, achievement of early benefits, and reduction in operational risk.

Early implementation of TFDM will consist of the following:

- Traffic Flow Management System (TFMS) enabled data exchange for additional data elements from the flight operators;
- Deployment of the System Wide Information Management (SWIM) Visualization Tool (SVT) to provide Surface Situational Awareness to TRACON controllers at 11 sites – All completed as of January 31, 2015;
- Sustainment of the Phoenix (PHX) Advanced Electronic Flight Strip System (AEFS) prototype and deployment of additional AEFS prototypes at approximately 5 sites; Cleveland (CLE), San Francisco (SFO), Las Vegas (LAS), Charlotte (CLT) and Newark (EWR). The FAA's Joint Resource Council approved Newark Liberty International Airport (EWR) to receive the AEFS prototype on April 22, 2015. 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 involves 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 TFM 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 exchange of data 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 scheduler/sequencer 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 CO_2 emissions.

Initial Investment Decision was achieved in March 2014. Final Investment Decision (FID) date is planned for April 2016. Once a favorable FID is obtained the program will proceed to contract award and begin solution development and implementation. The program's current notional implementation plan is based on a three build approach and deployment to approximately 89 airports from FY 2022 to FY 2030. Pending FID and the awarded contractor’s proposed solution, Build 1 will consist of Electronic Flight Data/Electronic Flight Strips, system interfaces with EFD, and Departure Scheduler; Build 2 will consist of Departure Metering capability; and Build 3 will conclude with Departure Spacing Program system replacement.

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 57,975, 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 capacity. 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 performance and airport capacity utilization during severe weather and other off-nominal conditions.

Program Plans FY 2017 – Performance Output Goals
- Complete the Preliminary Design Review (PDR) for Build 1 Development and Integration.
- Start TFDM detail design for Build 1 Development and Integration.
- Complete Technology Refresh deployment of EFSTS at 24 of 39 sites (82% complete).

Program Plans FY 2018 – Performance Output Goals
- Complete Critical Design Review (CDR) for Build 1 Development and Integration.
- Begin Build 1 software and hardware development of TFDM Build 1 system.
- Complete Technology Refresh deployment of EFSTS at 7 of 39 sites (100% complete).
- Finalize Program Agreements (including specifications on the funding TFDM will provide) for the modification required for FDIO, TDLS, RMLS and TFMS to support the TFDM implementation.
- Additional performance output goals will be developed at FID.

Program Plans FY 2019 – Performance Output Goals
- Start the site implementation planning for TFDM build 1 key site.
- Conduct an Early User Involvement Event to demonstrate system capabilities and allow the FAA field representatives and the TFDM User Group to formally evaluate the human/system design.
- Additional performance output goals will be developed at FID.

Program Plans FY 2020 – Performance Output Goals
- Complete System Integration of TFDM Build 1.
- Conduct System Requirements Review (SRR) for Build 2 Development and Integration.
- Conduct PDR for Build 2 Development and Integration.
- Start TFDM detail design for Build 2 Development and Integration.
- Additional performance output goals will be developed at FID.

Program Plans FY 2021 – Performance Output Goals

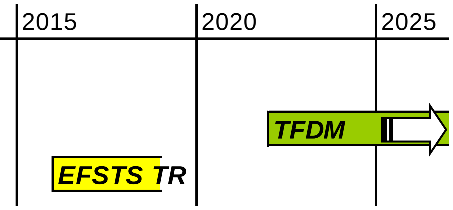
- Complete software and hardware development of TFDM Build 1 system.
- Conduct CDR for Build 2 Development and Integration.
- Begin Build 2 software development of TFDM system.
- Additional performance output goals will be developed at FID.

System Implementation Schedule

Terminal Flight Data Manager (TFDM)

First site IOC: 2022 -- Last site IOC: 2030

EFSTS Technology Refresh: 2016 -- 2018



2B19, VOICE RECORDER REPLACEMENT PROGRAM (VRRP)

FY 2017 Request $2.0M

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 capabilities including:

- increased recording capacity,
- recording of Voice over Intranet Protocol (VoIP) telephones, and
- connectivity to FAA Telecommunications Infrastructure (FTI)'s enterprise Network Time Protocol (NTP).

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. There are over 460 voice recorders with an operational life of 10 years currently operating in ATC facilities. The existing recorders will start to reach the end of their service life beginning in 2017.

A Final Investment Decision (FID) for NVRP is planned for 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

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 voice communications 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.

Program Plans FY 2017 – Performance Output Goals

- Develop products in support of the Initial Investment Decision (IID), which may include:
    - Initial Business Case documentation;
    - Enterprise Architecture Products;
    - Initial Program Requirements (iPR);
    - Initial Implementation Strategy and Planning Document (ISPD); and
    - Final Investment Analysis Plan (IAP).
- Achieve IID.
- Complete Screening Information Request (SIR) release and evaluation.

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 ISPD; and
    - Acquisition Program Baseline (Execution Plan).
- Achieve FID.

Program Plans FY 2019-2021 – Performance Output Goals

- Deliver approximately 150 systems per year; waterfall to be determined at FID.

2B20, INTEGRATED TERMINAL WEATHER SYSTEM (ITWS) TECHNOLOGY REFRESH

FY 2017 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 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 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 maintain this availability.

Program Plans FY 2017 – Performance Output Goals
- Complete ITWS Software adaptation to a new platform for ITWS Situation Display Workstation.

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 2020-2021 – Performance Output Goals
- None.

2B21, NEXT GENERATION: SURVEILLANCE AND WEATHER RADAR CAPABILITY (NSWRC) AND BACKUP SURVEILLANCE CAPABILITY (NBSC)

FY 2017 Request $1.0M

- A, Next Generation Surveillance & Weather Radar Capability (NSWRC), S14.01-01
- B, Next Generation Backup Surveillance Capability (NBSC), S15.01-01

A, Next Generation Surveillance & Weather Radar Capability (NSWRC), S14.01-01

Program Description

The Next Generation Surveillance and Weather Radar Capability (NSWRC) will provide a cost-effective replacement for primary terminal surveillance and weather radars. The FAA currently operates several models of Airport Surveillance Radars (ASR) and the Terminal Doppler Weather Radars (TDWR) for terminal aircraft surveillance and weather detection. The majority of these systems use technology that is over 20 years old, in some cases it is over 40 years old, most have exceeded their service life. Ongoing technology refresh and Service Life Extension Programs (SLEPs) may keep these radars operating in the near-term; however, as the demands of the NAS increase, the present radars will not be capable of delivering the functionality needed for the future.

NSWRC will address all existing primary radar requirements as well as any of the following emerging requirements that may be approved:

- Ability to detect and track aircraft and weather in the presence of extreme clutter, such as wind farm interference;
- Ability to reduce Operations and Maintenance (O&M) costs; and
- Ability to effectively discriminate between different types of hydrometeors (e.g. rain, ice, sleet, hail, etc.).

NSWRC completed the Concept Requirements Definition Readiness (CRDR) in December 2012; and is on track for an Investment Analysis Readiness Decision (IARD) by December 30, 2016. The current plans are to have the Initial Investment Decision (IID) by December 2018 and Final Investment Decision by December 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

Significant cost avoidance will be realized by NSWRC by assuming the mission of the 281 legacy radar systems and reducing the extensive overlapping coverage of those legacy radars. This could reduce the segment of radars needed for terminal surveillance and weather systems from the current total of 281 to a predicted 230 systems. In addition, a common NSWRC platform will consolidate four separate life-cycle support infrastructure capabilities into one common second level engineering, depot and training capability reducing life-cycle support costs.

Program Plans FY 2017 – Performance Output Goals
- Complete draft of Initial Program Requirements Document (iPRD).
- Complete draft of initial Implementation Strategy and Planning Document (ISPD).
- Complete Investment Analysis Plan (IAP) status report update for NSWRC alternatives.

Program Plans FY 2018-2021 – Performance Output Goals
- None.

B, Next Generation Backup Surveillance Capability (NBSC), S15.01-01

Program Description

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 (MSSR) systems. The FAA currently operates several models of beacon systems in the NAS. Most of these legacy systems are nearly thirty years old and have exceeded their service life. FAA will need the NBSC as a secondary surveillance system into the future as a back-up to Automatic Dependent Surveillance-Broadcast (ADS-B) surveillance. The NBSC will support cooperative target acquisition and maintain continuity of operations if ADS-B outages should occur. Ongoing technology refresh and Service Life Extension Programs (SLEPs) may keep legacy radars operating in the near-term; however, as the demands of the NAS increase it is becoming increasingly clear that the present radars will not be capable of delivering the required functionality in the future.

The NBSC program plans to complete Concept and Requirements Definition Readiness (CRDR) by December 2016 and is on track for an Investment Analysis Readiness Decision (IARD) by December 2017. An Initial Investment Decision (IID) is expected by December 2018 with a Final Investment Decision (FID) by December 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The NBSC supports costs savings by reducing OPS costs through the elimination of multiple radar configurations in the NAS. Consolidating four separate, near end of life-cycle surveillance capabilities, into one common equipment baseline with integrated second level engineering and depot and training capabilities will reduce life-cycle support costs.

Program Plans FY 2017 – Performance Output Goals

- Complete Concept Requirements Definition Readiness (CRDR).
- Complete draft of the initial Program Requirements Document (iPRD).
- Complete draft of the initial Implementation Strategy and Planning Document (ISPD).

Program Plans FY 2018-2021 – Performance Output Goals

- None.

2B22, Flight and Interfacility Data Interface (FIDI)

FY 2017 Request $15.0M

Flight and Interfacility Data Interface (FIDI) – Phase 1, Segments 1 & 2, G08A.01-01

Program Description

The Flight and Interfacility Data Interface (FIDI) technology refresh program will modernize flight data and interfacility data interfaces between the En Route Automation Modernization (ERAM) systems and Terminal and Oceanic Automation systems including Advanced Technologies & Oceanic Procedures (ATOP), Standard Terminal Automation Replacement System (STARS), Flight Data Input/Output (FDIO), Terminal Flight Data Manager (TFDM), Information Display System (IDS), Tower Data Link System (TDLS) and Micro-En Route Automated Radar Tracking System (MEARTS). FIDI is a multi-system portfolio investment to replace the antiquated legacy communications infrastructure with Internet Protocol (IP) interfaces and modernized flight data management, distribution and presentation between the ERAM system and other interfacing Terminal and Oceanic client ATC systems.

NAS services to be refreshed by the FIDI program are the Flight Data Entry and Printout (FDAT) and the Interfacility Data Transfer (IDAT). The FDAT and IDAT services currently rely on legacy communications technology that is based on Time-Division Multiplexing (TDM)/serial interfaces. The existing TDM serial lines do not allow for the reconfiguration of the communications links between ATC facilities in the event of a facility outage. Moreover, the existing data formats of the FDAT and IDAT services are limited due the legacy interfaces and intermediate equipment that connect en route, terminal, and oceanic automation systems. In the future, more detailed flight information consistent with international standards will be available. Modernizing the data interfaces will enable NextGen operational improvements across the NAS by providing the full range of flight data that controllers and automation systems will require.

The FIDI program will upgrade the FDAT and IDAT interfaces with modernized interfaces requiring only standard FAA Telecommunications Infrastructure (FTI) network services. In conjunction with the Surveillance Interface Modernization (SIM) program, which allows the use of Internet Protocol (IP) switched network communications to relay radar data to automation systems, this program will enable the decision to decommission the ECG equipment at all 20 en route centers.

Benefits of FIDI include:

- Reduced probability of flight data exchange outages between facilities, due to facility outages, and higher system availability during contingency operations, utilizing the reconfiguration capability inherent in IP-based networks;
- Reduced sustainment costs of serial/ TDM communication hardware in end systems by migrating the interfaces to IP/Ethernet standards;
- Enabling the extension of Trajectory-Based operations to terminal airspace by enabling improved access to flight data information in ATCTs and TRACONs, with resultant reduction in reliance on verbal communication to control traffic and growth in throughput/capacity utilization; and
- Reduced NAS lifecycle costs through platform elimination or consolidation, including ECG, FDIO - Gateway, and Electronic Flight Strip Transfer System (EFSTS) systems, and FDIO platforms separate from STARS automation in TRACONs.

The FIDI program will be structured in two overlapping Phases:

- Phase 1 is a Technology Refresh which will convert FDAT and IDAT services from TDM to IP protocols and develop a modern FDAT software interface within ERAM for FDAT clients. Phase 1 will be further structured into two segments. Segment 1 will migrate the following systems to IP communications; ERAM, STARS, TFDM, FDIO, ATOP, and MEARTS. Segment 2 will implement new FDAT software interfaces to the following systems: ERAM, TFDM, FDIO, NAS IDS, TDLS, and Visual Information Display System (VIDS). After achieving the FAA JRC's Investment Analysis Readiness Decision (IARD), the program will proceed with the Final Investment Analysis (FIA) to achieve the FAA JRC's Final Investment Decision (FID).

- Phase 2, which will run concurrently with Phase 1, will focus on integrating the modernized FDAT interface into STARS, replacing TRACON FDIO functions with STARS. After achieving the FAA JRC's IARD, the program will proceed with the final investment analysis to achieve the FAA JRC's FID.

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 FIDI program will modernize the flight data exchange services between en route and terminal and oceanic automation systems which will reduce the number of outages and improve the operational availability of flight data exchanges between NAS automation systems.

Program Plans FY 2017 – Performance Output Goals

- Complete the following products to support the FIDI Phase 1 and Phase 2 IARD:
    - Shortfall Analysis;
    - Solution Concept of Operations;
    - Alternatives Analysis;
    - Enterprise Architecture Products; and
    - Preliminary Program Requirements.
- Achieve FIDI Phase 1 and Phase 2 IARD.

Program Plans FY 2018 – Performance Output Goals

- Complete the following products to support the FIDI Phase 1 FID:
    - Final Program Requirements (fPR) Document;
    - Enterprise Architecture Products;
    - Business Case documentation;
    - Final Implementation Strategy and Planning Document (ISPD);
    - Acquisition Program Baseline (Execution Plan).
- Achieve FIDI Phase 1 FID.

Program Plans FY 2019 – Performance Output Goals

- Pending FID approval:
    - Complete initial migration of FDAT/IDAT Communications to FTI.
    - Complete engineering development of enhanced ERAM flight data interface capabilities.
    - Achieve Initial Operating Capability of FDIO enhancement for flight data distribution to automation systems.

Program Plans FY 2020 – Performance Output Goals

- Pending FID approval:
    - Complete engineering design/development of TFDM flight data interface capabilities.
    - Complete operational test of STARS flight data interface capabilities.

Program Plans FY 2021 – Performance Output Goals

- Pending FID approval:
    - Complete operational readiness test of FDIO Connected Systems.
    - Complete operational readiness test of ATOP flight data interface capabilities.

C: Flight Service Programs

2C01, AVIATION SURFACE WEATHER OBSERVATION SYSTEM

FY 2017 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 (SAWS), 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 (ITWS) and the Weather and Radar Processor (WARP).

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 development costs, logistics support costs, and software maintenance costs/effort.

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 Target

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 2017 – Performance Output Goals
- Install 87 AWOS Technology Refresh mods (187 of 187, 100%).
- Install AWOS Technology Refresh at all remaining sites. (APB milestone)
- Install 50 F-420 Technology Refresh mods (50 of 210, 23%).
- Complete ASOS Operational Test and Evaluation (OT&E).
- Begin ASOS Software Operational Test and Evaluation (OT&E) at key site.

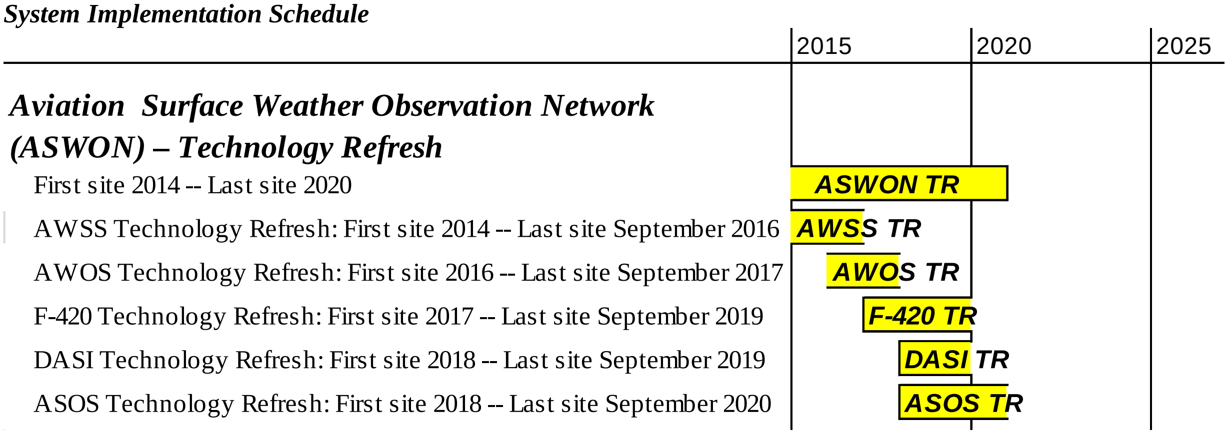
Program Plans FY 2018 – Performance Output Goals
- Install 75 F-420 Technology Refresh mods (125 of 210, 60%).
- Install 90 DASI Technology Refresh mods (90 of 180, 50%).
- Install 100 ASOS Technology Refresh mods (100 of 571, 18%).

Program Plans FY 2019 – Performance Output Goals
- Install 85 F-420 Technology Refresh mods (210 of 210, 100%).
- Complete F-420 Technology Refresh. (APB milestone)
- Install 90 DASI Technology Refresh mods (180 of 180, 100%).
- Complete DASI Technology Refresh. (APB milestone)
- Install 150 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 – Performance Output Goals
- None.

System Implementation Schedule



2C02, FUTURE FLIGHT SERVICES PROGRAM (FFSP)

FY 2017 Request $3.0M

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
- Notices to Airmen (NOTAM) entry and dissemination
- Instrument Flight Rules Clearance relay
- Pilot weather report (PIREP) entry
- Security related to Special Flight Rules Area / Air Defense Identification Zone / Flight Restricted Zone
- Services provided to DoD

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 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 commercial technologies as their capabilities mature and user needs warrant;
- Incorporate FAA Next Generation Air Transportation System capabilities (e.g., Common Support Services – Weather , Aeronautical Information Management Modernization – Segment 2) as they become available; and
- Provide a flexible, scalable, and net centric Voice Communications System using Voice over Internet Protocol technology enabling communication assets to be addressable and shareable to facilitate business continuity and service delivery objectives.

The FFSP will expand the web portion of flight services and reduce or eliminate human delivery of flight services as much as 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 preflight, inflight 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, 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 inflight communications. In April 2015, the FAA announced its intent to award a contract extension for up to 42 months to continue AFSS services and allow time for a new Future Flight Services (FFS) contract award and the transition of services.

- The Direct User Access Terminal Service (DUATS) II contracts with Computer Sciences Corporation (CSC) and Lockheed Martin Corporation, provide users with internet-based preflight services (self-briefings and flight plan filing) without the aid of a flight service specialist.

- The Operational and Supportability Implementation System (OASIS) II contract with Harris Corporation, provides an integrated computer-based system used by FAA flight service specialists in Alaska. OASIS provides integrated textual and weather graphics products, flight plan processing, emergency services, law enforcement, flight planning and regulatory information and other services as defined in FAA Joint Order 7110.10.

The AFSS contract period of performance will expire in September 2019 and the DUATS II contract period of performance will expire in April 2020. In order to transition to a new service provider prior to both the AFSS and DUATS II contract expirations, one or more Flight Service contracts must be awarded. 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 one or more new FSS contract(s), which is planned to be awarded in the 1st quarter 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 is planned in FY 2016 and the Final Investment Decision (FID) is planned in the 1st quarter 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 2017 – Performance Output Goals

- Develop the following products in support of the FID:
  - Final Program Requirements documentation;
  - Enterprise Architecture Artifacts;
  - Final Implementation Strategy and Planning Document; and
  - Acquisition Program Baseline (Execution Plan).

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 FFS contract(s).

Program Plans FY 2019-2021 – Performance Output Goals

- Performance Output Goals will be developed at FID based on the contract transition strategy selected.

2C03, ALASKA FLIGHT SERVICE FACILITY MODERNIZATION (AFSFM)
FY 2017 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 continuity of Flight Service operations. Over 1/3 of the 17 Alaska facilities were constructed in the 1970's and require extensive renovations to meet current building codes, fire life safety, Architectural Barriers Act Accessibility Standard (ABAAS) and electrical standards. Specifically, Flight Service buildings will be updated to meet Occupational Safety and Health Administration (OSHA) and Americans with Disabilities Act (ADA) requirements, and the electrical and safety systems will be upgraded to ensure they meet Industry Standards.

The program corrects deficiencies such as substandard lightning, grounding and bonding protection, electrical systems, and/or heating and cooling systems that could disrupt Flight Service operations. These conditions could 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 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 increasing operational availability and capabilities by providing facilities upgrades and addressing quality of life issues in existing Alaska Flight Services Facilities.

Program Plans FY 2017 – Performance Output Goals
These actions may be superseded if a higher priority need is entered into the Corporate Work Plan (CWP) prior to its start:
- Complete roof replacement at Kenai Flight Service Station (FSS).
- Complete roof replacement at Juneau FSS.
- Refurbish/upgrade building interior (break room, pilot briefing room, rest rooms, etc.) at Talkeetna FSS.

Program Plans FY 2018 – Performance Output Goals
These actions may be superseded if a higher priority need is entered into the 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 actions 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 actions 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 actions 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.

2C04, WEATHER CAMERA PROGRAM
FY 2017 Request $2.2M

Weather Camera Program – Future Segments, M08.31-02

Program Description

The Weather Camera Program sustains the operational Weather Cameras which 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. The program ensures that camera network services are available, reliable, responsive, and accessible to the aviation pilots and aviation user groups. The program provides: camera facility monitoring and restoral activities, replacement of defective equipment identified in trouble tickets, and logistics, spares, and technician training. The Weather Camera Program also manages all of its procurement and other contract requirements including equipment procurement, telecommunication contracts, site facility lease contracts, site maintenance contracts, and maintains and reports on required program performance metrics.

The Program Office also funds the renovation of structures that house the camera systems and provides upgrades to poor performing sites. These sites must be refurbished periodically due to age, outdated equipment, and damages caused by and exposure to environmental elements such as extreme cold weather, high winds, and other weather conditions.

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. According to the Post Implementation Review, aviation efficiency in flight time and fuel savings has improved by 63%. Over the life cycle of the Weather Camera Program, this will save millions of dollars in fuel expenses and reduce the overall carbon footprint.

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

In the state of Alaska, flying is equivalent to driving in the contiguous US, making the use of small aircraft essential to everyday life. Many times flying is the only means to get children to/from school activities; to transport service providers such as clergy, doctors, dentists, and nurses; to deliver patients to medical facilities; and to supply the communities with groceries, fuel, and mail. While flying is essential to daily life in Alaska, rapidly changing weather presents challenges that negatively affect the accident rate. FAA data indicates accident rates in Alaska have been nearly 400 percent above the national average.

The limited availability of weather information in Alaska contributes to a higher risk of accidents and can result in flight inefficiencies. Without weather information about their destination airport and route of flight, pilots cannot make informed decisions on whether it is safe to fly or if they should continue their flight. This can lead to accidents or unnecessary fuel costs, caused by the need to circumvent bad weather or, in some cases, to land at an alternate airport. There is a need for real-time views of current weather conditions accessible to the aviation community in Alaska. The FAA Weather Camera Program has installed aviation weather cameras as an aid to Visual Flight Rule pilots operating in Alaska.

Between 1990 and 2006, there were 1497 commuter and air taxi crashes in the United States. Of these accidents, 520 occurred in Alaska (35% of the total). Historically, the National Transportation Safety Board (NTSB) has stated that on a national average, 22.6% of all accidents are in some way weather related. For the State of Alaska, this would translate into an average of 7.3 weather related accidents per year within the 1990-2006 time frames. Two of the Weather Camera Program's, internal goals are to help reduce weather related accidents in Alaska. The first goal is to reduce the En Route or Approach and Landing Low visibility related accident rate per 100,000 operations for Non-IFR capable commercial and general aviation aircraft within the state of Alaska. To date, and according to the Post Implementation Review, the Weather Camera Program is exceeding its expected performance metrics in Alaska by reducing weather-related aviation accidents from 0.28 accidents per 100,000 operations to 0.13 accidents (53% reduction). The second goal is to reduce the number of unnecessary flight hours caused by lack of weather information.

Program Plans FY 2017 – Performance Output Goals
- Replace legacy and failing cameras/routers at five sites.
- Refurbish mountain pass high-sites at: Lake Clark Pass East and Lake Clark Pass West.

Program Plans FY 2018 – Performance Output Goals
- Replace legacy and failing cameras/routers at five sites.
- Refurbish remote powered camera sites: Misty Fiords, Cape Fanshaw and Skwentna.

Program Plans FY 2019 – Performance Output Goals
- Replace legacy and failing cameras/routers at five sites.
- Refurbish remote powered camera site: Grave Point.

Program Plans FY 2020 – Performance Output Goals
- Replace legacy and failing cameras/routers at five sites. (Prior year funding)
- Refurbish remote powered camera site: Summit. (Prior year funding)

Program Plans FY 2021 – Performance Output Goals
- None.

D: Landing and Navigation Aids Programs

2D01, VHF OMNIDIRECTIONAL RADIO RANGE (VOR) WITH DISTANCE MEASURING EQUIPMENT (DME)
FY 2017 Request $7.0M

- A, Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC), N06.00-00
- B, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program, N06.01-01

A, Very High Frequency Omni-Directional Range (VOR) Collocated with Tactical Air Navigation (VORTAC), N06.00-00

Program Description

This program replaces, relocates, or improves VOR and VORTAC facilities. The VOR and VORTAC, a combination of VOR and Tactical Air Navigation (TACAN) system, provide navigational guidance for civilian and military aircraft in both the en route and terminal areas. Decisions concerning the VOR Minimum Operational Network (MON) will determine, whether VOR or TACAN 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. Until that transition is complete, VORTACs must remain in service and may be relocated, technologically refreshed, or replaced. Currently 60% of the VORTAC systems are over 30 years old. It is projected that within 10-15 years all existing VORTAC systems will be beyond their estimated service life.

There are approximately 967 VORTACs or VORs with Distance Measuring Equipment (DME) 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 its direction from the aircraft and the DME provides its distance; slant range because of the aircraft's altitude.

This program also 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.

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 VOR/VORTAC facilities is either near or past the designed useful life of these systems. Sustaining, relocating, or dopplerizing these facilities maintains their operational availability at or above 99.7%.

Program Plans FY 2017 – Performance Output Goals

- Procure one DVOR Doppler Antenna Kits.
- Complete one on-going DVOR project.
- Initiate one new start DVOR project.

Program Plans FY 2018-2021 – Performance Output Goals

- Procure two DVOR Doppler Antenna Kits.
- Complete two on-going DVOR projects.
- Initiate one new start DVOR project.

B, Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network (MON) Implementation Program, N06.01-01

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 will 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. Phase 1 Final Investment Decision (FID) was approved on September 30, 2015 to discontinue approximately 74 VORs by the end of September 2020 and 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 2017 – Performance Output Goals

- Complete discontinuing four to thirteen 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 MON VORs.

Program Plans FY 2018 – Performance Output Goals
- Complete discontinuing four to eighteen 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.
- Begin VOR MON Program Phase 2 Investment Analysis.

Program Plans FY 2019 – Performance Output Goals
- Complete discontinuing 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.

Program Plans FY 2020 – Performance Output Goals
- Complete discontinuing 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.
- Complete VOR MON Program Phase 2 Investment Analysis.
- Achieve the VOR MON Phase 2 FID.

Program Plans FY 2021 – Performance Output Goals
The activities listed below are contingent upon achieving the VOR MON Phase 2 FID in FY 2020.
- Complete discontinuing 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.

2D02, INSTRUMENT LANDING SYSTEMS (ILS) – ESTABLISH
FY 2017 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 aircraft, 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 airports that meet the following criteria: 1% or more of total U.S. enplanements (“Large Hub”), 0.75% or more of total U.S. non-military itinerant operations. In addition, airports that have between 0.25% and 0.99% of total U.S. enplanements (“Medium Hub”) or between 0.50% and 0.74% of U.S. non-military itinerant operations.

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 57,975, 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 2017 – Performance Output Goals

- Procure five ILS systems and ancillary equipment.
- Complete approximately five ILS replacement projects.
- Complete one on-going ALSF-2 establishment project.

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 seven ILS systems and ancillary equipment.
- Complete approximately seven 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 approximately seven ILS replacement projects.

Program Plans FY 2021 – Performance Output Goals
- Procure seven ILS systems and ancillary equipment.
- Complete approximately seven ILS replacement projects.

2D03, WIDE AREA AUGMENTATION SYSTEM (WAAS) FOR GPS
FY 2017 Request $85.0M

- A, 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
- B, Global Positioning System (GPS) Civil Requirements, N12.03-01

A, 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 (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 supports the redesign of airspace to establish Area Navigation (RNAV) routes in the terminal and en-route environments (T and Q routes) 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.

<u>Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):</u>
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). 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). 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 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 to include integration of a new WAAS reference receiver and safety computer, upgrades to the terrestrial communication system (TCS) and development and fielding of new processors. There will be 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. Additionally, this includes data collection by operators, benefits analysis, avionics integration and development of WAAS-specific procedures within the NAS; and
- Technology Evolution: Research activities to support current WAAS capability (threat model assessments, ionospheric effects analysis, safety analyses and improving/maintaining interoperability with international Satellite Based Augmentation Systems (SBAS)) and research future capabilities to extend satellite navigation supported operations. 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.

For the WAAS Lease Services portion of the program see N12.01-09.

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 communication satellites required to provide the broadcast of the WAAS signal. WAAS will support FAA NextGen initiatives to meet new & growing air transportation demands through identification of WAAS equipage benefits for users through 2025.

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 that there is nearly an 8 fold reduction in approach accident rates (53 per million for non-precision approaches vs. 7 per million for precision approaches) when precision vs. 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 3,567 LPVs, as of September 2015.

Program Plans FY 2017 – Performance Output Goals

Wide Area Augmentation System (WAAS) – Phase IV Segment 1 (N12.01-07):

- Technology Refresh:
  - Complete release package for DFO Release 1, Processor Upgrade. (APB milestone)
  - Transition of WAAS Mexico Connectivity (Ring 2) to Federal Telecommunications Infrastructure (FTI) Gateways.
  - Replace WAAS Assurance Level D Processors and upgrade Operating System (OS) and Compiler at first and last sites. (APB milestones)
  - 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:
  - Conduct initial evaluation of Prototype Dual Frequency Algorithms.
  - Conduct research of issues identified in ARAIM Milestone 3 report.
- GEO Satellite Acquisition:
  - Complete GEO 6 Radio Frequency Uplink (RFU) Site Acceptance Test (SAT).

Wide Area Augmentation System (WAAS) – Phase IV Segment 2 (N12.01-08):

- None.

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 release package for DFO Release 2, GEO 5. (APB milestone)
  - Complete release package for DFO Release 3, G-III Multicast Structure. (APB milestone)
  - Establish contract for Ground Uplink Station (GUS) receiver.
  - 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 25 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 Dual Frequency Antenna Minimum Operational Performance Standards (MOPS).
  - Commence ARAIM safety case.

- GEO Satellite Acquisition:
  - Conduct GEO 6 integration and testing of ground and satellite components.
  - Release GEO 7 Screening Information Request (SIR).

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.
- Technology Refresh:
  - Complete release package 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 DFO Release 5 deployment and integration of GEO 6 into operational WAAS.
  - Award contract for new generation Signal Generator (SIGGEN).
  - Complete release package for DFO Release 5, GUS Processor Type 1 (GPT) Safety Computer Validation and GEO 6. (APB milestone)
  - 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 25 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 (PDR).

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):
- 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 draft Dual Frequency Multiple Constellation SBAS MOPS.
- GEO Satellite Acquisition:
  - Complete GEO 7 Critical Design Review (CDR).

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):

- Technology Refresh:
  - Output goals to be developed at FID.
- 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.

B, Global Positioning System (GPS) Civil Requirements, N12.03-01

Program Description

GPS Civil Requirements program provides system design and development for a network of GPS monitoring stations and processing facilities to monitor quality of the GPS signal for civil users. The Global Positioning System (GPS) is a satellite-based system that provides position, navigation, and timing (PNT) service for use by the U.S. government and world-wide users with no direct user charges. GPS provides two PNT services; the Precise Positioning Service, using the dual L1-C/A (L band signal - Coarse Acquisition) and L2 signals, and the Standard Positioning Service (SPS), using the single L1-C/A signal. Only the SPS is available for worldwide use by the civil community. The GPS program currently consists of second generation satellites (GPS-II) and the Operational Control Segment. GPS is entering a period of transition from GPS-II to the third generation satellites (GPS-III) and the modernized operational control segment (OCX).

The National Space-based PNT policy (NSPD-39) requires civil agencies to fund new and unique civil GPS capabilities beyond the civil signals already contained in the current GPS, which includes the L1C signal and civil signal monitoring. DOT is serving as the lead civil agency.

The civil signal monitoring requirements are documented in the Civil Monitoring Performance Standard. Implementation of Civil Signal Monitoring will consist of system design and development activities performed by the GPS-III and OCX prime contractors, managed by the USAF GPS Directorate. The GPS Signal Monitoring system will consist of a worldwide network of 18-21 GPS monitor stations connected to two processing facilities. The monitor stations must be installed at worldwide geographically dispersed locations such that every GPS satellite can be continuously monitored from at least two monitor stations. The monitor stations will collect real-time measurements of the GPS signals from L1C, L1-C/A, L2C, and L5. L5 will be added on the next generation satellites. The stations will forward this information to processing facilities where software algorithms will monitor the signal for accuracy, integrity, continuity, and availability of performance to verify modernized GPS is performing properly.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

GPS-based navigation contributes to aircraft arrivals supporting average daily capacity for airports. GPS Civil Signal Monitoring enables GPS operators on the ground to quickly identify a civil signal anomaly and determine if the cause is due to either a satellite or a control segment failure and take corrective action to restore service. GPS Civil Signal Monitoring also enables the GPS community to assess the performance of civil signals to ensure that they meet the commitments made by the United States Government in the GPS SPS Performance Standard.

Program Plans FY 2017 – Performance Output Goals

- GPS technical oversight: MITRE support, Technical Assistance Support, Volpe, and National Coordination Office (NCO) support.
- Provide oversight of GPS safety assurance of the satellite vehicles and next generation OCX.
- Provide oversight of GPS spectrum protection analyses pertaining to GPS civil signals.
- Provide assessment of requirements and performance of modernized GPS signals and their impact on civil GPS aviation applications.
- Perform configuration control functions for GPS Civil Applications office to include review and approval of all requests for change.
- Support program management reviews and design reviews for the satellite vehicle and OCX programs.

Program Plans FY 2018-2021 – Performance Output Goals

- None.

2D04, RUNWAY VISUAL RANGE (RVR) & ENHANCED LOW VISIBILITY OPERATIONS (ELVO) PROGRAM

FY 2017 Request $6.5M

- A, Runway Visual Range (RVR) – Replacement/Establishment, N08.02-00
- B, Enhanced Low Visibility Operations (ELVO) – Phase II, N08.03-01

A, Runway Visual Range (RVR) – Replacement/Establishment, N08.02-00

Program Description

The RVR program replaces older RVR equipment with PC-Based RVR equipment. 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. The acquisition of more visibility sensors are required for a Category II/III approach. 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.

- 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 decisions and air traffic management decisions regarding whether flight plans should be approved for an aircraft to fly to or take off from an airport with low visibility. There are 280 airports in the NAS that have RVR systems.

The new-generation RVR and PC-based RVR are safer than the older systems, because the equipment is mounted on frangible structures that break away if accidently struck by an aircraft during take-off or landing. Replacement decisions are prioritized based on the level of activity at the airport and life-cycle issues. This program also provides equipment to upgrade qualified runways from Category I to a Category II/III precision approach.

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

Older 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 2017 – Performance Output Goals
- Procure eight RVR systems.
- Install RVR systems at eight locations.

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 12 RVR systems.
- Install RVR systems at 12 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.

B, Enhanced Low Visibility Operations (ELVO) – Phase II, N08.03-01

Program Description

The Enhanced Low Visibility Operations (ELVO) program Phase II provides the equipment and procedures to allow for reduced minimums for landing and takeoff during periods of low visibility at selected airports. Phase 1 of the program established the criteria for low visibility operations and implemented more than 985 new procedures not requiring infrastructure investment. These reduced minimums require that visibility as measured by the Runway Visual Range (RVR) system be at or above the specified levels when Instrument Flight Rules (IFR) required under Instrument Meterological Conditions (IMC) exist. ELVO Phase II continues the work initiated by Flight Standards to put into place additional low visibility capabilities within the NAS. These additional capabilities include: RVR1800, Special Authorization (SA) Category (CAT) I, SA CAT II, and lower than standard IFR take off minimums. These low visibility flight operations were shown to provide significant additional benefit to operations and increase NAS efficiency. In addition to the lower than standard IFR take off minimums (as low as 500RVR), the table below shows the low visibility flight operations ELVO Phase II allows for landing.

Enhanced Low Visibility Operations (ELVO) – Lower RVR Minimums			
Flight Operation	**Minimums**	**Decision Height (DH) / Decision Altitude (DA)**	**Required Avionics**
CAT I	1800RVR	200 ft DA	Flight Director; or Head-Up Display (HUD); or Autopilot
Special Authorization (SA) CAT I	1400RVR	150 ft DH	HUD
SA CAT II	1200RVR	100 ft DH	Autoland or HUD

Examples of operational benefits realized from ELVO implementations:

- Portland International Airport (PDX) avoided diversion of 58 arrivals with ~3,700 passengers on Christmas Eve, 2009 using SA CAT I;
- Operations continued at Boston Logan International when the primary runway was out of service and SA CAT II was implemented on the cross wind runway. This resulted in an estimated $5.7M in avoided delay costs while the primary runway was out of service. A recurring annual benefit of $530,000 is expected by providing an alternative runway when winds and visibility are unfavorable; and
- San Francisco has experienced a 22-25% increase in throughput through implementation of lower take off minima.

The low visibility conditions ELVO addresses often result from fog. These conditions can cause delays not only at the site of occurrence but at connecting sites, and throughout the NAS. If these delays are in the early part of the day, the NAS schedule impact through delayed, diverted, or cancelled flights can be significant. ELVO results in fewer disruptions to scheduled operations and reductions in secondary delays.

The program is baselined to provide ELVO capabilities at a minimum of 15 sites within the NAS at locations in need of additional CAT II level of service. Additionally, this program will support the congested New York/New Jersey (NY/NJ) region by implementing a regional approach within the next 5 years. The ELVO Program is a less expensive way to achieve CAT II level of service, because it relies on the advanced avionics onboard the aircraft, rather than investing in a CAT II Instrument landing System. Airports that would benefit from ELVO were identified for ELVO Phase II during Investment Analysis. Using the list of potential sites, the program schedule and key milestones will be updated annually to reflect the sites funded.

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 57,975, or higher, arrivals and departures.*

Relationship to Performance Metric

Enhanced low visibility operations support the capacity metric by:

- Increasing the number of arrivals and/or departures during IMC;
- Decreasing the number of flight delays, cancellations, and/or diversions that occur during IMC conditions;
- Allowing airlines to maintain schedule reliability in marginal weather conditions (since both the primary and alternate routes must be approved within the flight plan);
- Providing SA CAT II more cost effectively and rapidly than Standard CAT II; and
- Allowing airports that have only one CAT II/III runway to cost effectively add SA CAT II capability on an additional runway to provide back-up service.

Program Plans FY 2017 – Performance Output Goals

- Initiate establishment of new low visibility services at a minimum of four locations.
- Obtain full operational capability for low visibility services at three sites.

Program Plans FY 2018 – Performance Output Goals
- Initiate establishment of new low visibility services at a minimum of four locations. (Prior year funds)
- Obtain full operational capability for low visibility services at three sites. (Prior year funds)

Program Plans FY 2019 – Performance Output Goals
- Obtain full operational capability for low visibility services at five sites. (Prior year funds)

Program Plans FY 2020-2021 – Performance Output Goals
- None.

2D05, Approach Lighting System Improvement Program (ALSIP)
FY 2017 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 structures that collapse or break apart upon impact (frangible). There are approximately 30 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.

The number of installations indicated in the performance output goals reflects only the scheduled installations, the actual number will vary because FAA will take advantage of cost saving opportunities in coordinating needed replacements with airport financed projects and some replacements must be done on an emergency basis when existing systems are damaged.

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 2017 – Performance Output Goals
- Procure approximately five MALSR systems and ancillary equipment
- Complete MALSR replacement at approximately five locations.

Program Plans FY 2018 – Performance Output Goals
- Procure approximately five MALSR systems and ancillary equipment.
- Complete MALSR replacement at approximately five locations.

Program Plans FY 2019 – Performance Output Goals
- Procure approximately five MALSR systems and ancillary equipment.
- Complete MALSR replacement at approximately five locations.

Program Plans FY 2020 – Performance Output Goals
- Procure approximately five MALSR systems and ancillary equipment.
- Complete MALSR replacement at approximately five locations.

Program Plans FY 2021 – Performance Output Goals
- Procure approximately five MALSR systems and ancillary equipment.
- Complete MALSR replacement at approximately five locations.

2D06, DISTANCE MEASURING EQUIPMENT (DME)
FY 2017 Request $3.0M

Sustain Distance Measuring Equipment (DME), N09.00-00

Program Description

DME is a radio navigation aid used by pilots to determine the aircraft's slant distance from the DME location. The program is procuring and installing state-of-the-art DME systems to support replacement of DMEs that have exceeded their service life expectancy; establish new DMEs at qualifying airports; to relocate DME facilities; and establish DMEs in lieu of Instrument Landing System markers.

The program supports a Commercial Aviation Safety Team (CAST) recommendation to implement DME on various airport runways. The CAST includes FAA, airline and airport personnel, and it 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 57,975, 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 2017 – Performance Output Goals

- Procure 25 DME systems.
- Complete 25 DME establish/sustainment projects.

Program Plans FY 2018 – Performance Output Goals

- Procure 25 DME systems.
- Complete 25 DME establish/sustainment projects.

Program Plans FY 2019 – Performance Output Goals

- Procure 35 DME systems.
- Complete 35 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.

2D07, VISUAL NAVAIDS - ESTABLISH/EXPAND

FY 2017 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 Identification Light (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 FAA, airline and airport personnel, and it has identified 781 runway ends that require implementation of a visual glide slope indicator approach capability. This capability will 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 2017 – Performance Output Goals
- Procure five PAPI systems.
- Install PAPI systems at five locations.

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 five PAPI systems.
- Install PAPI systems at five locations.

Program Plans FY 2020 – Performance Output Goals
- Procure five PAPI systems.
- Install PAPI systems at five locations.

Program Plans FY 2021 – Performance Output Goals
- Procure five PAPI systems.
- Install PAPI systems at five locations.

2D08, INSTRUMENT FLIGHT PROCEDURES AUTOMATION (IFPA)
FY 2017 Request $9.4M

Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 1, A14.02-02 / Instrument Flight Procedures Automation (IFPA) – Technology Refresh, Segment 2, A14.02-03

Program Description

IFPA is a suite of Information Technology tools, consisting of the Instrument Procedure Development System (IPDS), Instrument Flight Procedures (IFP) database, Airports and Navigations Aids database (AirNav), Obstacle Evaluation (OE) system, and the Automated Process Tracking System (APTS). 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 Navigation (AeroNav) Products directorate maintains more than 21,000 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 segments, according to the baselined lifecycle (FY 2012-2032).

<u>IFPA – Technology Refresh, Segment 1 (A14.02-02):</u>
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 APTS workflow software was planned to be replaced with new commercial-off-the-shelf (COTS) business process workflow software. The APTS system will be renamed to AeroNav Products Workflow System (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 (OE's). APWS will provide new workflow processes associated with FAA's NAV Lean initiative 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 software tool was upgraded for COTS architecture changes, including conversion for the Windows-7 operating system, and was deployed in Q4 FY 2015. Technology Refresh of the IFPA server infrastructure began in FY 2013 and was completed in FY 2014.

While originally planned for completion in FY 2016, 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 which exceeded the program's ability to absorb the cost within the approved baseline. The work was stopped in August 2015 and an assessment initiated to investigate options for continuing the program. In Q1 of FY2016, the program office obtained approval for a solicitation for a new solution. A revised program baseline to extend development of a new solution to Q4 FY 2018 will be presented to the JRC in FY 2016.

<u>IFPA – Technology Refresh, Segment 2 (A14.02-03):</u>
A study began in early FY 2015 to determine the type of computer equipment and associated software tools that will be included in the IFPA Technology Refresh Segment 2 effort and to develop a schedule with milestones for that segment. A final investment decision (FID) is planned for FY 2016 to coincide with expected JRC approval of the Segment 1 revised baseline.

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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017 – Performance Output Goals
IFPA – Technology Refresh, Segment 1 (A14.02-02):
- Complete APWS Test Readiness Review (TRR).

IFPA – Technology Refresh, Segment 2 (A14.02-03):
- Complete IPDS Critical Design Review (CDR) for COTS software technology refresh. NOTE: All program milestones for FY 2017-21 will be determined and finalized in the Approved Program Baseline (APB) at FID in FY 2016.

Program Plans FY 2018 – Performance Output Goals
IFPA – Technology Refresh, Segment 1 (A14.02-02):
- Complete APWS Development Test (DT).
- Complete APWS Operational Test (OT).
- Complete APWS Initial Operating Capability (IOC).

IFPA – Technology Refresh, Segment 2 (A14.02-03):
- Complete Requirements Analysis and Documents from System Engineering efforts and begin software programming for COTS software technology refresh of IPDS.
- Procure and install new IPDS computers.

Program Plans FY 2019 – Performance Output Goals
IFPA – Technology Refresh, Segment 1 (A14.02-02):
- None.

IFPA – Technology Refresh, Segment 2 (A14.02-03):
- Complete Development Test (DT) of COTS software technology refresh for IPDS.
- Procure and install computer monitors.
- Complete technology refresh of server infrastructure.

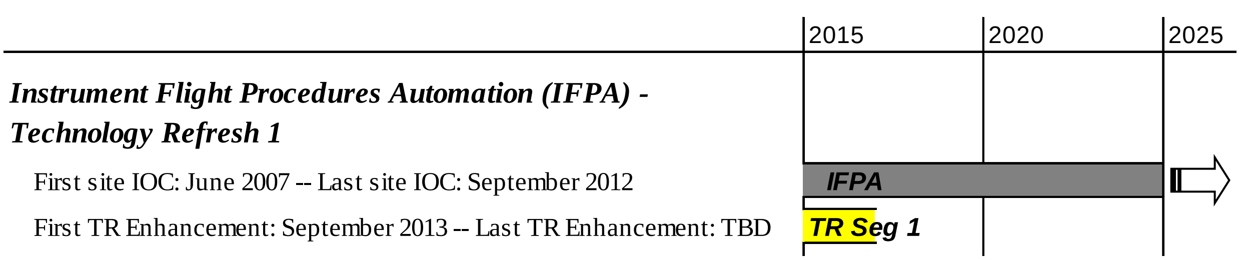
Program Plans FY 2020 – Performance Output Goals
IFPA – Technology Refresh, Segment 1 (A14.02-02):
- None.

IFPA – Technology Refresh, Segment 2 (A14.02-03):
- Complete Operational Test (OT) for IPDS.

Program Plans FY 2021 – Performance Output Goals
IFPA – Technology Refresh, Segment 1 (A14.02-02):
- None.

IFPA – Technology Refresh, Segment 2 (A14.02-03):
- Achieve Initial Operating Capability (IOC) for IPDS. (Prior year funding) NOTE: All program milestones for FY 2017-21 will be determined and finalized in the APB at FID in FY 2016.

System Implementation Schedule



2D09, Navigation and Landing Aids – Service Life Extension Program (SLEP)

FY 2017 Request $3.0M

Navaids – 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 failure would result in increased visibility minima which can cause NAS schedule impact through 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 2017 – Performance Output Goals

- Procure three ALSF-2 RLMS kits.
- Complete approximately three ALSF-2 RLMS installations.
- Complete approximately 10 REIL replacement projects.

Program Plans FY 2018 – Performance Output Goals
- Complete two ILS replacement projects.
- Procure three ALSF-2 RLMS kits.
- Complete approximately three ALSF-2 RLMS installations.
- Replace approximately 10 REIL replacement projects.

Program Plans FY 2019 – Performance Output Goals
- Complete approximately four ILS replacement projects.
- Complete approximately two MALSR replacement projects.
- Procure five ALSF-2 RLMS kits.
- Complete approximately five ALSF-2 RLMS installations.
- Complete approximately 10 REIL replacement projects.

Program Plans FY 2020 – Performance Output Goals
- Complete approximately eight ILS replacement projects.
- Complete approximately two MALSR replacement projects.
- Procure six ALSF-2 RLMS kits.
- Complete approximately six ALSF-2 RLMS installations.
- Complete approximately 10 REIL replacement projects.

Program Plans FY 2021 – Performance Output Goals
- Complete approximately eight ILS replacement projects.
- Complete approximately two MALSR replacement projects.
- Procure six ALSF-2 RLMS kits.
- Complete approximately six ALSF-2 RLMS installations.
- Complete approximately 10 REIL replacement projects.

2D10, VASI REPLACEMENT – REPLACE WITH PRECISION APPROACH PATH INDICATOR

FY 2017 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 877 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 2017 – Performance Output Goals
- Procure 18 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 18 locations.

Program Plans FY 2018 – Performance Output Goals
- Procure 18 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 18 locations.

Program Plans FY 2019 – Performance Output Goals
- Procure 36 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 36 locations.

Program Plans FY 2020 – Performance Output Goals
- Procure 36 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 36 locations.

Program Plans FY 2021 – Performance Output Goals
- Procure 54 Precision Approach Path Indicator systems.
- Replace the Visual Approach Slope Indicator lights with Precision Approach Path Indicators lights at 36 locations.

2D11, RUNWAY SAFETY AREAS – NAVIGATION MITIGATION
FY 2017 Request $14.0M

Runway Safety Area – Navigation Mitigation, N17.01-01

Program Description

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. One key element of this program is RSA Sterilization which includes provisions for clear areas, surface drainage, and weight supportability.

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 by December 31, 2015. Legislation requires FAA to report on the agency's progress toward RSA improvements.

The program corrects FAA-owned NAVAIDs in RSAs by taking action on those navigation systems that are not in compliance with the RSA requirements. The scope of the work to be accomplished will range from the installation of frangible connections on identified structures to the relocation of facilities within RSA if no other solution is available. The FAA is committed to clearing all safety improvements by December 31, 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

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 or RSA, 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 2017 – Performance Output Goals
- Complete 70 Facilities & Equipment (F&E)-funded RSA improvements.

Program Plans FY 2018 – Performance Output Goals
- Complete 11 F&E-funded RSA improvements.

Program Plans FY 2019-2021 – Performance Output Goals
- None.

2D12, NAVAIDS MONITORING EQUIPMENT
FY 2017 Request $2.0M

NAVAIDS Monitoring Equipment, M08.41-02

Program Description

The Navaids Monitoring Equipment (NME) program will deploy a system that provides consolidated monitoring and control of navigational aid equipment by replacing multiple independent control and monitoring units located in air traffic control towers with a single integrated interface. NME will consist of a display located in the tower that interfaces to various navigational aids such as instrument landing systems (ILS), runway visual range (RVR) equipment, runway end identifier lights (REIL), precision approach path indicator (PAPI) light arrays, and airport lighting systems that are located on the airfield. By monitoring NME system displays, air traffic control specialists and technical operations will have the ability to change the state and status (e.g. on/off, brightness) of Navaid equipment. Through consolidated monitoring using NME system displays, technical operations will be able to more efficiently monitor the state and condition of Navaids equipment.

The NME program will provide efficiencies by combining the control and monitoring functionality currently being provided by legacy systems into a single solution with one common software, training and logistics platform. The NME system will be installed at approximately 32 airports across the NAS.

An Investment Analysis Readiness Decision (IARD) is planned for September 2016, Initial Investment Decision (IID) for September 2017 and Final Investment Decision (FID) for September 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 airport capacity for Core airports of 57,975, 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 system will be deployed at certain core airports and will assist in maintaining average daily airport capacity by providing an integrated display 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 2017 – Performance Output Goals
- Complete Initial Program Requirements Document (iPRD).
- Complete Business Case Analysis Report (BCAR).
- Complete Initial Implementation Strategy and Planning Document (ISPD).
- Achieve IID.

Program Plans FY 2018 – Performance Output Goals
- Complete Final Program Requirement Document (fPRD).
- Complete Final Business Case Analysis Report (BCAR).
- Complete Final Implementation Strategy and Planning Document (ISPD).
- Achieve FID.
- Award NME contract for system development and implementation.
- Begin system development.

Program Plans FY 2019 – Performance Output Goals
- Output goals will be developed at FID.

Program Plans FY 2020-2021 – Performance Output Goals
- None.

E: Other ATC Facilities Programs

2E01, Fuel Storage Tank Replacement and Management
FY 2017 Request $22.7M

Fuel Storage Tank Replacement Management, F13.01-00

Program Description

The FAA 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 (pipe, 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 and 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. Prime generators provide the sole source 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 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 system lifecycle for FST systems. Annually; an average of 190 FST system replacements are 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 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 2017-2021 – Performance Output Goals

- Replace, modernize or upgrade 114 fuel 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 2017 Request $40.5M

Unstaffed Infrastructure Sustainment (UIS), F12.00-00

Program Description

There are approximately 12,500 unstaffed facilities within the NAS. The Unstaffed Infrastructure Sustainment (UIS) program provides for the modernization of NAS buildings, structures, supporting electrical and heating/air conditioning equipment, and other real property assets that make up each facility. This 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 due to Environmental impacts (e.g., roof leaks, air conditioner failures, etc.);
- 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 replacement and/or upgrade of real property and unstaffed structures. These projects include upgrades, modernizations, refurbishments, and replacements of:

- NAS antenna and equipment towers;
- Heating, ventilating, and air conditioning (HVAC) equipment;
- Buildings and shelters;
- Roofs;
- Electrical panels and distribution wiring;
- Locks and 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 Unstaffed Infrastructure Sustainment 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 2017 – Performance Output Goals

- Complete 150 unstaffed infrastructure projects located in all three service areas for Communication, Navigation, Surveillance, and Support Services.
- Replace 120 antenna towers to improve maintenance and safety conditions for FAA employees.

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.
- Replace 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.
- Replace 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.
- Replace 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.
- Replace 120 antenna towers to improve maintenance and safety conditions for FAA employees.

2E03, Aircraft Related Equipment Program
FY 2017 Request $13.0M

- 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

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 two 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 (AFIS) and the Next Generation Automated Flight Inspection System (NAFIS). ARE also provides a communication system for data gathered while airborne. The Flight Operations Management System (FOMS) is used to schedule and manage the inspection process and to handle 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
- GPS 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 and 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 2017 – Performance Output Goals
Aircraft Modernization:
- Acquire, install, or complete:
    - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule updated in FY 2016.
    - ADS-B Transponders for the Beech 300 fleet.
    - Transponder Attenuator replacements for all Beech 300 aircraft.
    - Inertial Reference Unit (IRU) update for the one Challenger 604 and three Challenger 601 aircraft.
    - Advanced Avionics package on one of two Challenger 605 aircraft.
    - Very High Frequency (VHF) and GNSS Radio Frequency Interference (RFI) sensors for the Beech 300 and Challenger 600-series aircraft.
    - Interior modification and FANS 1A+ avionics package for the one Challenger 604 aircraft.

Flight Inspection System Sustainment:
- Execute NAFIS interim updates for deployed aircraft.

Flight Inspection System Modernization:
- Deploy NAFIS Phase II on seven Beech 300 aircraft.

Program Plans FY 2018 – Performance Output Goals

Aircraft Modernization:

- Acquire, install, or complete:
    - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule updated in FY 2017.
    - ADS-B Transponders for the Beech 300 fleet.
    - Global Navigation Support System (GNSS) Landing System (GLS) CAT II/III equipment for Challenger 600-series.
    - Heads Up Display (HUD) / Enhanced Vision System (EVS) 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 GNSS 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.

Program Plans FY 2019 – Performance Output Goals

Aircraft Modernization:

- Acquire, install, or complete:
    - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule 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:

- Install NAFIS Phase II updates for the fleet.
- Install NAFIS Phase II Block Upgrades.

Program Plans FY 2020 – Performance Output Goals

Aircraft Modernization:

- Acquire, install, or complete:
    - Equipment to establish connected aircraft based on the multi-fleet, multi-year schedule updated in FY 2019.
    - Flight Management System (FMS) upgrade for the Beech 300 fleet.
    - Avionics system upgrades for the Challenger 601 fleet and the Lear 60 fleet.

Flight Inspection System Sustainment:

- Install NAFIS Phase II updates for the fleet.

Program Plans FY 2021 – Performance Output Goals

Aircraft Modernization:

- Acquire, install, or complete:
    - FMS upgrade for the Beech 300 fleet based on the multi-year schedule established in FY 2020.
    - Avionics system upgrades for the Challenger 601 fleet and the Lear 60 fleet based on the multi-year schedule established in FY2020.

Flight Inspection System Sustainment:

- Install NAFIS Phase II updates for the fleet.

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. In Q4 FY 2015 the FAA installed an A320 flight package capability into the existing Airbus 330/340 simulator as part of the M12.01-03 CIP program.

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.

A final investment decision (FID) is planned in FY 2017 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 an air traffic control lab 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 2017 – Performance Output Goals

- Purchase and install the Boeing 737 MAX features; Roll Control Alerting System (RCAS), 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 (NPN).
- Complete update of the Boeing Motion system.

Program Plans FY 2018 – Performance Output Goals

- 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 I/O (XR) interface.

Program Plans FY 2020 – Performance Output Goals

- Purchase and install the upgraded input/output 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 A320 New Engine Operations Flight Package.
- Purchase and install A330 New Engine Operations Level D simulator update.
- Purchase and install the Boeing 737 Max 8 update.

2E04, AIRPORT CABLE LOOP SYSTEMS – SUSTAINED SUPPORT

FY 2017 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. The 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).

Aeronautical Mobile Airport Communications System (AeroMACS) is an all Internet Protocol (IP) based wireless broadband network. AeroMACS typically consists of Commercial-Off-The-Shelf (COTS) base stations and mobile subscriber units equipped with small-sized antennas and standardized air interfaces. AeroMACS can be installed at FAA locations for airport surface communications as it provides extremely reliable high-density data rates at a low cost to the FAA.

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 981 delays associated with cable loop outages from 1998 to 2012 for the 35 largest airports in the NAS. The number of associated delays has decreased an average of 2% annually since that time.

Program Plans FY 2017 – Performance Output Goals
- Complete electronics installation at Ontario, CA (ONT).
- Complete construction at Ft Lauderdale, FL (FLL) and Oakland, CA (OAK).
- Develop detailed plan for engineering and construction for Houston, TX (IAH).
- Complete four smaller scale projects (regionals), sites to be determined at the A/G Communications Integrated Requirements Team (AGIRT) in FY 2017.

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 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.

2E05, ALASKAN SATELLITE TELECOMMUNICATION INFRASTRUCTURE (ASTI)
FY 2017 Request $6.0M

Alaskan Satellite Telecommunication Infrastructure (ASTI), C17.02-01

Program Description

The ASTI program will upgrade the FAA owned and operated communications network, using satellite transmissions of data, to 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 (ASOS), Automated Weather Observation System (AWOS), and AWOS Data Acquisition System (ADAS);

- WAAS Reference Station; and
- Automatic Dependent Surveillance-Broadcast (ADS-B).

The ASTI network consists of hub earth stations, remote earth stations, leased transponder space segment, and a Network Operations Control Center (NOCC). ASTI uses primary and alternate satellites to provide service diversity. The remote earth stations are linked to their respective hubs and the NOCC through leased transponders.

The ASTI program will acquire and provide Commercial off-the-Shelf equipment and associated support services. The modernization efforts will yield several important benefits:

- Improvements in network availability to required levels (.9999 for Phase I sites and .999 for Phase II sites)
- Improve information system security to meet Federal standards;
- Reduce number and duration of outages;
- More efficient use of satellite transponder bandwidth;
- Contain Operations and Maintenance (O&M) costs; and
- Improve life cycle support (i.e., training, second level engineering support, radome maintenance and depot level supply support).

The ASTI Modernization program achieved its final investment decision on June 2011. Subsequently the ASTI Modernization program achieved its first two APB milestones by November 2011. The following year the program began experiencing delays primarily attributed to the prime contractor and technical challenges with solution development. Some of the major delays included the following:

- The prime contractor made a business decision to acquire GDC multiplexer subcontractor due to financial challenges experienced by subcontractor;
- ASTI is required to support the legacy system communications interfaces which was developed in the 1970’s and must be in compliance with the latest information security standards as well as support higher data rates required by newer systems;
- Component swaps proved more complex requiring integration between the Multiplexer, the Network Management Control System (NMCS), and security monitoring functions;
- Additional time required for development due to the complexity of the legacy Time-division multiplexing (TDM) technology and hardware;
- GDC Multiplexer component upgrades required longer time to develop; and
- Integration between legacy hardware and modem software is more complex than anticipated.

In November 2015, the ASTI program requested, and was given approval by the Joint Resources Council (JRC) to prepare a Baseline Change Decision (BCD) by the 1st quarter of FY 2017. During the JRC discussions, the program presented the results of an Analysis of Alternatives that accessed the direction of the program and how to best mitigate the technical challenges. The ASTI program was determined to be the only viable solution for the timely replacement of the nearly unsustainable legacy Alaskan NAS Interfacility Communications System (ANICS) system. Efforts are currently underway by the prime contractor and FAA management to address these challenges by providing additional resources; applying more stringent oversight of the GDC Multiplexer card production; and implementing more robust test procedures.

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 2017 – Performance Output Goals
- Complete the site familiarization required for Key Site pending approval of the ASTI re-plan.

Program Plans FY 2018 – Performance Output Goals
- Complete training required for 21st Site pending approval of the ASTI re-plan.

Program Plans FY 2019 – Performance Output Goals
- Complete training required for 64th Site pending approval of the ASTI re-plan.

Program Plans FY 2020-2021 – Performance Output Goals
- None.

2E06, FACILITIES DECOMMISSIONING
FY 2017 Request $6.2M

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 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 is prioritized nationally 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 needed site restoration;
- 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 (EDDA) reports for government-owned properties, as required by the General Services Administration (GSA) 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 (O&M) 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017 – Performance Output Goals
- Complete approximately 50 Real Property Disposal Projects. 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 3 Very High Frequency Omnidirectional Range (VOR) sites

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 RCLR / RCLT Tower sites.
- Dispose of 8 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.

2E07, ELECTRICAL POWER SYSTEMS – SUSTAIN/SUPPORT
FY 2017 Request $105.0M

Power Systems Sustained Support (PS3), F11.01-01 / X, Power Systems Sustained Support (P3S) – Future Segments, F11.01-02

Program Description

The Electrical Power Systems Sustained Support (PS3) program funds the purchase and installation of components for backup electric power systems and power regulation and protection equipment. Backup electrical power systems are necessary to allow continued operation of air traffic control facilities when there is an interruption in commercial power sources. These disruptions can result in grounded flights, are placed in airborne holding patterns, or are re-routed to other airports. Reliable backup power systems are installed so air traffic control electronics can maintain required availability and capability and prevent disruptions. These power systems also prevent damage to sensitive electronic equipment due to commercial power surges and fluctuations. The Power program replaces and refurbishes components of existing power systems and cable infrastructure when necessary to maintain and improve the overall electrical power quality, reliability, and availability. The type of power system deployed at a site varies by load sensitivity and the criticality of the equipment that it supports. This program is included in the ATC Facilities Sustainment Strategic Plan.

Power Systems Sustained Support (PS3) (F11.01-01):
PS3 sustains the following components and services:

- NAS Batteries: Large scale battery complexes serve as backup power sources for key NAS electronic installations at en route, terminal, and General National Airspace System (GNAS) facilities. These batteries provide power for a limited time 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 5- to 7-years to assure reliability.
- Power Conditioning System (PCS) / Uninterruptible Power Supply (UPS): The 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 sustains PCS/UPS systems that reach their expected useful life of 20 years.
- Direct Current Backup System (DC BUS): A DC BUS stores power in batteries, providing a low cost, short term power source at facilities with limited electrical loads. The PS3 sustains DC BUSes that have a useful life of up to 20 years.
- ARTCC Critical and Essential Power System (ACEPS): Because of the critical role of the En Route and large Terminal Control Centers, they require high quality and reliable power provided by ACEPS. The FAA operates ACEPS at 21 ARTCCs, two Combined Center Radar Approach Control (CERAPs) and three large Terminal Radar Approach Control (TRACONs). ACEPS is comprised of engine generators, switchgear, and UPS. PS3 sustains 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.
- Lightning Protection, Grounding, Bonding and Shielding (LPGBS): LPGBS minimizes electrical hazards to personnel, facilities and electronic equipment caused by lightning, voltage surges, electrostatic discharge (ESD), 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. Useful life of LPGBS elements is 25 years.
- Electrical Line Distribution (ELD): 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. The PS3 program replaces components that have exceeded their useful life of 25 years.
- Engine Generators: Engine generators at GNAS facilities provide backup power (and are the primary source of power at some remote locations) for essential NAS electronic systems when commercial power is unavailable or becomes unreliable. Engine generators have a 24-year useful life.
- 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 a family of standardized CPDS types, and each type is optimally matched to the criticality and activity level of the NAS facility it serves. The PS3 program replaces all CPDS components except for the engine-generators, UPS and batteries.
- Alternative Energy Systems (AES): This activity integrates a broad range of clean energy technologies to meet NAS operational demands. Using AES technologies reduces the Agency’s carbon footprint and helps to achieve Executive Order 13514 goals for reduction of fossil fuel dependencies. Alternative energy generation systems used within the FAA include: solar energy, wind energy, and fuel cells. PS3 sustains AES installations that provide power to NAS equipment.
- Environmental Remote Monitoring System (ERMS): ERMS provides the interface between power systems (EG’s, 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.

- PS3 Program Management and System Engineering: Systems engineering within the Power Services Group defines and documents customer requirements for power systems and administers those requirements through the design phase, system validation, quality control, quality assurance, safety improvement, and the useful life. Systems engineering also addresses sustaining established alternative energy generation systems, establishing and administering test facilities, and developing procedures for enhanced system designs.

Power Systems Sustained Support (P3S) – Future Segments (F11.01-02):
The Future Segments program will continue the same activities as the base program starting in FY 2019. The Final Investment Decision (FID) is planned for the 3rd quarter in FY 2016.

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 2017 – Performance Output Goals
Power Systems Sustained Support (PS3) (F11.01-01):
Sustain existing NAS power systems by completing these projects (Actual may vary based upon validation and priority for year):
- NAS Battery set replacement (76 Sets).
- PCS / UPS (21 Sets).
- DC BUS (27 Sets).
- ACEPS (2 Sets).
- LPGBS elements (9 Sets).
- ELD Replacements (7 Sets).
- Engine Generators Replacement (69 Sets).
- CPDS (6 Sets).
- AES (6 Sets).
- ERMS (70 Sets).
- PS3 Program Management and System Engineering (10 Sets).

Power Systems Sustained Support (PS3) – Future Segments (F11.01-02):
- None.

Program Plans FY 2018 – Performance Output Goals
Power Systems Sustained Support (PS3) (F11.01-01):
Sustain existing NAS power systems by completing these projects (Actual may vary based upon validation and priority for year):
- NAS Battery set replacement (96 Sets).
- DC BUS (1 Set).
- ACEPS (4 Sets).
- LPGBS elements (1 Set).
- ELD Replacements (12 Sets).
- Engine Generators Replacement (47 Sets).
- CPDS (1 Set).
- 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):

Sustain existing NAS power systems by completing these projects (Actual may vary based upon validation and priority for year):

- NAS Battery set replacement (70 Sets).
- PCS / UPS (16 Sets).
- DC BUS (23 Sets).
- ACEPS (2 Sets).
- LPGBS elements (5 Sets).
- ELD Replacements (8 Sets).
- Engine Generators Replacement (69 Sets).
- CPDS (6 Sets).
- AES (7 Sets).
- ERMS (70 Sets).

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):

Sustain existing NAS power systems by completing these projects (Actual may vary based upon validation and priority for year):

- NAS Battery set replacement (76 Sets).
- PCS / UPS (35 Sets).
- DC BUS (57 Sets).
- ACEPS (3 Sets).
- LPGBS elements (23 Sets).
- ELD Replacements (11 Sets).
- Engine Generators Replacement (104 Sets).
- CPDS (9 Sets).
- AES (7 Sets).
- ERMS (90 Sets).
-

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):

Sustain existing NAS power systems by completing these projects (Actual may vary based upon validation and priority for year):

- NAS Battery set replacement (76 Sets).
- PCS / UPS (35 Sets).
- DC BUS (57 Sets).
- ACEPS (3 Sets).
- LPGBS elements (23 Sets).
- ELD Replacements (11 Sets).
- Engine Generators Replacement (104 Sets).
- CPDS (9 Sets).
- AES (7 Sets).
- ERMS (90 Sets).

2E08, ENERGY MANAGEMENT AND COMPLIANCE (EMC)

FY 2017 Request $2.0M

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 off-grid power and non-polluting energy sources for all activities and acquisitions. This program is included in the ATC Facilities Sustainment Strategic Plan.

The EMC program also contributes to FAA's progress toward meeting federal greening mandates, including:

- National Energy Conservation Policy Act,
- Energy Policy Act of 2005 (EPACT),
- Energy Independence and Security Act of 2007 (EISA),
- Executive Order 13693, and
- DOT/FAA Strategic Sustainability Performance Plan (SSPP).

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 five 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 to improve ATO performance including infrastructure improvements with the greatest cost to benefit ratios and shortest payback periods.
3. **Increasing the number of high performance sustainable buildings** in ATO's portfolio by implementing targeted infrastructure improvements at selected large staffed facilities in compliance with Executive Order 13693.
4. **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.
5. **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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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% at facilities where advanced meters are installed, 12-13% at facilities where energy improvements are performed, and 14% at facilities where High Performance Sustainable Building (HPSB) upgrades are performed.

Program Plans FY 2017 – Performance Output Goals
- Install advanced electric meters at one facility.
- Perform energy and water improvements at three facilities.
- Perform HPSB upgrades at two 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 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 three facilities.
- Perform HPSB upgrades at one facility.
- 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 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 Department of Energy (DOE) and the Office of Management and Budget (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 Department of Energy (DOE) and the Office of Management and Budget (OMB).

2E09, CHILD CARE CENTER SUSTAINMENT
FY 2017 Request $1.0M

Child Care Centers – Infrastructure Improvements, F22.01-01

Program Description

The child care centers were constructed and furnished in the early 1990's and now need to be upgraded and modernized to provide for the ongoing, growing needs of employees and to ensure that safety systems are up to date. Many require refurbishment including: roof replacements, HVAC system upgrades, fire suppression system replacement and other facility infrastructure system upgrades. The program will also modernize the child care centers to meet safety and building code requirements. This is a multi-year modernization program that will address facility requirements for 13 FAA operated Child Care Centers located at Air Route Traffic Control Centers (ARTCCs) and Terminal Radar Approach Control (TRACON). Available onsite child care greatly enhances the FAA's ability to recruit and retain a highly qualified, diverse work force.

Federal agencies are authorized to support provisioning of child care centers under the Trible 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.*

Relationship to Performance Target

Support of work-site child care centers has a direct positive correlation with the OPM Employee Viewpoint survey. The top ten GSA child care center customers all score within the top 20 on the Employee Viewpoint survey. The Child Care Center program supports the current metric of improving the FAA's ranking in 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 indicates onsite child care also results in less absence and stress related to child care issues. Availability of on-site child care allows FAA employees to focus on the agency's mission and the critical job responsibilities involved, rather than having to worry about child care concerns.

Program Plans FY 2017 – Performance Output Goals

- Complete upgrade/modernization projects at 13 centers including but is not limited to access systems, playground turf, remaining building/structural renovations, fire alarm panels, finger/access gates, and mechanical controls. The number of projects will be based on a facility condition survey.

Program Plans FY 2018 – Performance Output Goals

- Complete upgrade/modernization projects at 13 centers including but is not limited to sprinkler systems, storage cabinets, and remaining appliances. The number of projects will be based on a facility condition survey.

Program Plans FY 2019-2021 – Performance Output Goals

- None.

2E10, FAA TELECOMMUNICATIONS INFRASTRUCTURE 2

FY 2017 Request $10.4M

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 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 also address challenges associated with the phase-out of 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 upon these services will be able to modernize their telecommunications interfaces by the target phase-out date of 2020. 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.

A strategy decision point is planned for Q4 of FY 2016 to brief the JRC on the findings from the market research and recommendations will be made for tailoring the program for future 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Target

This program enables FAA to begin initial planning for the FTI-2 program to acquire telecommunications services as a commercial commodity rather than as the specialized services obtained under the legacy FTI program tailored to support unique NAS interfaces. Analysis is under way to determine the potential cost benefits of the program.

Program Plans FY 2017 – Performance Output Goals

- Develop artifacts required by the Joint Resource Council to achieve Initial Analysis Readiness Decision (IARD):
  - Preliminary Program Requirements
  - Initial Investment Analysis Plan
- Other output goals determined at the strategy decision point.

Program Plans FY 2018 – Performance Output Goals

- Develop artifacts required by the Joint Resource Council to achieve IID:
  - Enterprise Architecture Products/Views
  - Safety Assessment Plan
- Other output goals determined at the strategy decision point.

Program Plans FY 2019-2021 – Performance Output Goals

- None.

2E11, SYSTEM CAPACITY, PLANNING AND IMPROVEMENTS

FY 2017 Request $6.5M

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.

This work includes:

- Airport modeling and analysis using actual data collected from ATC systems in the field to determine the value of potential improvements in airspace or airfield modifications;
- Enhancements of the Performance Data Analysis and Reporting System (PDARS) through the implementation of the Data Visualization and Reporting System (DVARS), a fully integrated performance measurement tool designed to help the FAA improve the NAS by tracking the daily operations of the ATC system and their environmental impacts;
- Using PDARS/DVARS operational data to baseline the measurement and analysis of Next Generation Air Transportation System (NextGen) capability improvements such as the efforts to support Optimization of Airspace and Procedures in the Metroplex (OAPM);
- Leveraging new technologies to enhance capabilities of PDARS/DVARS;
- Development of new agency level metrics to enhance management awareness of, and response to, system performance. Maintain and enhance the FAA Operational Metrics Web Page;
- Benchmarking ATO performance with other Air Navigation Service Providers to support joint projects with EUROCONTROL and as part of International Civil Aviation Organization (ICAO), Civil Air Navigation Services Organization and Aerospace Transportation Advisory Group work plans. These efforts are performed 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;
- Provide analytical and modeling support for Commercial Space initiatives;
- Airport capacity studies that provide assessment of procedural, technology, or infrastructure improvements; and,
- Provide performance modeling and economic analysis to develop a business case with ICAO member states for reduced oceanic separation using ADS-B.

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 57,975, 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 2017 – Performance Output Goals

- Implement PDARS/DVARS web-based access capabilities.
- Integrate available SWIM data products into the PDARS/DVARS system.
- Implement upgraded PDARS/DVARS processing system.
- Produce Annual Joint Performance Benchmark Report with EUROCONTROL/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 2018 – Performance Output Goals

- Complete implementation of PDARS/DVARS into a net centric system.
- Implement new SWIM data products into the PDARS/DVARS system.
- Implement upgraded PDARS/DVARS visualization products.
- 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 EUROCONTROL/the European Commission.
- Complete PDARS/DVARS implementation.
- 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 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).
- Identify DVARS system enhancements to meet user needs.
- Implement Tier 1 objective requirements of the DVARS system.

Program Plans FY 2020 – Performance Output Goals

- Produce Joint Performance Benchmark Report with EUROCONTROL/the European Commission.
- Implement identified DVARS system enhancements.
- Implement Tier 2 objective requirements of the DVARS system.
- DVARS system review for identification of system modernization and enhancement.
- 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 2021 – Performance Output Goals

- Produce Joint Performance Benchmark Report with EUROCONTROL/the European Commission.
- Initiate DVARS system modernization and enhancement.

2E12X, INDEPENDENT OPERATIONAL TEST AND EVALUATION

FY 2017 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 (DT), Operational Test (OT), Site Acceptance Test (SAT), and Field Familiarization, system assessments conducted prior to contract award, and R&D 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 2017-2021 – Performance Output Goals

A specific list of designated systems or modifications to be assessed will be determined at the beginning of each fiscal year.

- Develop final IOA report(s).

ACTIVITY 3: NON-AIR TRAFFIC CONTROL FACILITIES AND EQUIPMENT

A: Support Programs

3A01, HAZARDOUS MATERIALS MANAGEMENT

FY 2017 Request $31.0M

Environmental Cleanup / Hazardous Materials (HAZMAT), F13.02-00

Program Description

The Hazardous Materials Management (HAZMAT) program remediates FAA owned or leased sites that were contaminated by FAA or previous owner activities. As of the beginning of FY 2016, the FAA has identified approximately 697 contaminated sites nationwide that require investigation, remediation, and closure activities. Environmental Cleanup site investigations have indicated that toxic contamination resulted from a variety of hazardous substances including: cleaning solvents, fuels, pesticides, asbestos, polychlorinated biphenyls (PCBs), and heavy metals. FAA organizations, including the Mike Monroney Aeronautical Center and the William J. Hughes Technical Center, have mandatory remediation and monitoring schedules in place as part of negotiated agreements with regulatory agencies. 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). In addition, contaminated sites and past noncompliance with requirements of the HAZMAT program account for a large portion of the unfunded environmental liabilities documented in the FAA's Financial Statement. This program is included in the ATC Facilities Sustainment Strategic Plan.

The FAA publishes annually the Environmental Site Cleanup Report (ESCR). This document contains current and expected future cleanup activities for the 697 contaminated sites mentioned above. An estimate of out-year Environmental Remediation (ER) Liabilities is also included in this report. At the beginning of FY 2016 the ER Liability was estimated at approximately $650 million; with contingency and inflation added the ER Liability was estimated at approximately $1 billion. We continue to make good progress toward remediating these sites; however, additional sites are also added each year and some higher cost remediation sites are expected to remain open for many years or decades. During FY 2015, 129 sites were closed from the program and 118 additional sites were added to the program.

The HAZMAT program cleans these contaminated sites 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 (SARA) 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 beyond incidental contamination associated with normal FST operations (e.g., greater than 25 gallons or a foot into native soil beyond the limits of the tank pit);
- Asbestos, lead, and polychlorinated biphenyl (PCB) cleanups for spills or other releases into the environment (not including the abatement of these materials on either the interior or exterior surfaces of a structure unless the abatement is required as part of an environmental cleanup action);
- Corrective actions and hazardous waste spill responses pursuant to the Resource Conservation and Recovery Act (RCRA);
- Hazardous waste site identification activities and characterization of environmental past practices; 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The HAZMAT program supports the FAA's Performance Metric to implement cost efficiency initiatives by continuing to improve financial management of cleanup activities for contaminated sites within existing NAS land and structures. 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. These activities result in a safe and environmentally sound workplace, and protection of the natural resources of surrounding communities.

Program Plans FY 2017-2021 – Performance Output Goals

- Complete remediation activities at five percent (5%) of the total locations listed in the Environmental Site Cleanup Report, resulting in a finding that no further resources need to be applied to these sites.

3A02, Aviation Safety Analysis System (ASAS)

FY 2017 Request $11.3M

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.

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.

Scope and activities for this segment will be defined in Q1 FY 2017 at Final Investment Decision (FID).

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. In Segment 2, 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. Approximately 20% of the combined SASO and ASKME benefits are attributed to RCISS. Segment 3 analysis of the RCISS contribution to ASKME, SASO, and AMSIS quantifiable safety benefits is expected to yield similar results.

Program Plans FY 2017 – Performance Output Goals

- Achieve RCISS Segment 3 FID.
- Complete technology refresh of 25% of the safety workforce mobile toolkits with enhanced telecommunications services.
- Complete Mobility Deployment 10 contract award for annual technology refresh of safety workforce mobile toolkits.
- Complete Enterprise Data Center Deployment 10 contract award for annual technology refresh of Enterprise Data Center centralized data storage and processing equipment.
- Begin migration of select AVS safety data and applications to the cloud.

Program Plans FY 2018 – Performance Output Goals

- Complete technology refresh of 25% of the safety workforce mobile toolkits with enhanced telecommunications services.
- Complete Mobility Deployment 11 contract award for annual technology refresh of safety workforce mobile toolkits.
- Complete Enterprise Data Center Deployment 11 contract award for annual technology refresh of Enterprise Data Center centralized data storage and processing equipment.
- Complete 50% migration of select AVS safety data and applications to the cloud.

Program Plans FY 2019 – Performance Output Goals

- Complete technology refresh of 25% of the safety workforce mobile toolkits with enhanced telecommunications services.
- Complete Mobility Deployment 12 contract award for annual technology refresh of safety workforce mobile toolkits.
- Complete Enterprise Data Center Deployment 12 contract award for annual technology refresh of Enterprise Data Center centralized data storage and processing equipment.
- Complete migration of select AVS safety data and applications to the cloud.

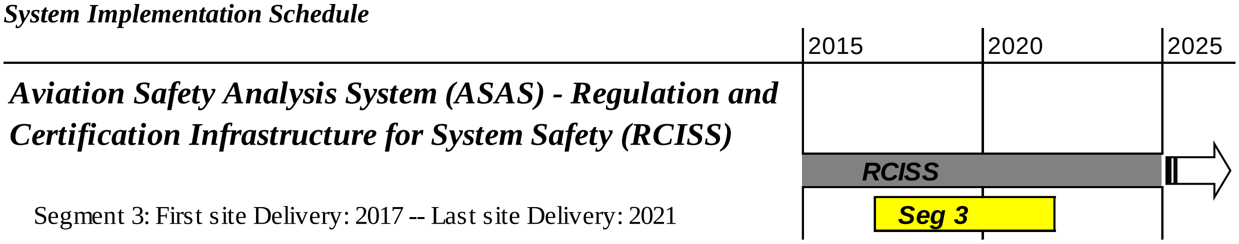
Program Plans FY 2020 – Performance Output Goals

- Complete technology refresh of 25% of the safety workforce mobile toolkits with enhanced telecommunications services.
- Complete Mobility Deployment 13 contract award for annual technology refresh of safety workforce mobile toolkits.
- Complete Enterprise Data Center Deployment 13 contract award for annual technology refresh of Enterprise Data Center centralized data storage and processing equipment.

Program Plans FY 2021 – Performance Output Goals

- Complete technology refresh of 25% of the safety workforce mobile toolkits with enhanced telecommunications services.
- Complete Mobility Deployment 14 contract award for annual technology refresh of safety workforce mobile toolkits.
- Complete Enterprise Data Center Deployment 14 contract award for annual technology refresh of Enterprise Data Center centralized data storage and processing equipment.

System Implementation Schedule



3A03, National Airspace System (NAS) Recovery Communications (RCOM)

FY 2017 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 2017 – Performance Output Goals

- Complete the site preparation and installation of VHF/FM equipment for the Cleveland District, OH.
- Complete VHF/FM network engineering, design, and equipment procurement for the Philadelphia District, PA.
- Develop a major EON application to incorporate the latest changes in requirements and technology innovation.
- Complete refresh of Audio/Visual and IT Network at Primary Alternate Facility (PAF).
- Perform vehicle upgrades and quarterly testing for CST.
- Procure secure cellular phones.
- Complete technology refresh of Project 1 Network at seven sites.
- Complete technology refresh of STEN equipment for Alaskan, Southern, and Western-Pacific Regions.
- Procure fixed satellite test system.

Program Plans FY 2018 – Performance Output Goals

- Complete the site preparation and installation of VHF/FM equipment for the Philadelphia District, PA.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Columbia District, SC.
- Complete technology refresh of the Disaster Recovery site.
- Perform vehicle upgrades and quarterly testing for CST.
- Complete technology refresh of Project 1 Network at 3 sites.
- Complete technology refresh of STEN equipment for HQ, New England, and Southwest Regions and the Mike Monroney Aeronautical Center.
- Complete technology refresh of EON Geographic Information System (GIS) hardware and software.
- Complete technology refresh of STEN Iridiums.

Program Plans FY 2019 – Performance Output Goals
- Complete the site preparation and installation of VHF/FM equipment for the Columbia District, SC.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Washington District, WA.
- Develop EON GIS application for use on mobile phones and tablets.
- Perform vehicle upgrades and quarterly testing for CST.
- Complete technology refresh of Project 1 Network at 3 sites.
- Complete technology refresh of STEN equipment for Eastern, Central, Great Lakes, and Northwest Mountain Regions.
- Complete technology refresh of M10i (Juniper) network routers.

Program Plans FY 2020 – Performance Output Goals
- Complete the site preparation and installation of VHF-FM equipment for the Washington District, WA.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Fort Worth District, TX.
- Procure data feeds and develop software to enhance EON's internal and external data sharing capabilities.
- Complete technology refresh of CST Emergency Response Vehicle communications equipment.
- Complete technology refresh of secure facsimile equipment.
- Complete technology refresh of Storage Area Network (SAN) and network switches.

Program Plans FY 2021 – Performance Output Goals
- Complete site preparation and installation of VHF-FM equipment for the Fort Worth District, TX.
- Complete the VHF/FM network engineering, design, and equipment procurement for the Chicago District, IL.
- Complete technology refresh of network servers, firewalls, routers, and video monitors.
- Perform technology refresh on facility equipment at the PAF.
- Perform EON infrastructure refresh (servers and software) to provide an enhanced resilient platform for collaborative communications, continuity of operations, and decision support
- Complete technology refresh on Homeland Security Data Network (HSDN) system.
- Complete technology refresh of COMSEC equipment.

3A04, FACILITY SECURITY RISK MANAGEMENT
FY 2017 Request $21.0M

Facility Security Risk Management (FSRM) – Two, F24.01-02

Program Description

The FSRM program was established in response to Presidential Decision Directive 63, Critical Infrastructure Protection which has been superseded by Homeland Security Presidential Directive (HSPD) 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. The program provides risk mitigation at all FAA staffed facilities. The program provides an integrated security system that includes access control, surveillance, x-ray machines, metal detection, and intrusion detection. Other upgrades 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 1075 staffed facilities. Approximately 423 of the 1075 facilities still require upgrades to install equipment to read Personal Identity Verification (PIV) 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 (SSDI), Corrective Maintenance Contract (CMC) II, and National Security Officer Services (NSOS) 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 prevents or reduces the probability of a loss of NAS service.

Program Plans FY 2017 – Performance Output Goals
- Complete PIV retrofit (405 sites). (APB milestone)
- Complete installation of X-ray machines (15 sites) by September 30, 2017.
- Complete technical refresh (30 sites).

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 (40 sites).
- Complete installation of X-ray machines (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 (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 (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 (125 sites).

3A05, INFORMATION SECURITY
FY 2017 Request $25.0M

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 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 2002, 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 Information Security & Privacy (IS&P) Directorate is a partnership between the FAA Chief Information Officer's organization and other FAA lines of business and staff offices (LOBs/SOs) with a focus on protecting FAA information and infrastructure. The Security Operations Center (SOC) provides the following services:

- Support continued cybersecurity research and development;
- 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, which provides 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.

This comprehensive 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 and infrastructure, and 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 clients. 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.

The office of the Chief Information Officer takes a comprehensive, proactive approach to preventing and isolating intrusions in the FAA's infrastructure. This cyber defense strategy involves hardening of the individual system and network elements, and isolating and backing-up those elements to avoid services disruptions.

Advanced Persistent Threat (APT) events are targeted attacks on federal government systems, which pose a serious and imminent threat to those systems. These are events specific in nature, objective and patterned. The development of the term "Advanced Persistent Threat" 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. In addition to the APT events the FAA must respond to a myriad of attacks on its systems. The FAA is evolving towards a risk-based approach to computer network defense integrating new technologies into the cyber security program to protect the FAA and enhance the capability to respond to emerging cyber threats.

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 2017 – Performance Output Goals

- Evaluate solutions and services to achieve Continuous Diagnostics and Mitigation (CDM) Phase 2 goals such as network access control management, credentials and authentication management, account access management, and security-related behavior management.
- Evaluate and deploy new technologies to combat APT.
- Validate full packet capture capability at two new strategic network points.
- Integrate advanced and evolved vulnerability and United States Government Configuration Baseline (USGCB) scanning within the FAA's IP based networks.
- Evaluate new technologies to address complex and rapidly changing cyber threats and vulnerabilities.
- Deploy Wireless Intrusion Detection/Wireless Application Protocol (WID/WAP) to 91 FAA facilities.
- Conduct software code vulnerability security analysis on 120 legacy and developmental agency systems.
- Develop architecture and engineering efforts for alternative solutions to secure new FAA systems.
- Implement PIV Card requirement for non-NAS networks to access internal FAA network (i.e. Virtual Private Network (VPN)).

Program Plans FY 2018 – Performance Output Goals

- Implement solutions and services to achieve 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 91 FAA facilities.
- Evaluate new technologies to address complex and rapidly changing cyber threats and vulnerabilities to include wireless technologies.
- 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 Wireless Intrusion Detection/Wireless Application Protocol (WID/WAP) to 91 FAA facilities.
- Evaluate new technologies to address complex and rapidly changing cyber threats and vulnerabilities to include wireless technologies.
- Complete software code vulnerability security analysis on the remaining 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.
- Evaluate new technologies to address complex and rapidly changing cyber threats and vulnerabilities to include wireless technologies.

Program Plans FY 2021 – Performance Output Goals

- Implement solutions and services to achieve CDM Phase 3 capabilities to manage events in preparing for and responding to incidents and contingencies.
- Evaluate and deploy new technologies to combat APT.
- Deploy full packet capture capability at two new strategic network points.
- Evaluate new technologies to address evolving cyber threats and vulnerabilities, to include wireless technologies.

3A06, SYSTEM APPROACH FOR SAFETY OVERSIGHT (SASO)

FY 2017 Request $17.2M

System Approach for Safety Oversight (SASO) – Phase 2b, A25.02-02

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 Flight Standards Safety Assurance System (SAS), 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 I (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 II is further developing and implementing the SAS concept for other CFR Parts pertaining to aviation. SASO Phase II is divided into two phases: Alpha and Beta. Phase II Alpha will be completed in FY 2016.

SASO Phase II Beta covers the period from FY 2015 through FY 2024. SASO Phase II Beta will address additional requirements of FAA Order VS 8000.367A. SASO Phase II Beta is divided into two segments:

- **Segment 1 (FY 2015 - FY 2024).** This segment includes the effort to enhance the basic SAS framework developed and deployed in Phase II 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. This represents an additional 7,500+ certificate holders for a combined total of over 13,000 certificates. Segment 1 also includes the development and implementation of the three remaining components of the SMS: Safety Risk Management, Safety Policy, and Safety Promotion. SASO Phase II Beta Segment 1 has been further subdivided into Segment 1a and Segment 1b. Segment 1a will focus on the highest AFS priorities, which will include SAS development for Title 14 CFR Parts 141, 142, 147 and 183. SAS functionality is also enhanced in the areas of activity recording, office workload list, risk profile, and the Certificate Services Oversight Process. Segment 1a develops and implements efficiencies in the repair station assessment process and develops SMS safety promotion through a variety of means and communication mechanisms to enhance industry collaboration. Segment 1a includes a planning effort to prepare for Segment 2, which includes an analysis of AFS business processes, systems, data management, and developing a business case. The Phase II Beta, Segment 1a Final Investment Decision (FID) is scheduled for Q2, FY 2016. Segment 1b will focus on AFS's remaining requirements, as defined in the SASO final program requirements document to complete the AFS SMS.

- **Segment 2 (FY 2018 - FY 2024).** This segment includes the implementation of an approved AFS business consolidation plan which includes: 1) system/business process consolidation; 2) system procurement and system decommissioning; 3) policy, documentation and training development; and 4) instruction to support AFS business, system consolidation and efficient data management. Upon completion of this segment, AFS business processes, systems and data management will be standardized and consolidated, thus creating efficiencies that significantly enhance AFS oversight capability. The Phase II Beta, Segment 2 FID 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

SASO supports the 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 II Alpha implemented an automation system that fulfills the first of four SMS components, Safety Assurance. SASO Phase II 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 2017 – Performance Output Goals
- Segment 1a: Complete Office Workload IPT Critical Design Review (CDR).

Program Plans FY 2018 – Performance Output Goals
- Segment 1a: Complete Critical Design Review (CDR) for SAS Functional Release 1.
- Segment 1a: Complete Development Testing 1 for SAS Functional Release 1.

Program Plans FY 2019 – Performance Output Goals
- Segment 1a: Complete Development Testing 2 for Functional Release 1.
- Segment 1a: Complete Beta Testing for SAS Functional Release 1.
- Segment 1b: Achieve Phase II Beta, Segment 1b FID.
- Segment 2: Achieve Phase II Beta, Segment 2 FID.

Program Plans FY 2020 – Performance Output Goals
- Segment 1b: Output goals will be determined at FID.
- Segment 2: Output goals will be determined at FID.

Program Plans FY 2021 – Performance Output Goals

- Segment 1b: Output goals will be determined at FID.
- Segment 2: Output goals will be determined at FID.

System Implementation Schedule

3A07, Aviation Safety Knowledge Management Environment (ASKME)

FY 2017 Request $4.2M

Aviation Safety Knowledge Management Environment (ASKME) – Segment 2, A26.01-01

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 was approved by the JRC in September 2011 to continue development and deployment of these business solutions through FY 2017.

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 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 design certification, production/ manufacturing certification, airworthiness certification, and compliance and enforcement.

Additional ASKME capabilities will help inspectors in 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 (audit) 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:

- Electronic File System (EFS) – Production Support and Historical Scanning;
- Work Tracking Software – Budget Management (WTS-BMgmt);
- Airworthiness Directives Development (ADD);
- Airworthiness Certifications; and
- Compliance and Enforcement Actions (CEA).

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 AIR 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 the collection of lessons learned as it applies to AIR's safety-related responsibilities (e.g. aircraft certification and certificate management, regulatory development, designee supervision and oversight, and operational safety). ASKME will provide AIR with a comprehensive mechanism aimed at: 1) the early identification and resolution of accident precursors; 2) the promotion of systematic and structured risk assessment/risk management practices; and 3) 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 2017 – Performance Output Goals

- Complete the portion of the ASKME Segment 2 integrated system required to provide the CEA (Compliance & Enforcement Actions) functionality. (APB milestone)
- Complete the portion of the ASKME Segment 2 integrated system required to provide the AC (Airworthiness Certification) functionality.
- Complete the portion of the ASKME Segment 2 integrated system required to provide the BMGMT (Budget Management) functionality.
- Conduct user in service training.
- Complete development, implementation and release of ASKME Segment 2. (APB milestone)

Program Plans FY 2018-2021 – Performance Output Goals

- None.

3A08, AEROSPACE MEDICAL EQUIPMENT NEEDS (AMEN)

FY 2017 Request $3.0M

- Aerospace Medical Equipment Needs (AMEN) – Phase 2, M53.01-02
- X, Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Phase 3, M53.01-03

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, 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, physicians, and engineers is becoming obsolete. This aging equipment places several accreditations at risk (i.e., American Board of Forensic Toxicologists and Quality Management Systems – ISO 9001:2008) and does not allow the FAA to keep up with science and technological advances currently available in the market.

Phase 2 includes the replacement of CAMI Human Factors Research Division's old and obsolete research laboratory assets. AMEN Phase 2 will replace 12 equipment items, all of which are 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. The AMEN Phase 2 program achieved a Final Investment Decision (FID) in October 2015 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: 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 2017 – Performance Output Goals

- Complete documentation for acquisition of the following items:
  - TAGARS
- In Service (available for use): Engineering Calibration Device (CAL)

Program Plans FY 2018 – Performance Output Goals

- Complete documentation for acquisition of the following items:
  - GATTOR
  - ARS
- In Service (available for use):
  - Anthropometric Test Device (ATD)
  - Miniature Data Acquisition System (mDAS)
  - Ultraviolet and Visible Absorption Spectroscopy (UV/VIS)
  - micro gas chromatograph (mGC)

Program Plans FY 2019 – Performance Output Goals

- In Service (available for use): ATCARS (Prior year funds)

Program Plans FY 2020 – Performance Output Goals

- In Service (available for use): TAGARS (Prior year funds)

Program Plans FY 2021 – Performance Output Goals

- In Service (available for use): (Prior year obligations)
  - GATTOR
  - ARS
  - AURS

X, Aerospace Medical Equipment & Infrastructure Needs (AMEIN) – Phase 3, M53.01-03

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.

AMEIN Phase 3 – Aerospace Medical Equipment & Infrastructure Needs (AMEIN) (Wind & Wave Evacuation and Survival (WiWAVES) Program) will provide for the continued technology refresh of CAMI aerospace medical divisions' laboratory assets.

Phase 3 of this program will replace the aging Water Survival Research Facility (WSRF) at CAMI, which was installed in 1967 and last renovated in 1983. The WSRF failed structurally in 2012 and was out of service for several months causing the suspension of all research and safety analysis activities during that time. While the WSRF was being repaired some education activities were temporarily performed at a local college swimming pool which has since been closed. Continuing deterioration of the WSRF presents a high risk of catastrophic structural failure which 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.

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 2017 – Performance Output Goals
- None.

Program Plans FY 2018 – Performance Output Goals
- Award architecture and engineering design contract for WiWAVES facility.
- Complete Engineering and Ground Studies.
- Complete Environmental Studies.

Program Plans FY 2019 – Performance Output Goals
- 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
- 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
- Award construction contract for Phase 2 (of 2) of WiWAVES facility to include construction of briefing room and support spaces (i.e., locker rooms, support equipment, control room, etc.).

3A09, NEXTGEN – SYSTEM SAFETY MANAGEMENT PORTFOLIO
FY 2017 Request $17.0M

- 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, 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 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 both new systems in NextGen and existing 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 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 also has advanced 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 than some that may remain hidden until being uncovered later in post-incident investigations. New automated processes will facilitate advanced analysis of comprehensive data which will provide new insights about potential safety risks in both the current NAS and as the NAS implements NextGen capabilities.

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 ASIAS analyses are communicated to the ASIAS participants and, as authorized by the ASIAS Executive Board (AEB), 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, 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 2017 – Performance Output Goals

- Establish an initial data sharing agreement with at least one Rotorcraft operator.
- Establish a data collection and sharing capability for the GA community using GA Flight Data Monitoring (GA-FDM) acquisition systems.
- Complete transition to AIRINC 717-based Flight Operational Quality Assurance (FOQA) analysis capability to improve big data processing efficiency.
- Develop Models and Metrics to access human factors issues related to NAS accident and incident risks.
- Develop machine learning frameworks that actively recalibrate safety metrics as behaviors change in the NAS.
- Deploy automated capabilities to alert ASIAS participants on atypical flight and system behavior using fused digital and textual data.

Program Plans FY 2018 – Performance Output Goals

- Incorporate avionics manufacturers' data into the ASIAS data set.
- Incorporate available Unmanned Aircraft Systems (UAS)/Remotely Piloted Aircraft (RPA) data into the ASIAS data set to characterize UAS operations in the NAS.
- Transition non-protected ASIAS data to a FAA cloud-based architecture for improved data storage and analytical capabilities, and for enhancing data sharing and access to other ASIAS stakeholders.
- Develop models to simulate Terrain Awareness Warning System (TAWS) alerts for both simulated and radar flight tracks; integrate capability into the FAA Terminal Area Route Generation and Traffic Simulation (TARGETS) tools for testing of new procedures.
- Develop a capability to support the distribution, collection, and management of ASIAS information through the ASIAS Tagging, Tracking, and Integration of Knowledge (ATTIK) system for improved safety analysis.

Program Plans FY 2019 – Performance Output Goals
- Incorporate engine manufacturers' data into the ASIAS data set.
- Establish a Low-Cost Helicopter Flight Data Monitoring (LC-HFDM) capability for rotorcraft participants.
- Develop capability to monitor and assess data quality for ASIAS participants' Safety Management System (SMS) and other Safety Reporting Programs.
- Develop improved risk models for trend/anomaly detection capabilities to find high-risk and anomalous flights, leveraging new data sources such as GA and Rotorcraft operational information.

Program Plans FY 2020 – Performance Output Goals
- Develop adaptive analytics (updatable models) to support near real-time and historical analysis of safety risks, leveraging other relevant FAA safety capabilities such as System Safety Management Transformation (SSMT).
- Deploy advanced visualization (e.g. 3-D) tools on the ASIAS portal that include user customized parameters and displays 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 (GA-JSC), and rotorcraft community safety risk mitigation activities.
- Develop analytical capabilities that leverage new information in NextGen, such as data from commercial space operations.
- Enhance UAS hotspot monitoring capability to enable automated altering for ASIAS community members.

B, Systems Safety Management Transformation (SSMT), G07M.02-01

Program Description

This program develops 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 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. A demonstration of a National Level System Safety Assessment working prototype will be conducted that will proactively identify emerging risks as NextGen capabilities are defined and implemented. 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 activities included in the Systems Safety Management Transformation program include:

Terminal, EnRoute and Oceanic Risk Baseline and Forecast:
Terminal Area, EnRoute 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 35 major airports.

Integrated Safety Assessment Model (ISAM) Baseline and Forecast:
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. The ISAM model will also be extended to cover worldwide accident rates and incident data through coordination with EUROCONTROL to support research conducted by the Single European Sky Air Traffic Management Research (SESAR) 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 2017 – Performance Output Goals
Terminal, EnRoute and Oceanic Risk Baseline and Forecast:
- Produce validated end-to-end estimate of complete flight track risk baselines, airport, terminal, and enroute by incorporating threaded track data.
- Produce safety risk baseline for typical Oceanic Operations – North Atlantic incorporating EUROCONTROL Integrated Risk Model inputs.
- Produce applied forecast case analysis for one complete flight track demonstration.
- Produce integration report with ISAM model.

Program Plans FY 2018 – Performance Output Goals
Integrated Safety Assessment Model Risk Baseline and Forecast:
- Produce integrated world-wide risk analysis through integration with the EUROCONTROL Risk model.
- Produce monthly NAS-wide risk metrics and report including system baselines and operational impacts of NextGen changes.
- Quantify risk analysis for a manufacturing process using an Event Sequence Diagrams and Fault Trees related to a new concept such as additive manufacturing.

Program Plans FY 2019 – Performance Output Goals
Integrated Safety Assessment Model Risk Baseline and Forecast:
- Produce daily risk analysis report for NAS-wide risk metrics including airport surface, terminal and enroute risks with wake encounter and weather related risks.
- Produce revised monthly NAS-wide risk metrics and report including system baselines and trends, reflecting commercial, general aviation and Unmanned Aircraft Systems (UAS) operations.
- Produce revised monthly commercial operations report for ATO and contract tower operations.
- Produce revised monthly NAS-wide risk forecasts, trend modeling and reporting.

Program Plans FY 2020 – Performance Output Goals
Integrated Safety Assessment Model Risk Baseline and Forecast:

- Produce daily risk analysis report for NAS-wide risk metrics including airport surface, terminal and enroute risks with wake encounter and weather related risks.
- Produce revised monthly NAS-wide risk metrics and report including system baselines and trends, reflecting commercial, general aviation and UAS operations.
- Produce revised monthly commercial operations report for ATO and contract tower operations.
- Produce revised monthly NAS-wide risk forecasts, trend modeling and reporting.

Program Plans FY 2021 – Performance Output Goals
Terminal, EnRoute and Oceanic Risk Baseline and Forecast:

- Produce validated weekly end-to-end estimate of complete flight track risk baselines, airport, terminal, and enroute, 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.

3A10, National Test Equipment Program

FY 2017 Request $5.0M

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 2017 – Performance Output Goals
- Procure and deliver 100 communication test sets.
- Procure and deliver 80 telephone test sets.
- Procure and deliver 204 cable and antenna analyzers.

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.

Program Plans FY 2019 – Performance Output Goals
- Procure and deliver 60 communication test sets.
- Procure and deliver 80 handheld vector network analyzers.

Program Plans FY 2020 – Performance Output Goals
- Procure and deliver 50 communication test sets.
- Procure and deliver 150 universal data test sets.
- Procure and deliver 158 oscilloscopes.

Program Plans FY 2021 – Performance Output Goals
- Procure and deliver 100 telephone test sets.
- Procure and deliver 400 communication test set.

3A11, MOBILE ASSETS MANAGEMENT PROGRAM

FY 2017 Request $5.8M

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, 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, TRACON facilities, remote transmitter/receiver (RTR) sites, remote communications air/ground (RCAG) 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 are in a serious state of disrepair and are often incapable of providing their intended service without first undergoing significant maintenance or repair before they can be deployed. The inventory consists of 104 assets, of which 45 are directly involved with controlling aircraft. The assets range from 30 kilowatt Mobile Engine Generators (MX) to four-position, mobile ATCTs (MATCTs). The near term priorities are to replace eight obsolete large four-position MATCTs and prioritize and restore the remaining assets in the inventory to a full operational capability. The MATCTs, which were acquired in the 1990s are experiencing material failures and must be replaced. With an increase in the frequency of ATCT modernization projects, the requirements for the use of MATCT’s, and MATCT’s with TRACON capability have also increased. MAMP is currently developing an additional modular air traffic control tower type with ability to incorporate TRACON positions and equipment. This new version, referred to as a Deployable Air Traffic Control Facility (DATCF), will be an OSHA/EOSH code compliant temporary facility designed specifically for longer term deployments of 12 months or more. Long range planning is to have and maintain an inventory of nine large MATCTs and a minimum of three DATCFs. This quantity and mix may change as the FAA’s Terminal modernization projects increase.

Presently, development of a lifecycle management program for mobile assets is ongoing, but not fully operational. As a result of this deficiency, the FAA is experiencing difficulty in providing functional mobile assets when emergency conditions require their use. 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 (MADC) has been established in the Central Service Area. The MAMP will assist the Eastern Service Area and Western Service Area in the development of designs for their Mobile Asset Deployment Centers in FY 2015. These designs are under development and efforts are ongoing to develop a business case for their construction. The Systems Support Centers (SSCs) affiliated with respective Deployment Centers will serve as property custodians of the mobile assets. Sheltered storage is mandatory. The Deployment Centers will arrange for transportation of the mobile assets to and from the event location, and verify inventory/assess condition with the receiving custodian. The Deployment Center will maintain a website schedule of the mobile assets deployments within their area of responsibility using the Mobile Asset eXchange (MAX) tool. The mobile assets will be maintained by SSC personnel supporting the MAMP Deployment Center in advance of a deployment.

Efforts are underway to develop a set 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 planned and unplanned outages in the NAS.

The MAMP is not dependent upon other CIP programs. The mobile assets that are acquired are provisioned with NAS systems that are 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 system program offices.

The 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 air traffic control towers, 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 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 2017 – Performance Output Goals
- Acquire one DATCF.
- Acquire one medium MATCT.
- Upgrade / modernize two MATCTs.

Program Plans FY 2018 – Performance Output Goals
- Acquire one DATCF.
- Upgrade / modernize two MATCTs.

Program Plans FY 2019 – Performance Output Goals
- Acquire one medium self-contained MATCT.

Program Plans FY 2020-2021 – Performance Output Goals

- None.

3A12, Aerospace Medicine Safety Information System (AMSIS)

FY 2017 Request $12.0M

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 (ATCSs);
- 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 the medical certification applications of approximately 450,000 pilots and ATCSs each year and maintains millions of medical records as part of AAM's role in the oversight of approximately 600,000 airmen and nearly 17,000 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, private sector and voluntary standards organizations, including the International Organization for Standardization (ISO). The systems must successfully and securely interface with approximately 4,250 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, AMSIS will use a segmented implementation approach. Mature requirements will be included in Segment 1, and requirements that require additional analysis will be included in Segment 2.

The scope of each Segment is:

Segment 1 (Mature Requirements)

- Common 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

AMSIS received an affirmative Initial Investment Decision (IID) on December 17, 2014, and the segmentation strategy was approved by the JRC at that time. The AMSIS 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 Q4 FY2016; the Segment 2 FID is planned for FY2018.

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 better 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 2017 – Performance Output Goals

- Prime solution contract award.
- Complete System Design (Segment 1).

Program Plans FY 2018 – Performance Output Goals

- Initiate System Development (Segment 1).
- Initiate Integration and Testing (Segment 1).
- Achieve Final Investment Decision (FID) (Segment 2).

Program Plans FY 2019 – Performance Output Goals

- Complete System Design (Segment 2).
- Initiate System Development (Segment 2).
- Initiate Integration and Testing (Segment 2).

Program Plans FY 2020 – Performance Output Goals

- Complete System Development (Segment 1).
- Complete Integration and Testing (Segment 1).
- Achieve Final Operational Capability (FOC) (Segment 1).

Program Plans FY 2021 – Performance Output Goals
- Achieve Final Operational Capability (FOC) (Segment 2).
- Complete program close-out.

3A13, Tower Simulation System (TSS) Technology Refresh
FY 2017 Request $3.0M

National Airspace System (NAS) Training - Equipment Modernization – Training Simulators – Tower Simulation System, M20.01-04

Program Description

The Tower Simulation System (TSS) equipment modernization program will update obsolete tower simulation equipment and analyze the potential for adding new airport locations and satellite facilities. The TSS is currently deployed at 32 sites and supports 117 tower facilities. 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 replaced with updated visual technology and video processors to increase fidelity, processing power, and reduce maintenance costs. The program will replace equipment at the 32 sites and procure mobile platforms to provide training capability at locations that do not require a permanent system. The mobile platforms will provide training at a greatly reduced cost.

The Investment Analysis Readiness Decision was completed and approved 1Q FY 2016. Final Investment Decision is planned for 1Q 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017 – Performance Output Goals
- Procure and install updated TSS equipment at 11 locations.

Program Plans FY 2018 – Performance Output Goals

- Procure and install updated TSS equipment at 18 locations.
- Procure 6 Small Mobile Systems and 6 Suitcase Systems.

Program Plans FY 2019-2021 – Performance Output Goals

- None.

3A14X, LOGISTICS SUPPORT SYSTEM AND FACILITIES (LSSF)

FY 2017 Request $0.0M

X, Logistics Center Support System (LCSS) – Technology Refresh, M21.04-02

Program Description

The Logistics Center Support System (LCSS) is a mission support IT procurement that re-engineers and automates the FAA's logistics management processes. LCSS is a modern Commercial Off-the-Shelf (COTS) Enterprise Resource Planning (ERP) system, utilizing object-oriented software design, service-oriented architecture, relational databases, and a web-based user interface. The program modernizes the FAA's supply chain management by refreshing the COTS system starting in 2021.

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, by 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 over 8,091 FAA customers at facilities nationwide, as well as, to the Department of Defense (Air Force, Navy, and Army), state agencies, and foreign countries.

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 Strategic Priority to Deliver Benefits through Technology and Infrastructure with enhanced 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 2017-2020 – Performance Output Goals

- None.

Program Plans FY 2021 – Performance Output Goals

- Develop program plans and requirements document for the Technology Refresh phase of the program.

B: Training, Equipment, and Facilities

3B01, AERONAUTICAL CENTER INFRASTRUCTURE MODERNIZATION
FY 2017 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 renovation, building system replacement, and telecommunications infrastructure upgrade.

The Aeronautical Center is the FAA's centralized location that supports the FAA NAS and comprises 1,100 acres of leased land with approximately 3.4 million square feet of space under roof and is home to the largest concentration of FAA personnel outside of Washington D.C. Each day the Aeronautical Center provides the 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 nearing 50 years of age 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 heating, ventilation, air conditioning, 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 when compared with 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 2017 – Performance Output Goals

- Complete renovation construction of Bldg 152, the Environmental Systems Support facility.
- Award Phase 1 (of 2) renovation construction contract for Multi-Purpose Building #24 to add seismic and wind bracing to mitigate earthquake and high wind damage.
- Complete relocation and construction of Common Air Route Surveillance Radar (CARSR) classrooms and laboratories to the west side of the campus.
- Award contracts for Phase (6 of 6) telecom network design, test, reconfigure network for redundancy, reliability, and security in 9 of 74 buildings. Includes security upgrades, disaster recovery testing, installation of communication duct banks, fiber/copper cable for southeast campus network diversity and availability.
- Complete network design, test, reconfiguration, security upgrades, disaster recovery testing and installation of communication duct banks/fiber cable.

Program Plans FY 2018 – Performance Output Goals

- Award construction design contracts to relocate classrooms and laboratories for the Air Surveillance Radar (ASR) to the west side of the campus.
- 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. The building is the workplace for approximately 500 FAA employees and contractors.
- 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.
- Award contracts for Phase 1 (of 6) telecom network design, test, reconfigure network for redundancy, reliability, security in 14 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 recovery testing, and installation of communication duct banks/fiber cable.

Program Plans FY 2019 – Performance Output Goals

- 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 recovery testing, and installation of communication duct banks/fiber cable.

Program Plans FY 2020 – Performance Output Goals

- 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 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 recovery testing, and east campus communication duct banks/fiber installation.

Program Plans FY 2021 – Performance Output Goals

- Complete construction to relocate classrooms and laboratories for the Air Surveillance Radar (ASR/Mode S) to the west side of the campus.
- Complete Phase 2 (of 2) of Multi-Purpose Building #24 renovation construction 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 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 recovery testing, and north campus communication duct banks/fiber installation.

3B02, Distance Learning

FY 2017 Request $1.5M

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) at all DLP learning centers, to increase connectivity, and upgrade network multimedia support and services. The system consists of about 1,100 learning centers located at virtually every FAA facility around the world: 2,275 DLPs at 610 Air Traffic Sites (includes 235 Federal Contract Towers (FCTs)) and 490 technical operations sites). The FAA is providing the technology refresh of the DLPs for two reasons: (1) to support high-performance media and simulations required in many lessons; and (2) because replacement parts for current platforms are becoming obsolete and hard to obtain.

The technology refresh is accomplished in a phased, multi-year approach. The FY 2014 technology refresh began a new technology refresh cycle which covers the years FY2014 – FY2017. A new five year technology refresh cycle will begin in FY 2018 and will run through 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 7 – Achieve documented cost savings and cost avoidance of $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The major benefit of distance learning is the substantial reduction in student time away from work, student travel, and per diem costs associated with resident-based training. In addition, distance learning delivery methods increase training effectiveness and opportunities for all FAA employees, as well as provide flexibility in training schedules through local management control. 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 the space it would occupy is reduced. All of these factors contribute to a reduction in the unit cost of service for en route, terminal, and flight service. The program contributes well over $18M savings in travel and per diem each year.

Program Plans FY 2017 – Performance Output Goals

- Award contract for technology refresh of remaining 400 DLPs (2275 of 2275, 100%) at Air Traffic Control-Technical Operations (ATO-TO) FCT learning centers by Sept-2017.
- Provide updates to courseware and applications via network and/or DVD's to 2275 DLPs by Sept-2017.

Program Plans FY 2018 – Performance Output Goals

- Award contract for technology refresh of initial 475 DLPs (475 of 2275, 21%) 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 450 DLPs (925 of 2275, 41%) 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 450 DLPs (1375 of 2275, 60%) 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 450 DLPs (1,875 of 2275, 80%) 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.

System Implementation Schedule

ACTIVITY 4: FACILITIES AND EQUIPMENT MISSION SUPPORT

4A01, System Engineering (SE2020) and Development Support

FY 2017 Request $35.0M

- A, CIP Systems Engineering & Development Support – SE2020, 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 – SE2020, M03.03-01

Program Description

The System Engineering 2020/2025 (SE2020/SE2025) 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 activities necessary to reach the Concept and Requirements Definition Readiness Decision (CRDRD) phase 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The SE2020/SE2025 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 2017-2021 – Performance Output Goals
<u>SE2020/SE2025 Contract:</u>
- Conduct Monthly meetings with 2020/2025 vendors.
- Conduct Quarterly Vendor Program Management Reviews.
- Conduct CFO Quarterly Reviews.
- Develop Contract and Financial Status Report (monthly basis).
- Develop 2020/2025 Update to FAA NextGen Executive Team (monthly basis).
- Conduct Monthly briefings for NextGen Directorates with SE2020/SE2025 task orders.
- Exercise Second Option Period for 2020 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 to support management dashboards and their relation to NextGen Advisory Council metrics.
- Conduct Post Implementation Reviews (PIR).
- 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 (SPIRE), FAA Acquisition System Toolset (FAST), Financial Management System (FMS), 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 ATO organizations to solve unforeseen issues that arise. These issues may be related to immediate needs such as: corrective action in information technology, e.g., installing a communications link for a new facility or service; or accommodating new requirements that require adjusting financial management systems to create new cost accounting reports. It also covers responding to emergency unforeseen regional problems such as relocating an antenna for a remote communication facility. These projects are unexpected and must be done 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017-2021 – Performance Output Goals
- Implement projects as required and approved in the budget year.

4A02, PROGRAM SUPPORT LEASES
FY 2017 Request $46.6M

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 which may encompass a variety of reasons since the last agreement was signed including 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017-2021 – 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 SUPPORT SERVICES (LSS)

FY 2017 Request $11.0M

NAS Regional/Center Logistics Support Services, M05.00-00

Program Description

The Logistics Support Services (LSS) program uses contractor support services at the Mike Monroney Aeronautical Center (MMAC), the William J. Hughes Technical Center, the three FAA Service Areas, and FAA Headquarters. This contractor support assists the FAA in contracting, real estate, and materiel management tasks. The contract is managed by the FAA's Aviation Logistics Division in direct support of Capital Investment Plan (CIP) projects, accounting system capitalization, and property control-related activities.

The LSS program supplements the workforce for acquisition, real estate, and materiel management in the three Logistics Service Areas and at the Aeronautical and Technical Centers. 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, FAA Technical Center, and FAA Aeronautical 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 2017 – Performance Output Goals

- Complete 92% 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 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 for a follow-on LSS contract to be awarded in FY 2019.
- 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.

4A04, MIKE MONRONEY AERONAUTICAL CENTER LEASES

FY 2017 Request $19.3M

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 Aeronautical Center space, which encompasses 2.8M square feet of leased space and 1,100 acres of land, having a replacement value of $696M.

The Aeronautical Center is the FAA's centralized location that supports FAA Air Operations/flight checks fleet of aircraft, engineering, system testing, training (Radar/Navigational Aids (Navaids)), NAS logistics, aviation regulation, registration, certification, aviation and transportation safety research, and Business Services in Oklahoma City.

The Center facilities support the work of 7,100 employees, students, and contractors on a daily basis, and accommodate approximately 11,000 visitors annually. It has the largest concentration of FAA personnel outside of Washington D.C.

The lease is comprised of:

- Master Lease land/building rent, sustainment and insurance
- Thomas Road warehouse lease
- Tower space for Terminal Doppler Weather Radar (TDWR) target generators

The Aeronautical Center requires large parcels of land as NAS test sites for surveillance radar, communications, weather, and navigation/landing systems, as well as warehouse, administrative office space, and training facilities. It is a 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 lease will expire 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The Mike Monroney 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 Navaids. An additional 13% of Aeronautical Center space provides business service facilities for DOT/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, $17.63 per net square foot compared to the $25.04 General Services Administration (GSA) rate for Oklahoma City; a $14.1M cost avoidance in FY 2015. Leasing is more cost effective than investing in the $696M replacement cost of the leased facilities.

Program Plans FY 2017 – Performance Output Goals

- Complete monthly lease payments on time.
- Award renovation construction contracts to replace lighting, insulation in Building 2; replace elevators in Bldgs 22 and 25, replace Heating, Ventilation, Air Conditioning (HVAC) in Hangars 8 & 9; replace windows, HVAC and electrical systems (Boiler, Chillers), and install fire suppression in Building 15.
- Award construction contract for north loop roadway for student and employee access to east side of campus.
- Award renovation design contract for the Radar Training Facility (RTF) to replace mechanical systems, (HVAC), electrical systems, plumbing, and provide energy efficiency in lighting and insulation.

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 renovation design of the Systems Training Building (STB) annex to replace interior finishes, electrical distribution, mechanical systems (HVAC); telecommunications, lighting and insulation.

Program Plans FY 2019 – Performance Output Goals

- Complete monthly lease payments on time.
- Award renovation construction contract for STB annex.
- Award renovation design contract to remove the Airmen Records Building (ARB) exterior façade, install insulation/vapor barrier, and replace panels for energy efficiency.
- Award construction of solar panels (Phase 1 of 2).
- Complete renovation construction in Building 15.

Program Plans FY 2020 – Performance Output Goals

- Complete monthly lease payments on time.
- Award renovation construction contract for the RTF building.
- Award exterior façade construction contract for the ARB building.
- Award construction of solar panels (Phase 2 of 2).
- Complete north loop roadway to access east campus.

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.

4A05, TRANSITION ENGINEERING SUPPORT

FY 2017 Request $24.1M

- 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 (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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The NISC program has provided numerous innovations that have provided cost savings to the FAA and to industry. For example, the NISC program is providing an Intelligent Records Management system to AVS. By integrating Commercial-off-the-Shelf (COTS) software with some custom software, the FAA will realize a cost savings of $340,000 during development. Additionally, on-going support costs will be lower since the solution incorporates COTS with only limited use of proprietary software. The FAA's NISC contract provides experienced personnel at a current average cost of $71 per hour. This cost effective rate supports the ATO 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, and process improvements which has resulted in both significant cost savings and cost avoidance.

Program Plans FY 2017-2021 – Performance Output Goals

- Achieve 100% of the quality requirements as defined in the NISC Task Orders.

B, Configuration Management Automation (CMA), M03.01-02

Program Description

The CMA program will procure 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 Configuration Management (CM):

- CM planning and management,
- Configuration identification,
- Configuration control,
- Configuration status accounting, and
- Configuration audits.

The goal of configuration management 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 so that maintenance workers and replacement programs have accurate and up to date information for maintaining or replacing existing systems.

CMA 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.

In addition, the program will host the CMA servers and provide associated training for users, and supply maintenance to the system.

CMA will be implemented in two Segments:

Segment I replaces the legacy systems (WebCM and RepCON) that support the NAS with a modern CM COTS tool that delivers current capabilities and offers all the advantages of today's technology. In addition to implementing a new tool to replace current capabilities, Segment I will provide:

- A closed-loop NAS Change Proposal (NCP) process, where approved configuration changes and implementation actions are reflected in tools and stakeholders are notified
- A CM environment with a single point of access for users to obtain accurate, traceable and up-to-date CM information from the following systems:
    - Remote Monitoring and Logging System (RLMS), Facility Power Panel Schedule (FPPS), Safety Risk Management Tracking System (SRMTS), Technicians Network (TechNET), NAS Documentation (NASDOC), NAS Technical Library, ProjectWise Electronic Drawing Management System (EDMS), Federal Identity Credential and Access Management (FICAM), Active Directory, and NAS EA).

Segment II includes requirements for the development of system interfaces and workflows necessary to support CM for Non-NAS systems. Segment II will leverage the Business Process Management (BPM) functionality and document management technology implemented in Segment I to deliver an integrated approach to configuration management across various FAA lines of business. Segment II will include interfaces with Supply Chain Optimization Portfolio to work toward a Reliability Centered Maintenance (RCM) philosophy. Each phase will be implemented in a separate fiscal year to accommodate limited funding resources.

A Final Investment Decision is planned for June 2016.

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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

The decommissioning of legacy NAS systems as NextGen equipment is installed requires accurate records of the configuration of present systems. Knowing the configuration of present systems and the changes needed to install new systems will result in FAA cost savings in both the short and long term. CMA is the tool that supports the planning required for both the removal of older equipment and fielding of new systems.

CMA will move FAA from a process that relies heavily on CM practitioners' institutional knowledge to giving them 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 inaccurate results. CMA will create the 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;
- Providing a cost efficient seamless enterprise-wide access to a repository of validated, real-time CM data which will reduce reviewers time and effort; and
- Standardizing CM processes which will result in a more efficient and effective management of the change process.

Program Plans FY 2017 – Performance Output Goals

- Achieve Final Operational Capabilities and In-Service Decision for Segment I.

Program Plans FY 2018 – Performance Output Goals

- Achieve implementation of Segment II capability to achieve enterprise visibility of Non-NAS IT assets.

Program Plans FY 2019 – Performance Output Goals

- Achieve implementation of Segment II to move to a deeper level of configuration management (from system to level to Lowest Replaceable Unit level).

Program Plans FY 2020-2021 – Performance Output Goals

- None.

4A06, TECHNICAL SUPPORT SERVICES CONTRACT (TSSC)

FY 2017 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 will provide approximately 500 Full Time Equivalent (FTE) of technical employee workforce capability and will monitor $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 are applied to the TSSC contract to support specific projects and tasks for which programs 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

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 2017-2021 – 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 2017 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 measuring performance of projects. The CWP helps users to share and coordinate FAA's project data during the various stages of implementation (i.e., planning, scheduling, budgeting, execution, and closeout). The CWP system and its supporting data are continuously used for reporting project metrics to project managers, responsible engineers, program offices, 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 2015. (FAA Business Planning Metric)*

Relationship to Performance Metric

The RTP/CWP contributes to FAA performance metric to maintain 90% of major system investments within 10% variance 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 2017-2021 – 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 2017 Request $60.0M

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 Sponsoring Agreement with the MITRE Corporation. The latest Sponsoring Agreement was executed in September 2015 and provides for continued FFRDC operations through FY 2020. The FAA has funded the CAASD FFRDC's support efforts under a series of support contracts since 1990. Currently FFRDC support is provided under the CAASD Contract's Option running from FY 2016 through FY 2020.

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 create the National Aviation Research Plan (NARP).

The CAASD ***Product-Based Work Plan*** (PBWP) defines an outcome-based program of technically complex research, development, and system engineering activities. Benefits 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 support FAA decision making and contribute to objective accomplishment.

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 including the closely spaced Paired Approach concept. 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. Conduct spectrum analysis focusing on strategic issues related to the availability of adequate spectrum resources. Participate in the development of international standards and harmonization. Develop transition strategies for the FAA's NextGen Voice Communications System (NVS).

Unmanned Aircraft Systems: Provide technical analyses supporting strategic solutions for managing UAS integration into the NAS and NextGen. Partner with other Government Agencies' FFRDCs in actively researching improved access for public UASs and facilitating cross-agency joint solutions. 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 (IDEA) laboratory infrastructure. Provide a data repository system that allows efficient access to aviation data and associated tools.

Mission-Oriented Investigation and Experimentation (MOIE): Develop tools and techniques for studying NAS capacity, throughput, performance, system dynamics and adaptation to technology and policy-driven change.

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

The 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 2017-2021 – Performance Output Goals

- Complete on-time 90% of the activities identified in the Product-Based Work Plan for the year.
- Update the Long Range Plan budget exhibit each year.
- Conduct Quarterly Reviews of CAASD progress.
- Conduct two FFRDC Executive Board milestone meetings per year.

4A09, NEXTGEN – AERONAUTICAL INFORMATION MANAGEMENT PROGRAM
FY 2017 Request $10.4M

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, 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.

<u>AIM Modernization Segment 2 (G05A.02-05):</u>
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 other types of aeronautical information, including the Federal NOTAM System; and
- Release 3 subsumes the NAS Resource (NASR) system and finalizes remaining capabilities.

Schedule to meet Final Investment Decision (FID):

- Investment Analysis Readiness Decision – Completed in February 2013
- AIM Modernization Segment 2 Initial Investment Decision – Completed in November 2013
- Release of the Screening Information Request for software development contract supporting AIM Modernization Segment 2 – Completed in January 2014
- AIM Modernization Segment 2 FID – 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:

- Concept and Requirements Definition Readiness Decision is scheduled for Q2 FY 2016;
- 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 2017 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- Complete Release 2 Operational Test and Evaluation. (APB Milestone)
- Achieve Operational Capability for Release 2. (APB Milestone)
- Complete Release 3 code development and development of test procedures.

AIM Modernization Segment 3 (G05A.02-06):

- None.

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):

- Develop documents related to pre-implementation for AIMM S3, including:
    - Statement of Work
    - Independent Government Cost Estimate

Program Plans FY 2019 – Performance Output Goals

AIM Modernization Segment 2 (G05A.02-05):

- Complete post implementation review for any identified trouble reports.

AIM Modernization Segment 3 (G05A.02-06):

- Complete acquisition activities including:
    - Acquisition strategy
    - Statement of Work
    - Proposal Evaluations
    - 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):

- Exercise contract option for Segment 3.
- Complete PDR for Release 1 that includes the final SSS and VRTM, and draft Release 1 SRS, SDD and WSDD.
- Complete DDR 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 DDR 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.

4A10, NEXTGEN – CROSS AGENCY NEXTGEN MANAGEMENT

FY 2017 Request $2.0M

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, and Department of Defense. Activities conducted under 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 $50.27 million in FY 2016. (FAA Business Planning Metric)*

Relationship to Performance Metric

Upgrading current NAS technology and infrastructure to support NextGen requires collaboration with both industry and partner agencies. Without a dedicated interagency focus, increased costs and schedule delays are possible if data sharing and all Federal surveillance requirements for NextGen are not identified when required. The Cross Agency NextGen Management program will provide the timely coordination needed between all Federal NextGen partners. Without this program FAA's ability to leverage potentially cost saving research and expertise from other agencies would also be reduced.

Program Plans FY 2017 – Performance Output Goals

- Complete Multiagency Aviation Cyber Exercise After Action Report 2017 edition including recommendations, cyber R&D, and shortfall analysis (e.g. Annual National-level CYBERGUARD).
- Complete and submit the NextGen Research-to-Operations (R2O) Projects 2017 progress report to NextGen Executive Weather Panel (NEWP).
- Complete Multiagency Integrated Surveillance Strategy and progress reports 2017 edition.
- Complete and submit the Research Transition Team status report for NextGen Executive Board report 2017 edition.
- Develop Partner Agency Unmanned Aircraft System (UAS) RE&D Roadmap
- Cross Agency NextGen 2016 initiatives integrated in the NAS Enterprise Architecture. Includes development of an FAA Enterprise Information System Security Architecture; and NAS EA Service and Infrastructure Roadmap Annual Update.
- Conduct Cybersecurity studies to ensure safe data exchange of NAS with our Partner Agencies.
- Incorporate long-term NASA Air Traffic Management (ATM) concepts into the NextGen cost-benefit analysis.

Program Plans FY 2018-2021 – Performance Output Goals

- Coordinate across partner agencies on the future of the aviation transportation system through collaboration on architecture and work plans.
- Complete coordination of a multi-agency plan for NextGen research to include up-to-date schedules and dependencies for activities endorsed by the Senior Policy Committee and approved by the NextGen Executive Board.
- Complete coordination of a multi-agency plan for research (including schedules and dependencies), and integrate the transition of high-priority multiagency NextGen R&D to support NextGen implementation.
- Complete coordination of a multi-agency plan in the architecture framework for NextGen implementation to include schedules and dependencies.

- Complete coordination of a multi-agency plan for the NAS Enterprise Architecture to support NextGen implementation to include schedules and dependencies.
- Manage inter-agency special studies and activities to mitigate risk and ensure that critical NextGen interoperability requirements are established for cross-agency harmonization.
- Develop and conduct Cybersecurity evaluations.
- Develop cost/benefit analyses in support of high-priority multi-agency planning and R&D initiatives.

ACTIVITY 6: ADS-B SERVICES AND WAAS GEOS

6A01, ADS-B SERVICES AND WAAS GEOS
FY 2017 Request $150.3M

- A, Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services, G02S.03-05
- B, Wide Area Augmentation System (WAAS) – Phase IV Segment 1 Sustain Leased Services, N12.01-09 / X, Wide Area Augmentation System (WAAS) – Phase IV Segment 2 Sustain Leased Services, N12.01-10

A, Automatic Dependent Surveillance Broadcast (ADS-B) – Sustain Leased Services, G02S.03-05

Program Description

This program continues the FAA subscription for ADS-B Baseline Services delivered by the prime contractor utilizing contractor owned and operated ADS-B infrastructure in place in the NAS. Performance-based service fees support the operation of the system, any necessary upgrades, and modernization. Subscription charges to the prime contractor consist of Service Establishment Charges for new service volumes and annual subscription charges to provide essential services to existing service volumes.

The program also provides for the Colorado WAM project which is operating a Multilateration surveillance service capability providing aircraft location information to the automation system at Denver ARTCC, allowing controllers to provide separation services at four Colorado airports (Durango, Gunnison, Montrose and Telluride).

ADS-B consists of a network of more than 630 Ground-Based Transceivers broadcasting across more than 300 service volumes. Service volumes are pre-determined volumes of airspace where ADS-B services are provided by using one or more ground-based transmitters. Each control area, Terminal or En Route Control, is made up of one or more service volumes.

ADS-B is an advanced surveillance technology that provides highly accurate and comprehensive surveillance information. Aircraft position, longitude, latitude, altitude, and time, is determined using the Global Navigation Satellite System, 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 for a periodic broadcast transmission, typically once a second, to airborne and ground-based ADS-B receivers. The information will be used to display aircraft position on en route and terminal automation systems such as Common Automated Radar Tracking System, Standard Terminal Automation Replacement System, Microprocessor En Route Automated Radar Tracking System, En Route Automation Modernization, and Advanced Technologies and Oceanic Procedures.

This system is an essential element of NextGen and supports implementation of the Operational Improvements that make air travel more efficient and safe. See also the main ADS-B program under G02S.03-01.

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 better use of existing airspace. This should result in more efficient use of airspace capacity, result in fewer delays, and enable optimal routing for aircraft. Other efficiency benefits include reductions in weather deviations, and reduced cancellations resulting from increased access to some Alaskan regions during reduced weather conditions. The efficiency benefits translate to savings in aircraft direct operating costs and to passenger value of time. The Business Case Analysis Report dated May 15, 2012 shows $3.2B in capacity and efficiency benefits.

Program Plans FY 2017-2020 – Performance Output Goals

- Provide service at more than 630 radio stations and more than 300 service volumes within specified requirements.

Program Plans FY 2021 – Performance Output Goals

- None.

B, Wide Area Augmentation System (WAAS) – Phase IV Segment 1 Sustain Leased Services, N12.01-09 / X, Wide Area Augmentation System (WAAS) – Phase IV Segment 2 Sustain Leased Services, N12.01-10

Program Description

The WAAS requires a minimum of three commercial geostationary satellites (GEOs) to meet its performance requirements. This program funds the required leased services for the 3 WAAS GEOs.

WAAS consists of a network of 38 precisely located ground reference stations distributed across the continental United States, Mexico and Canada that monitor global positioning system (GPS) satellite signals. Three master stations collect the 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 GEOs. 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. See also the main WAAS program under N12.01-07 and N12.01-08.

WAAS – Phase IV Segment 1 Sustain Leased Services (N12.01-09):
The Sustain Lease Services program funds the leases for the GEOs needed for WAAS.

WAAS – Phase IV Segment 2 Sustain Leased Services (N12.01-10):
The Sustain Lease Services program funds the leases for the GEOs needed for WAAS.

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 the terminal area and while conducting approach operations, a Flight Safety Foundation Report found that there is nearly an 8 fold reduction in approach accident rates (53 per million for non-precision approaches vs. 7 per million for precision approaches) when precision vs. 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 3.567 LPVs, as of September 2015.

Program Plans FY 2017-2019 – Performance Output Goals

WAAS – Phase IV Segment 1 Sustain Leased Services (N12.01-09):

- Provide leases for three WAAS geostationary satellites.

WAAS – Phase IV Segment 2 Sustain Leased Services (N12.01-10):

- None.

Program Plans FY 2020-2021 – Performance Output Goals

WAAS – Phase IV Segment 1 Sustain Leased Services (N12.01-09):

- None.

WAAS – Phase IV Segment 2 Sustain Leased Services (N12.01-10):

- Provide leases for three WAAS geostationary satellites.