Federal Aviation Administration

NATIONAL AIRSPACE SYSTEM CAPITAL INVESTMENT PLAN

FY2023–2027

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1 Capital Investment Plan (CIP) Overview

The Federal Aviation Administration (FAA) National Airspace System (NAS) Capital Investment Plan (CIP) identifies the capital investments required for a five-year period to sustain and modernize the infrastructure, systems, and services required for the safe and efficient operation of the NAS.

The FY 2023-2027 CIP Overview provides information on NAS programs and services. The CIP Overview includes the NAS Enterprise Architecture (EA) Roadmaps that highlight a 15-year view of NAS modernization and a list of capital investments associated with each Roadmap.

In addition, the CIP briefly describes the Next Generation Air Transportation System (NextGen) supported by budget portfolios and identifies aviation safety, facilities, and mission support programs. This CIP Overview, as well as previous versions, will be available at http://www.faa.gov/air_traffic/publications/cip.

1.1 CIP Development

The CIP is an integral part of the FAA's near-, mid-, and long-term planning and budgeting process. To develop the CIP, the FAA follows an annual process. Inputs come from the strategic plan, congressional direction and appropriation, and programs adjusting their goals based on other factors that affect their schedule. The FAA considers funding targets when developing the budget and setting funding levels for programs beyond the budget. The CIP development process includes a full review of the NAS EA Roadmaps to ensure that the program schedules shown are consistent with the President's Budget request and approved funding in the five-year CIP.

1.2 Five-Year Capital Investment Plan Priorities

Maintaining a balanced portfolio of capital investments each year is necessary to ensure the continued sustainment and modernization of the NAS. This process is integral to deliver new capabilities that will meet projected air transportation demands. The CIP goes through a rigorous process developing, planning, and prioritizing expected program outcomes for review and approval by decision makers.

Selected prioritized investments from 89 Facility and Equipment (F&E) Programs are highlighted below:

Terminal Air Traffic Control Facilities Replacement –This program is intended to replace those FAA-owned towers and TRACONs that no longer meet operational requirements and have sustainability gaps. The average age of Air Traffic Control Towers in the FAA portfolio is 33 years, and the average age of a Terminal Radar Approach Control facility is 26 years. There are facilities that are 65 years old. In some cases, Air Traffic Control

Towers and Terminal Radar Approach Control facilities built 20 years ago do not meet today's Occupational Safety and Health Administration, operational, and building requirements. Many facilities were not built to meet today's technological needs and this program provides the most efficient method for the FAA to meet operational needs and conform to current building codes and design standards. This program provides the means for FAA to embark on a long needed replacement cycle for outdated terminal facilities infrastructure.

Air Route Traffic Control Center (ARTCC) and Combined Control Facility (CCF) Building Improvements – Major construction projects will replace obsolete plant equipment and improve work areas. These projects include replacement of chillers, cooling towers and associated mechanical and electrical system elements necessary for cooling national airspace system electronics and computer equipment. Fire detection systems that have exceeded life expectancy and not supported by the manufacturer will be replaced. The new systems will be more efficient and reduce energy consumption at the facilities.

Electrical Power System Sustain/Support – The Power program undertakes the replacement, refurbishment, purchase, and installation of components that sustain national airspace electrical power infrastructure. Mitigating commercial power disruption ensures that air traffic operations can continue uninterrupted.

Unstaffed Infrastructure Sustainment (UIS) – The UIS program sustains national airspace supporting infrastructure at approximately 12,000 sites in the national airspace system. This will continue to enable the reliable and continuous operations of surveillance, navigation, communication, and weather equipment. Unstaffed infrastructure protects electronic equipment from weather hazards and unauthorized entry.

En Route Automation – The En Route Automation Modernization (ERAM) Enhancements include improvements to trajectory modeling, increased conflict detection and resolution capabilities to support separation management, and expand the automated coordination of flight data and aircraft control with the Canadian Air Navigation Service Provider (Nav Canada).

Automatic Dependent Surveillance – Broadcast (ADS-B) NAS Wide Implementation (ADS-B) – Continued implementation of ADS-B will provide more efficient use of airspace capacity, fewer flight delays, and more optimal routing for aircraft. Other efficiencies include reduced weather deviations and fewer cancellations during inclement weather conditions. ADS-B increases access to some Alaskan regions and Gulf of Mexico oil platforms.

Data Communications (Data Comm) – Data Comm will reduce operational errors associated with communications, enhancing the safety and efficiency of the National Airspace System. Data Comm will also reduce environmental impact of aviation operations due to less fuel burn and fewer emissions. The program will improve National Airspace System capacity and reduce delays resulting in passenger value of time savings.

Terminal Automation – Standard Terminal Automation Replacement System (STARS) is the principal tool used by air traffic controllers in and around airport terminal facilities for controlling aircraft. STARS infrastructure can be expanded and extended to meet increased traffic demands and accommodate the introduction of new automation functions necessary for improved safety, efficiency, and capacity.

Terminal Flight Data Manager (TFDM) – This program focuses on gaining efficient flow and management of aircraft on the surface at selected Metroplex airports and complex terminal airspaces within the national airspace system. High density airports typically see higher demand for runway capacity, operate multiple runways, and have complex airspace and ground interactions in the arrival and departure phases of flight. The surface capabilities resulting from this program will improve both the efficiency of individual flights, while optimizing runway throughput.

Unmanned Aircraft Systems (UAS) – The UAS programs will enable UAS operations in the national airspace system without impacting manned aircraft operations and creating disruptions or delays, and ensuring operations will be as safe as or safer than they are today. Improvements to national airspace system capabilities and operations will provide an integrated framework approach to addressing needs and solutions for safety and efficiency.

Terminal and En Route Surveillance Portfolio – Primary and secondary surveillance systems-outages contribute significantly to aircraft arrival and departure delays at major airports throughout the United States. The sustainment work under this portfolio will increase equipment and service availability, while reducing operational delays.

Terminal and En Route Voice Switch and Recorder Portfolio – Voice recorders are used by the FAA for recording voice conversations between air traffic controllers, pilots, and ground-based personnel. Recorded conversations are used in the investigation of accidents, incidents, and in the routine evaluation of air traffic operations. This program addresses reliability and availability concerns associated with deployed voice recorder models that are becoming obsolete and unsupportable.

Landing and Lighting Portfolio – This portfolio contains critical ground infrastructure that collectively enables all aircraft to navigate the established aircraft routes in the sky as well as the ability to safely descend and land on the airport runway. The work under this portfolio includes assessment of the systems to determine the need for system relocations, operational modifications, sustainment work to maintain and/or improve system performance, and to procure and install systems as needed.

The FAA’s FY 2023-2027 CIP provides a balanced portfolio of capital programs for the modernization and sustainment of systems and critical NAS infrastructure, integration of UAS operations into the NAS, and the operationalization of NextGen.

The Joint Resources Council (JRC)

The multi-year view of the CIP shows expected lead time for program acquisition planning including investment analysis, preparation of required documentation, and proposed schedule for investment decision briefings to the Joint Resources Council (JRC), as required by FAA's Acquisition Management System (AMS). Typical JRC investment decision milestones include Concept Requirements Definition Readiness Decision (CRDRD), Investment Analysis Readiness Decision (IARD), Initial Investment Decision (IID), and Final Investment Decision (FID). The planning and investment decisions published in the CIP can identify interdependencies among CIP programs. This helps to ensure appropriate planning and scheduling for the approval, acquisition, and deployment of related systems, equipment, or capabilities that are needed to deliver the expected benefits to the NAS.

In accordance with the FAA's Acquisition Management System (AMS), the Joint Resource Council (JRC) is responsible for the approval of major acquisition programs. The JRC consists of senior-level representatives from FAA's lines of business and staff offices. The JRC provides executive-level review, approval, and oversight of F&E programs in the CIP.

The JRC responsibilities related to the CIP programs include:

- Annual review and approval of the FAA investment portfolio as part of the F&E budget submission process
- Annual review and approval of the FAA's Enterprise Architecture Roadmaps
- Review and approval of program requests for investment decisions such CRDRD, IARD, IID, and FID
- Approval for all required AMS program documents including: the program requirements, acquisition program baseline, business case, and the implementation strategy and planning document
- Approval for all Acquisition Program Baseline (APB) change decisions that may alter program performance, cost, and schedule baselines
- Quarterly acquisition program reviews to manage ongoing investment programs and oversight of the execution and reporting of acquisition programs

The Enterprise Architecture Roadmaps published in the CIP show a multi-year view plan for program acquisitions approved by the JRC. The roadmaps include key acquisition milestones as defined by the AMS and any interdependencies between the programs. This helps to ensure appropriate planning and scheduling for the approval, funding, acquisition, and deployment of related systems, equipment, or capabilities that are needed to deliver the expected benefits to the NAS.

2 Key Considerations in Capital Planning

Addressing changes in air traffic demand and anticipated future growth requires planning to provide for increases in available NAS safety, capacity, efficiency, predictability, and system flexibility. Other considerations include periodic changes in economic conditions, progress of ongoing capacity expansion projects at major airports and sustainment for mission critical Air Traffic Control (ATC) systems, facilities, and other NAS infrastructure.

In accordance with FAA's AMS policy, proposed capital investments must be presented to the JRC for review and approval before they begin. Program offices and sponsors must develop a business case to justify the need for the program, explain technical requirements and the approach to complete the program, develop a lifecycle cost and schedule estimate, estimate personnel needed, and explain any interdependencies with other programs. Once approved, a program will enter the investment analysis process, be added to the NAS EA and the CIP, and be included in the President's Budget submittal to Congress. Once funds are appropriated, program offices must then manage risk during execution to successfully deliver planned outcomes on budget and on schedule. Finally, before new systems or capabilities can receive approval to operate in the NAS, they must demonstrate compliance with applicable FAA reliability and safety standards.

2.1 Economic Considerations

Access to a reliable worldwide aviation network is essential to the health of the U.S. economy. Both domestic and international commerce rely heavily on ready access to aviation services for carrying passengers and freight to cities around the world to help sustain economic growth. According to the latest published study on *The Economic Impact of Civil Aviation on the U.S. Economy*[1], economic activity attributed to civil aviation-related goods and services during 2016 totaled $1.8 trillion, generating 10.9 million jobs, and $488 billion in earnings. In total, U.S. aviation contributed 5.2 percent to the GDP. Other significant aviation-related economic activity cited in the January 2020 report includes:

- Air carriers operating in U.S. airspace transported 946.4 million passengers with over 1,377.1 billion Revenue Passenger Miles (RPM)
- In support of commercial activities, more than 66.8 billion revenue ton-miles of freight passed through U.S. airports
- It is estimated that commercial airline operations enabled $357.8 billion of visitor expenditures on goods and services
- Civil aircraft manufacturing, a top U.S. net exporter, had a positive trade balance of $70.9 billion

[1] Source: Office of Aviation Policy and Plans, "The Economic Impact of Civil Aviation on the U.S. Economy", January 2020 https://www.faa.gov/sites/faa.gov/files/about/plans_reports/2020_jan_economic_impact_report.pdf

2.2 Air Travel Demand

Historically, the demand for air travel is heavily influenced by changes in the economy. Figure 2-1 depicts the annual percentage change in Revenue Passenger Miles (RPM) and Gross Domestic Product (GDP, in constant 2012 dollars) since 1980. Prior to 2020, passenger demand for air travel in RPM had grown at a faster rate than the economy. In 2020, however, RPM declined more sharply than did GDP, resulting in lower total growth in RPM. By 2021, both series had begun to recover.

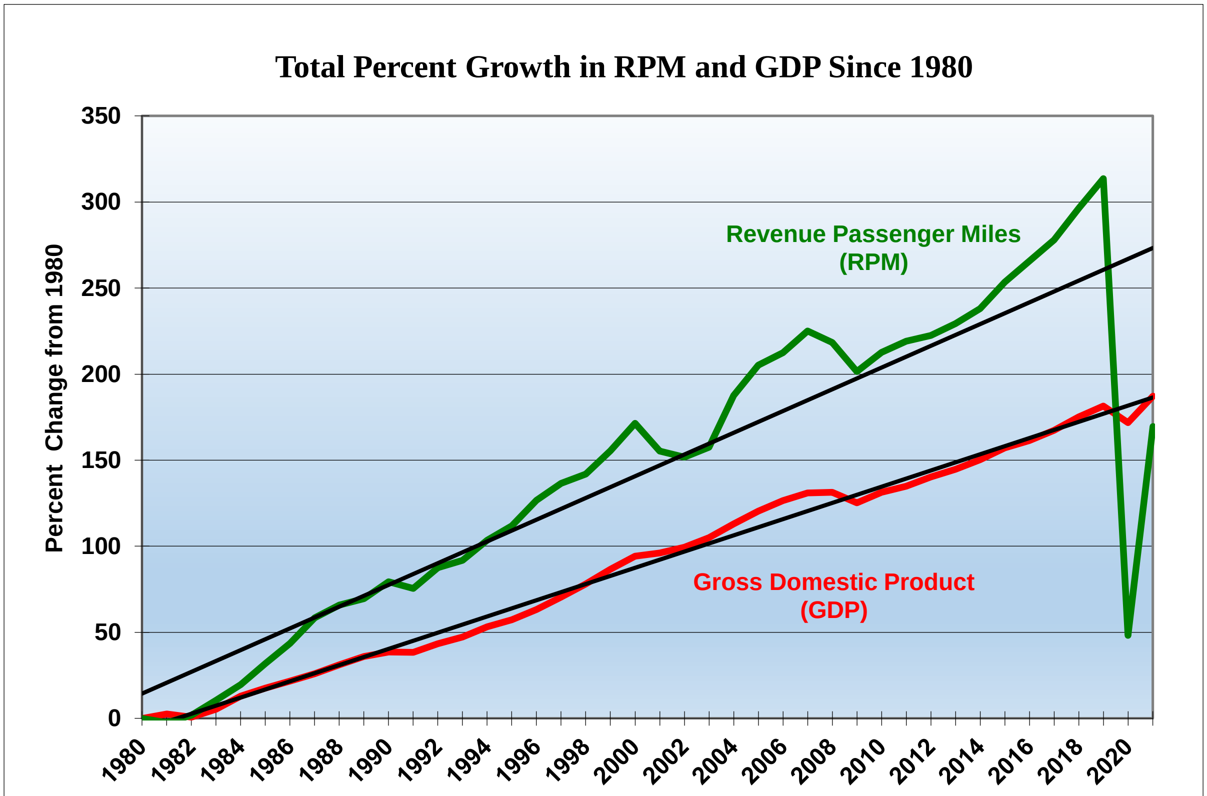


Figure 2-1 Air Travel Demand Relative to GDP

While 2020 saw sharp declines in GDP and air travel, the U.S. inflation-adjusted, real economic output long-term growth trend supports future increases in air travel demand. Recent economic data shows that GDP has returned to positive growth and the long-term correlation shown in figure 2-1 suggests the demand for air travel, as measured by RPM, will resume its corresponding increase.[2]

According to the latest *FAA Aerospace Forecast for Fiscal Years 2021-2041* (2021 FAA Forecast), overall system RPMs are projected to increase at an average rate of 6.2 percent per year from fiscal years 2021 to 2041, a rate that is boosted by strong growth during the recovery. Also, the 2021 FAA forecast calls for U.S. carrier passenger growth over the next 20 years to average 5.5 percent per year and growth in operations of 3.9 percent per year.[3]

2, 3 Source: Office of Aviation Policy, "FAA Aerospace Forecasts 2021-41," July 2021 https://www.faa.gov/data_research/aviation/aerospace_forecasts

The difference in the forecast increase for U.S. passenger traffic, compared to commercial operations, will be accommodated through larger aircraft with more seats per aircraft mile and higher load factors.

Despite the adverse impact of COVID-19, recent data indicates that air traffic is on the rebound; long-term, capital spending and investment by airlines will return.[4]

2.3 Airport Expansion Projects

Enhancing capacity and efficiency at large congested airports is critical to overall NAS performance. Delays at large hub airports often propagate to other airports throughout the system. For calendar year 2020 the 28 large hub airports handle about 72 percent of airline enplanements. The combined total of the 64 large and medium hub airports support about 93 percent of all U.S. passenger enplanements.[5] Delays at large and medium hub airports affect a significant number of passengers waiting to depart, as well as passengers waiting to board aircraft at the delayed flight's destination.

F&E investments are often required when airport authorities, in coordination with the FAA, build new, extended, or realigned runways to enhance safety, capacity, and efficiency. New charted flight procedures are normally needed to achieve full utilization of new runway infrastructure. Approach lights and visibility sensors must be positioned to ensure reliable access during inclement weather conditions to runways that have a precision approach capability. Airspace sectors around the airports may need to be reconfigured to accommodate new approach and departure patterns. Upgraded surveillance systems may be needed to cover the new departure and approach patterns, as well as expanded surface movement areas. Additional ATC automation equipment may also be needed to manage reconfigured surface traffic. In some cases, air traffic control facilities, such as control towers, must be relocated to support new or relocated airport infrastructure. The development of new or reconfigured airfield infrastructure may also require additional F&E investments to maintain safe and efficient operations at the airport. In most cases, the infrastructure development at airports is funded at least in part with Federal Airport Improvement Program grant funds or federally approved Passenger Facility Charges.

Examples of recent, ongoing, and upcoming airport expansion and improvement projects with FAA funding include:

- Rochester MN, Rochester International Airport - runway safety improvements project is a multi-year, multi-phase project to replace Runway 2/20, which has reached the end of its useful life, and to improve associated airfield pavement and equipment.

- Aguadilla PR, Rafael Hernández International Airport - The scope of work includes demolishing buildings south of the airport, converting the Mike taxiway into a new runway parallel to the existing runway, and converting the existing runway into a taxiway.

4 Source: International Air Transport Association (IATA) April 6, 2022 press release "Passenger Recovery Accelerates in February".

5 Source: Office of Airports, Office of Airport Planning and Capacity,
https://www.faa.gov/sites/faa.gov/files/about/plans_reports/2020_jan_economic_impact_report.pdf

2.4 NAS Modernization, Sustaining Systems and Infrastructure

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

The air traffic control infrastructure is a complex system made up of several thousand components that control air traffic approaching, landing, and departing from airports. The FAA is responsible for the maintenance of 377 facilities, including:

- 348 FAA-maintained Terminal Air Traffic Control Towers and Terminal Radar Approach Control Facilities that include 104 federally owned contract towers;
- 21 Air Route Traffic Control Centers (ARTCCs);
- 4 Combined Control Facilities (CCFs), and
- 4 unique facilities known as Enterprise Facilities that provide oversight for all NAS operations.

In addition, there are 203 airport sponsor-owned terminal facilities that control air traffic in the NAS. The daily flow of air traffic is dependent upon several hundred surveillance and weather radars, navigation systems for en route and airport approach guidance, and thousands of radios that allow pilots and air traffic controllers to be in continuous contact during an aircraft's flight. To sustain the high level of NAS reliability and availability required to ensure the safety and efficiency of flight, continued investment in the sustainment and improvement of these buildings, systems, and other legacy infrastructure is required.

The ATC Facilities Sustainment Portfolio focuses on the following Programs for sustaining the NAS infrastructure:

- ARTCC and CCF Building Sustainment
- Air Traffic Control En Route Radar Facilities Improvements
- Terminal Air Traffic Control Facilities – Replace
- ATCT / TRACON Facilities – Improve
- NAS Facilities Occupational Safety and Health Administration (OSHA) and Environmental Standards Compliance
- Fuel Storage Tank Replacement and Management
- Unstaffed Infrastructure Sustainment
- Real Property Disposition
- Electrical Power Systems – Sustain/Support
- Energy Management and Compliance (EMC)
- Hazardous Materials Management Facility Security Risk Management Mobile Assets Management Program

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, NAS Logistics, Airmen/Aircraft registration, Civil Aerospace Medical Institute (CAMI), Safety, and Business Services.

The William J. Hughes Technical Center (WJHTC) supports research, development, test, and evaluation of safety systems and new equipment as well as field support for all deployed NAS equipment. The infrastructure at these locations requires building system and telecommunications replacement.

3 Aviation Safety

The FAA Office of Aviation Safety (AVS) sets, oversees, and enforces safety standards for all sectors of the aviation industry affecting 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 investment Programs for aviation safety include:

- Regulation and Certification Infrastructure for System Safety (RCISS) – Sustainment 3
- Regulation and Certification Infrastructure for System Safety (RCISS) – Sustainment 4
- System Approach for Safety Oversight (SASO) – Phase 3
- System Approach for Safety Oversight (SASO) – Phase 4
- Aviation Safety Knowledge Management Environment (ASKME) – Enhancement 1
- Aerospace Medical Equipment Needs (AMEN) – Sustainment 3
- Wind & Wave Evacuation Survival Facility (WIWAVES) – Phase 1
- Aerospace Medicine Safety Information System (AMSIS) – Phase 1
- Aerospace Medicine Safety Information System (AMSIS) – Phase 2

4 Next Generation Air Transportation System (NextGen) Supported by Budget Portfolios

As part of its NextGen initiative, the FAA has nearly completed the fundamental infrastructure modernization of the NAS across communication, navigation, surveillance, automation, and information exchange domains. The initiative built key enabling technologies on that infrastructure, such as data communications between the controller and pilot, satellite navigation to enable aircraft to fly precisely defined three-dimensional flight paths, precise aircraft position reporting to ground automation systems and other aircraft through ADS-B, and data-sharing to provide the right information to the right people at the right time through System Wide Information Management (SWIM).

The FAA continues to integrate infrastructure and enabling technologies with new decision-support tools and applications to accommodate and improve a wide range of operations across all phases of flight and time horizons. The FAA also continues to incorporate new entrants into the NAS and improve cybersecurity, adding new policies, procedures, and processes in an integrated fashion to produce a transformed system.

Trajectory Based Operations (TBO) is an Air Traffic Management (ATM) method for strategically planning, managing, and optimizing flights throughout the operation using time-based management, information exchange between air and ground systems, and an aircraft's ability to fly precise paths in space and time. Flights that are more efficient will yield more predictable schedules and more environmentally friendly operations.

In its NextGen efforts, the FAA employs a portfolio approach to manage goals and the investments needed to fulfill them. The portfolio approach supports and guides program level investment, planning, and analysis by providing an integrated view of capabilities and system dependencies required for NextGen.

More information on NextGen, including the NextGen Annual Report, can be found at http://www.faa.gov/nextgen

4.1 Portfolio Descriptions and their Supporting Capital Programs

The following portfolio descriptions define the research, engineering, and acquisition activities needed to achieve additional functionality in base and new systems, along with any complementary development of standards, guidance, and procedures that may be required. Each of the descriptions in this section is followed by a list of the capital programs that supports the portfolio.

4.1.1 Separation Management Portfolio

The Separation Management 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. The investments in this portfolio provide the tools, procedures, standards, and guidance to improve the management of aircraft in a mixed environment with varying navigation equipment and wake performance capabilities.

Capital investment Programs for the Separation Management Portfolio include:

- Automatic Dependent Surveillance-Broadcast (ADS-B) In Applications – Flight Interval Management Planning
- Wake Turbulence Re-Categorization
- Separation Automation System Engineering
- Closely Spaced Parallel Runway Operations
- Concept Development for Integrated NAS Design & Procedures Planning
- Space Integration Capabilities
- Unmanned Aircraft Systems (UAS) – Upper Airspace
- Common Trajectory Models
- Applications in Support of Air Traffic Control

4.1.2 Traffic Flow Management (TFM) Portfolio

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

Capital investment Programs for Traffic Flow Management Portfolio include:

- Surface Tactical Flow
- Strategic Flow Management Application
- Advanced Methods
- Initial Trajectory Based Operations (TBO) Implementation
- Strategic Flow Management Engineering Enhancement (SFMEE)

4.1.3 On-Demand NAS Portfolio

The On-Demand NAS portfolio 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, equipment outages, and runway closures. This portfolio ensures that NAS and other aeronautical information are 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 and Flight Information Exchange Model.

Capital investment Programs for On-Demand NAS Portfolio include:

- Flight Object
- Common Status & Structure Data
- Dynamic Airspace
- Flight Deck Collaborative Decision Making

4.1.4 NAS Infrastructure Portfolio

The NAS Infrastructure portfolio includes capabilities that address aviation weather issues. This portfolio supports the need to improve ATM decision-making during adverse weather conditions, and improves the use of weather forecast information in the NAS. Furthermore, the portfolio evolves the existing aviation weather infrastructure such as, dissemination, processor, and sensor systems to standardize weather information and interfaces, and reduces operational costs. This work also includes new air traffic control management procedures, separation standards, and flexible airspace categories to increase throughput.

Capital investment Programs for NAS Infrastructure Portfolio include:

- Weather Forecast Improvements – Work Package 1
- NextGen Navigation Engineering
- New Air Traffic Management (ATM) Requirements
- Information Management

4.1.5 NextGen Support Portfolio

The NextGen Support portfolio explores new technologies at laboratories by providing the NAS environments required to validate a broad framework of concepts, technologies, and systems and to test the integration, development, and operations functions before they are introduced into the NAS. Operational Analysis supports a comprehensive evaluation of fielded improvements and reporting of post-implementation performance information.

The Capital investment Program for the NextGen Support Portfolio is NextGen Laboratories.

4.1.6 Unmanned Aircraft Systems (UAS) Portfolio

UAS operations have increased dramatically in both the public and civil sectors. The rapid development of this technology includes the potential for providing transportation services within metropolitan areas, such as passenger and cargo services. For these operations to be integrated into the NAS, air traffic products, policies, and procedures must be reviewed and refined, or developed through supporting research, to permit safe and efficient UAS operations in the NAS.

Capital investment Programs for Unmanned Aircraft Systems include:

- Unmanned Aircraft System (UAS) – Concept Validation and Requirements Development
- Unmanned Aircraft System (UAS) – Flight Information Management
- Unmanned Aircraft System (UAS) – Urban Air Mobility

4.1.7 Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio

The Enterprise, Concept Development, Human Factors, and Demonstrations portfolio supports the research needed to determine the viability and benefits of future NAS concepts. Enterprise-level activities are supported, including development of concepts across the NAS, human factors analysis of the future operational environment, and demonstrations of proposed system improvements. Concepts will be researched and assessed to identify issues, evaluate benefits, reduce risk, and develop preliminary operational requirements. Procedures will be evaluated to enhance safety, increase operational efficiency, airspace capacity, and expand current capabilities throughout the NAS.

Capital investment Programs for Enterprise, Concept Development, Human Factors, & Demonstrations Portfolio include:

- Enterprise Concept Development
- Enterprise Human Factor Development
- Stakeholder Demonstrations

4.1.8 Performance-Based Navigation (PBN) and Metroplex Portfolio

The PBN and Metroplex Portfolio uses area navigation (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.

The Capital investment Program for Performance-Based Navigation and Metroplex Portfolio is the NextGen Distance Measuring Equipment (DME) Support for Performance Based Navigation PBN) Strategy.

4.1.9 System Safety Management Portfolio

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

Capital investment Programs for System Safety Management Portfolio include:

- Aviation Safety Information Analysis and Sharing (ASIAS)
- Systems Safety Management Transformation (SSMT)

5 Enterprise Architecture (EA) Infrastructure Roadmaps

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 following selected Enterprise Architecture Infrastructure Roadmaps depict existing systems and services currently operating in the NAS, and the planned and proposed time-frame for capital programs. The roadmaps are updated annually and reflect the results of studies, demonstration projects, and economic analyses related to the programs.

The EA roadmaps are intended to provide a high-level view of the NAS systems and programs. They highlight the duration that systems are planned to remain in service. In addition, the roadmaps include major programs that will sustain or enhance existing and future systems.

Some new systems or services shown on the roadmaps may require aviation users to add avionics or other equipment to their aircraft. This may also alert some users of the requirement to add or adopt new procedures and training.

In a typical roadmap, existing FAA systems and services are shown in light blue in the first column of the roadmaps. Within the other columns, a solid gray bar represents a NAS program, while a solid orange bar indicates a NextGen program. The length of each program bar represents the projected schedule in calendar years that a program is funded or requires funding. A solid line around the bar means that the program is funded within the CIP financial baseline. A dotted line around the bar means that the program has not been approved to receive funding from the CIP financial baseline. In addition, the solid red lines indicate the length of time that systems will remain in operation. The dotted red lines indicate that a system is scheduled to be replaced. The end date is indicated with an X. Figure 5-1 is the legend for all infrastructure roadmaps.

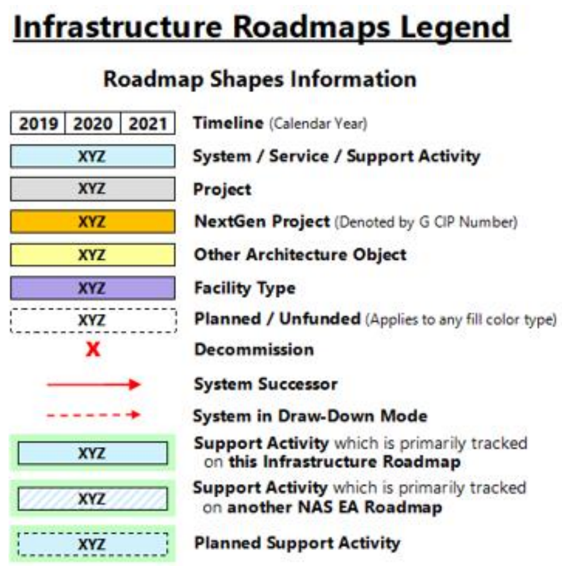


Figure 5-1 Infrastructure Roadmap Legend

The selected EA Infrastructure Roadmaps are organized by five functional areas or domains, and within each area there are several roadmaps for projects and programs:

- Automation
- Communications
- Surveillance
- Navigation
- Weather

Following each roadmap there is a listing of Programs that supports the roadmap.

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 are tracked and kept safely separated each day. Automation systems provide controllers with continuously updated displays that include aircraft identification, position, and whether the aircraft is level, climbing, or descending.

Traffic Flow Management System (TFMS) supports the FAA's Air Traffic Management (ATM) personnel in providing efficiency-critical NAS services. The system compares the projected traffic volume with the capacity of destination airports to determine if steps should be taken to manage traffic flow to prevent delays. Traffic Managers use the TFMS to maintain near real-time situational awareness and predict areas that may experience congestion due to capacity limitations resulting from weather conditions, airspace closures, or an unusual increase in traffic volume.

Automation implementation, including the plans to sustain, upgrade, replace, or decommission current systems from 2021 through 2035 are shown in the following NAS EA Roadmaps:

- Roadmap 1 (Figure 5-2) - Traffic Flow Automation, En Route Automation, and Terminal Automation
- Roadmap 2 (Figure 5-3) - Tower Automation, Oceanic and Offshore Automation, and Information Display Systems
- Roadmaps 3 and 4 (Figure 5-4) - Flight Services, Aeronautical, and Information Support

5.1.1 Air Traffic Management and En Route/Terminal Automation

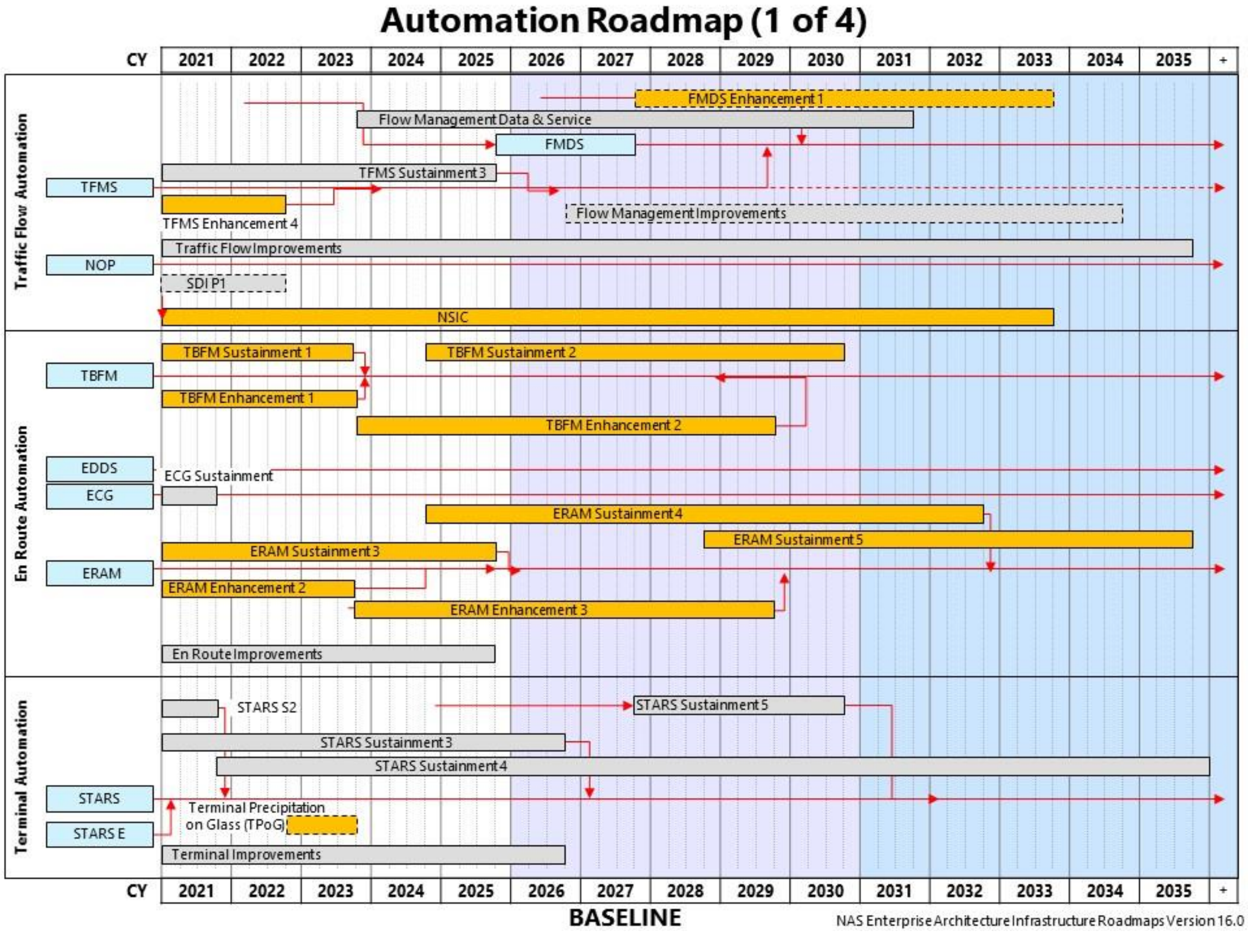


Figure 5-2 Air Traffic Management and En Route/Terminal Automation Roadmap

Capital investment Programs for Air Traffic Management and En Route/Terminal Automation include:

- En Route Automation Modernization (ERAM) Sustainment 3
- En Route Automation Modernization (ERAM) Enhancement 2
- ERAM Sector Enhancements - Independent Operational Assessment (IOA)
- Traffic Flow Management System (TFMS) Enhancement 4
- Traffic Flow Improvements
- Time Based Flow Management (TBFM) Enhancement 1
- Time Based Flow Management (TBFM) Sustainment 1
- En Route Improvements
- Space Data Integrator (SDI) Prototype Sustainment
- Space Integration Capabilities (SIC)
- Standard Terminal Automation Replacement System (STARS) Sustainment 3
- Standard Terminal Automation Replacement System (STARS) Sustainment 4

5.1.2 Air Traffic Support and Oceanic Air Traffic Control

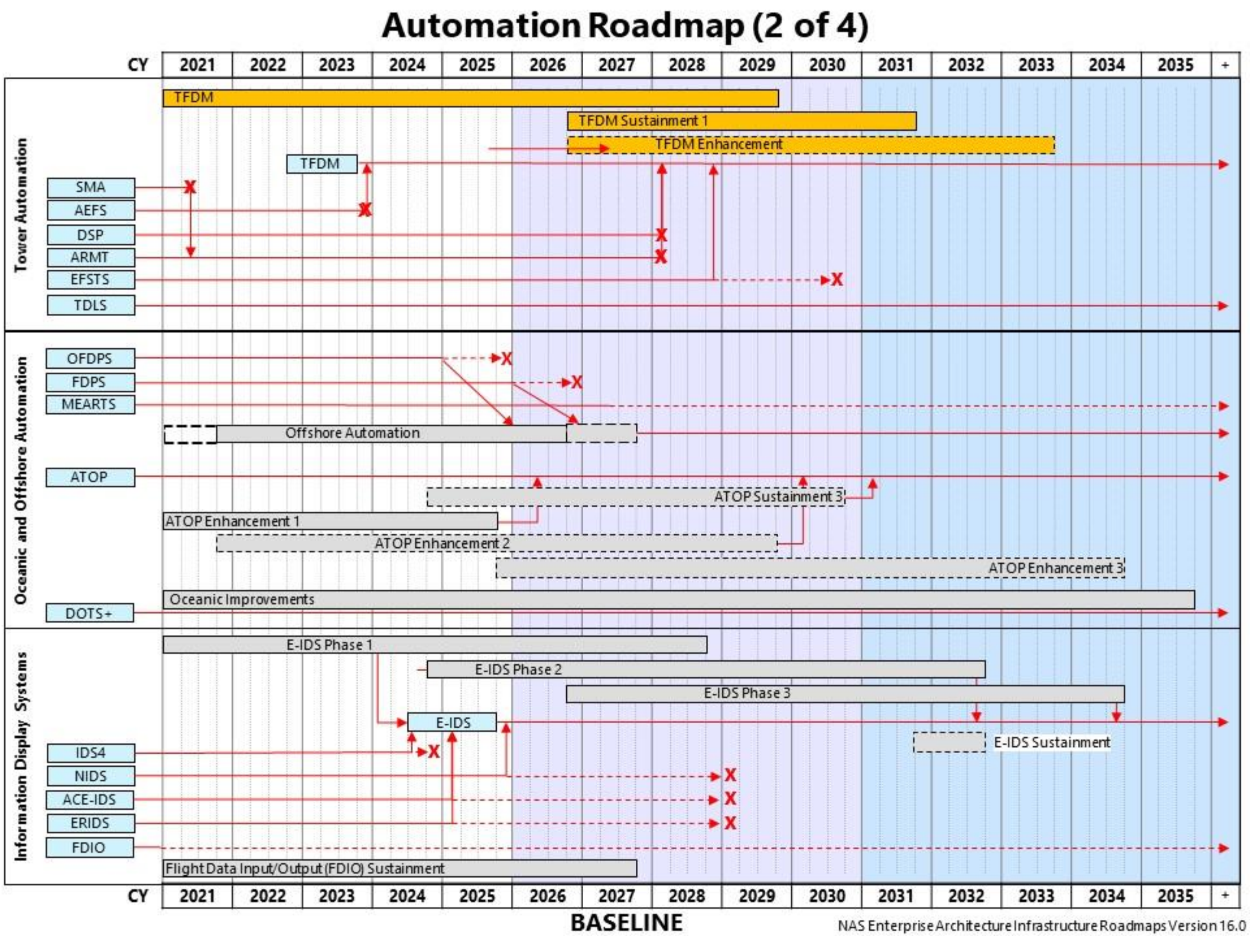
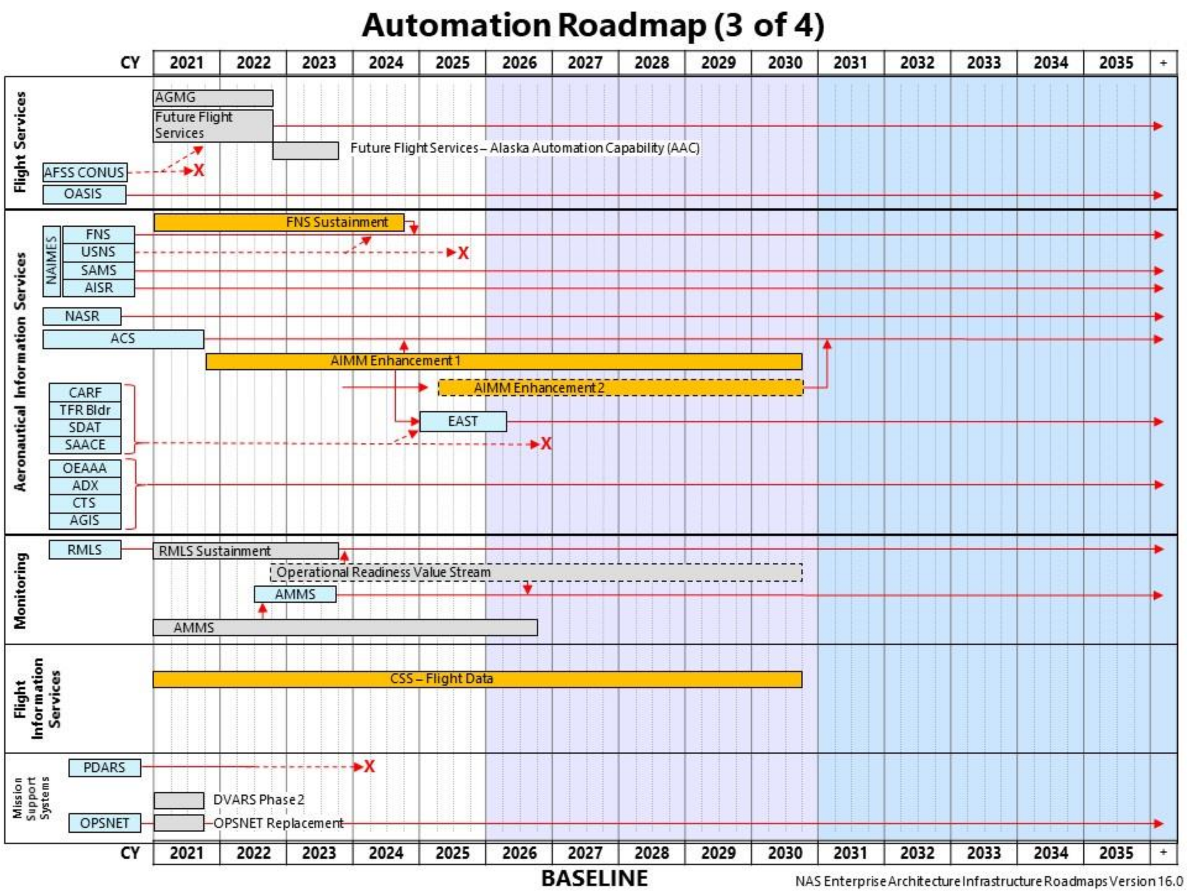


Figure 5-3 Air Traffic Support and Oceanic Air Traffic Control Roadmap

Capital investment Programs for Air Traffic Support and Oceanic Air Traffic Control include:

- Oceanic Improvements
- Advanced Technologies & Oceanic Procedures (ATOP) Enhancement 1
- En Route Automation Program - Flight Data Input/Output (FDIO) Sustainment
- Enterprise Information Display System (E-IDS) Phase 1
- Terminal Flight Data Manager (TFDM)
- TFDM - Independent Operational Assessment (IOA)



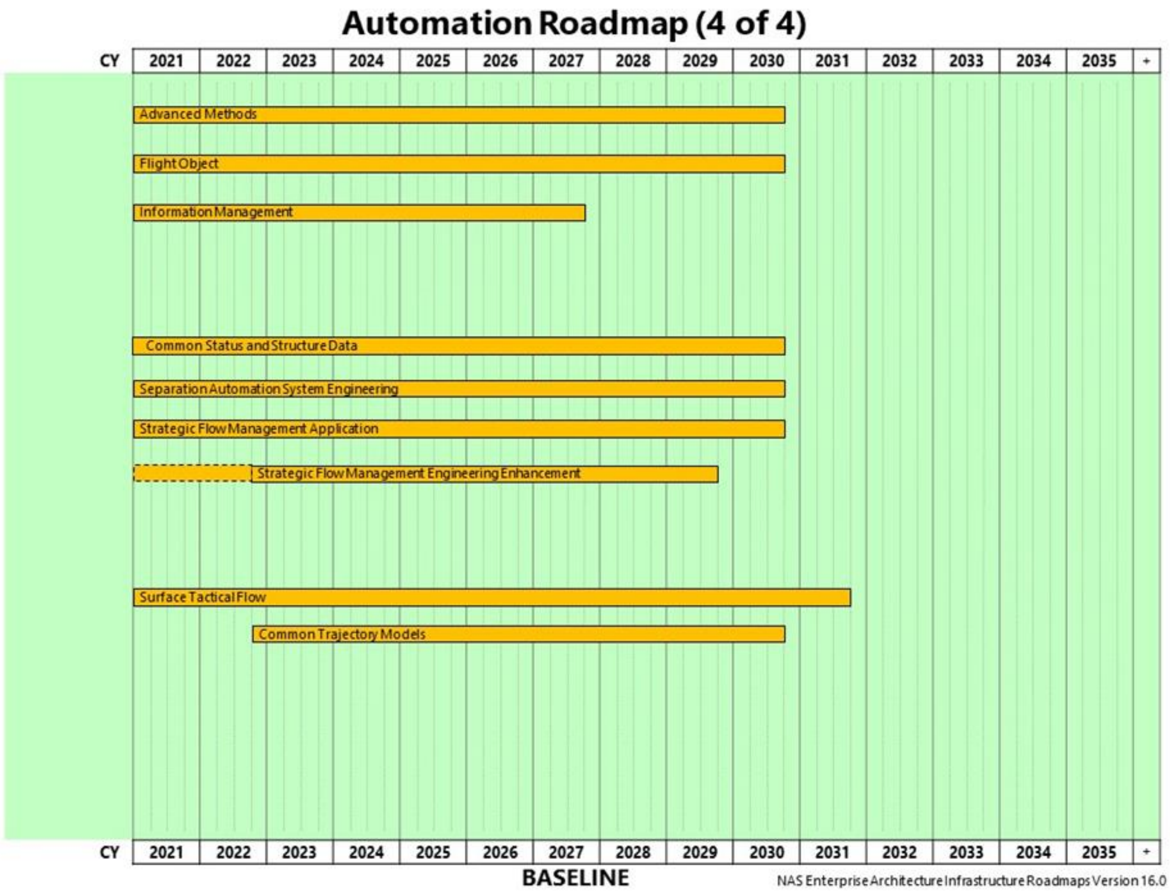


Figure 5-4 Flight Services, Aeronautical and Information Support Roadmaps

Capital investment Programs for Flight Services, Aeronautical and Information Support include:

- Common Support Services - Flight Data (CSS-FD)
- Future Flight Services
- Future Flight Services Air/Ground Media Gateway (AGMG)
- Data Visualization Analysis and Reporting System (DVARS) Phase 2
- Operations Network (OPSNET) Replacement
- Remote Monitoring and Logging System (RMLS) Sustainment
- Automated Maintenance Management System (AMMS) Planning
- Aeronautical Information Management (AIM) Modernization Federal NOTAMS System Sustainment

5.2 Communication Roadmaps

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

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

- Roadmap 1 (Figure 5-5) - Telecommunications and Other Communications
- Roadmap 2 (Figure 5-6) - Voice Switches and Voice Recorders
- Roadmap 3 (Figure 5-7) - Air-to-Ground Voice and Oceanic Air-to-Ground Communications
- Roadmap 4 (Figure 5-8) - Air-to-Ground Data Communications
- Roadmap 5 (Figure 5-9) - System Wide Information Management Messaging Infrastructure

5.2.1 Telecommunications and Other Communication

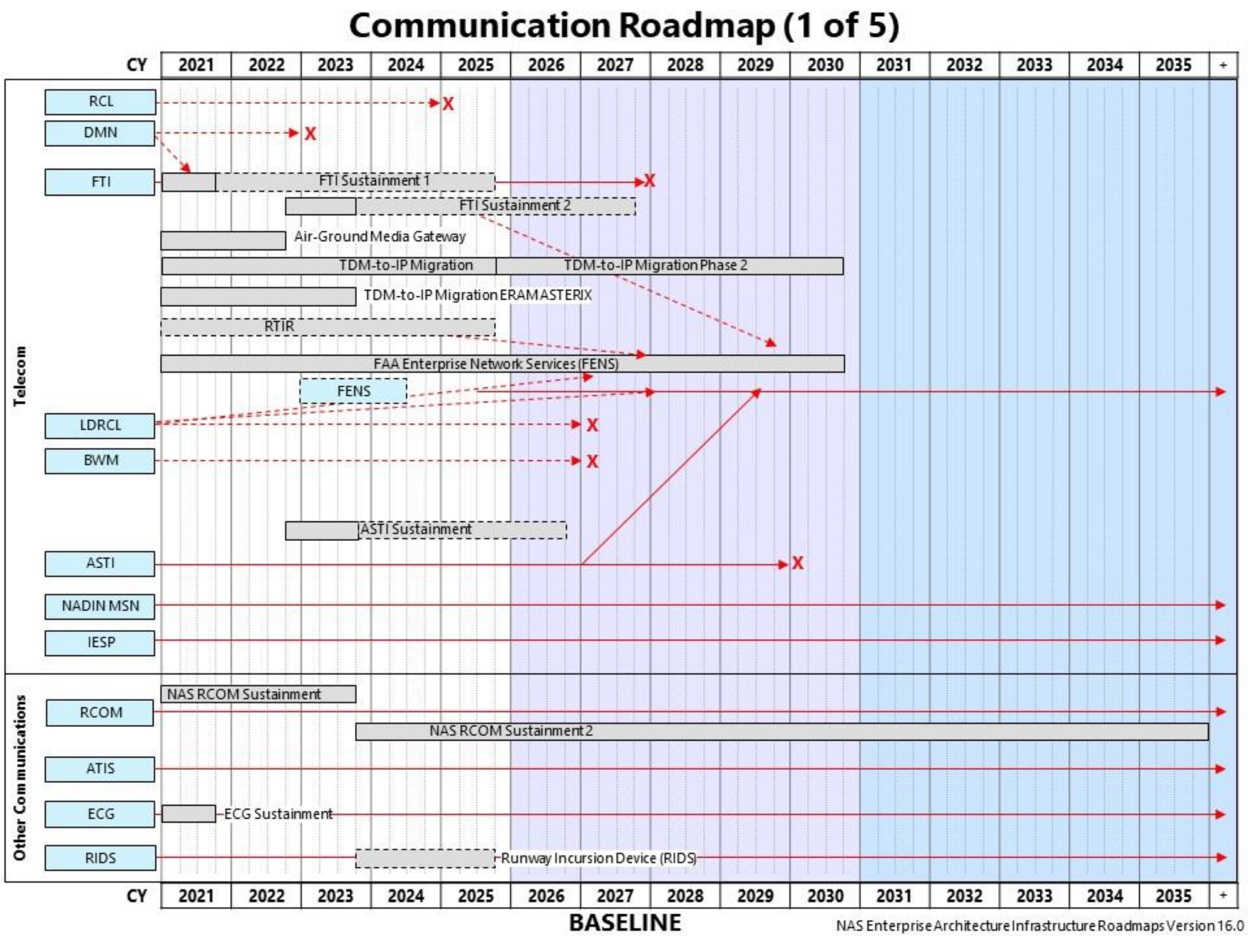


Figure 5-5 Telecommunications and Other Communications Roadmap

Capital investment Programs for Telecommunications and Other Communications include:

- Communications Facilities Sustainment
- FAA Enterprise Network Services (FENS)
- Time-Division Multiplexing to Internet Protocol (TDM-to-IP) Migration
- NAS Recovery Communications (RCOM) Sustainment

5.2.2 Voice Switches and Voice Recorders

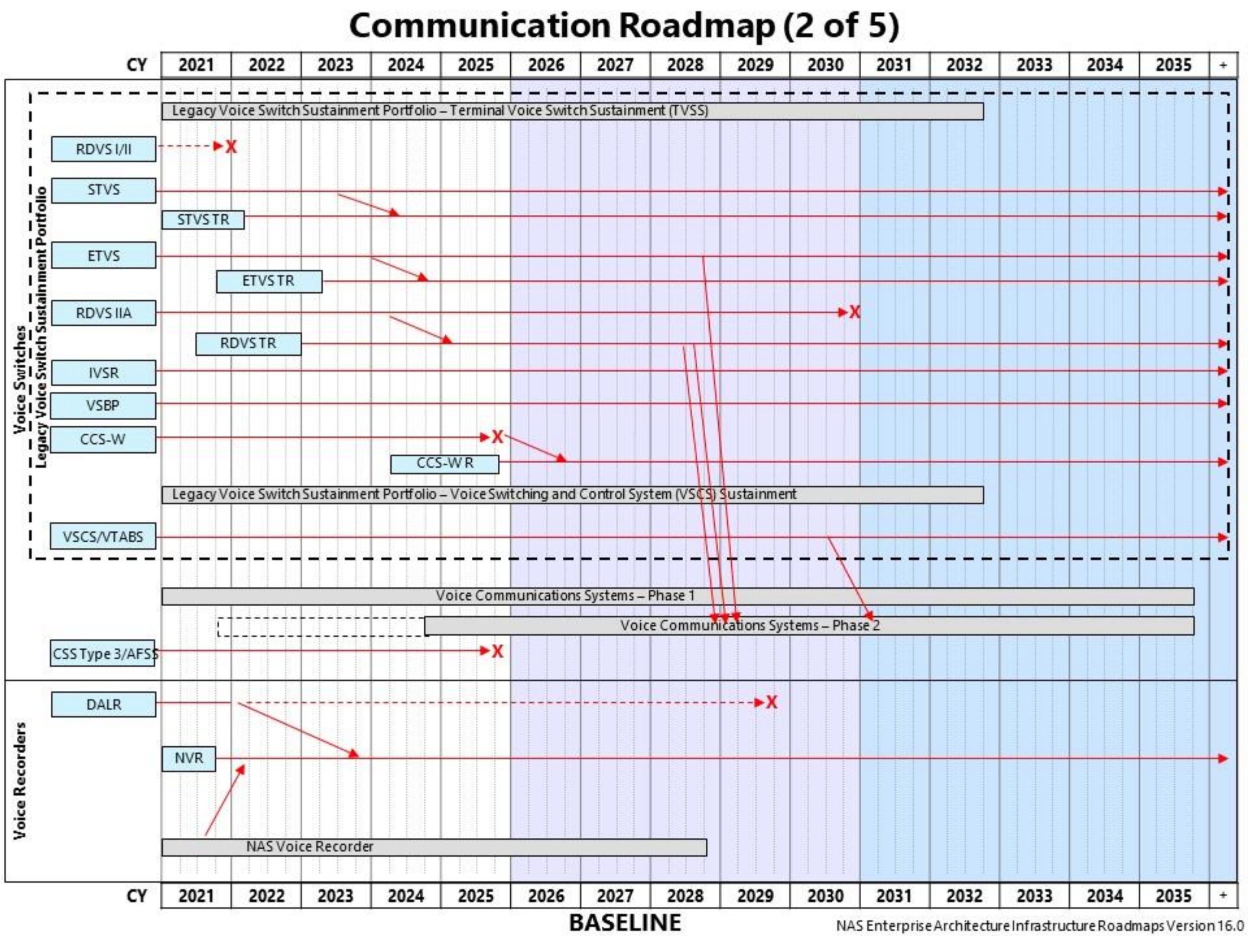


Figure 5-6 Voice Switches and Voice Recorders Roadmap

Capital investment Programs for Voice Switches and Voice Recorders include:

- Terminal Voice Switch - Legacy Voice Switch Sustain
- Voice Switching and Control System (VSCS) - Sustainment 4
- Voice Communication Systems - Phase 1
- NAS Voice Recorder

5.2.3 Air-to-Ground Voice and Oceanic Air-to-Ground Communications

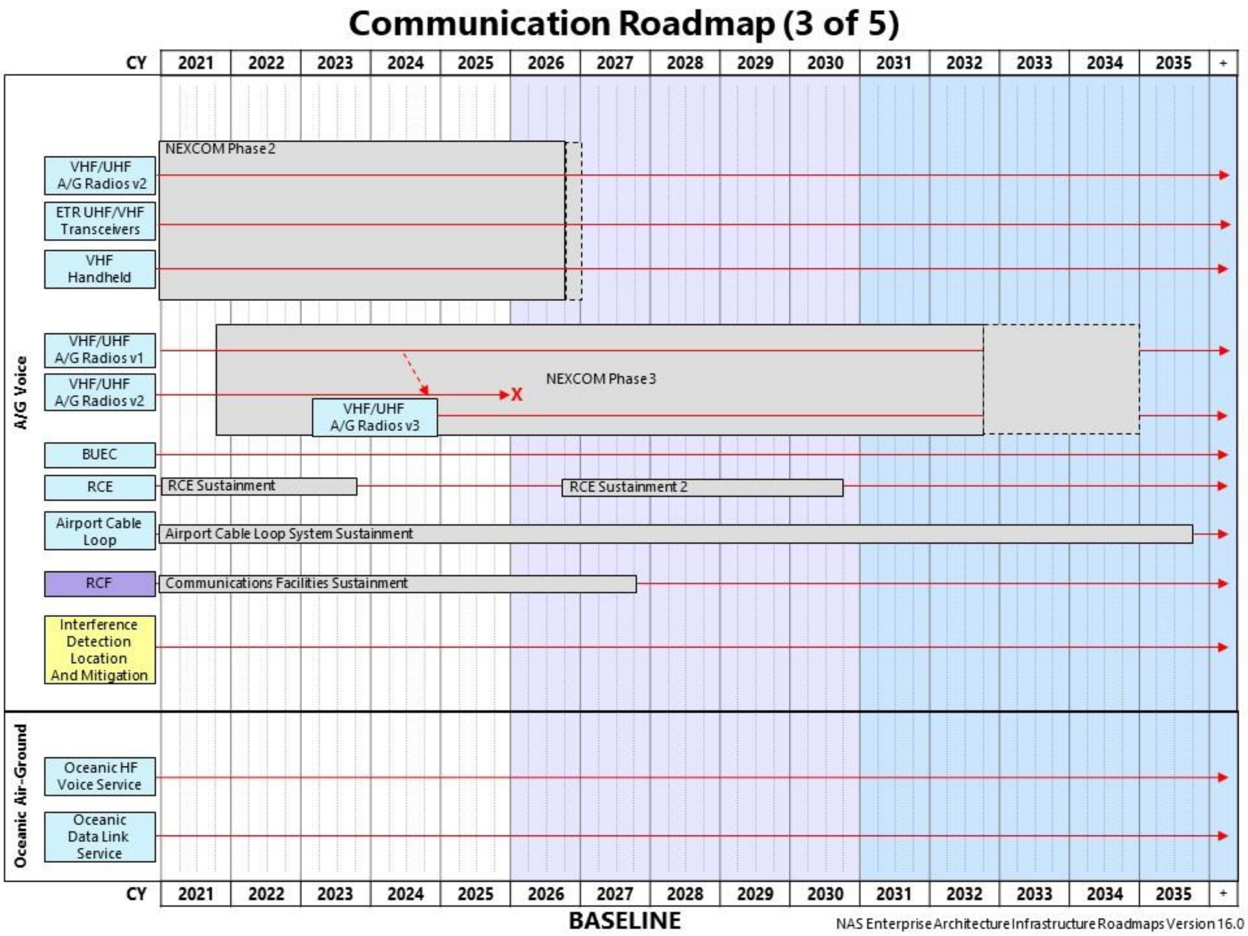


Figure 5-7 Air-to-Ground Voice and Oceanic Air-to-Ground Communications Roadmap

Capital investment Programs for Air-to-Ground Voice and Oceanic Air-to-Ground Communications include:

- Radio Control Equipment (RCE) –
- Communications Facilities Sustainment
- Next-Generation VHF and UHF A/G Communications (NEXCOM) – Phase 2
- Airport Cable Loop System

5.2.4 Air-to-Ground Data Communications

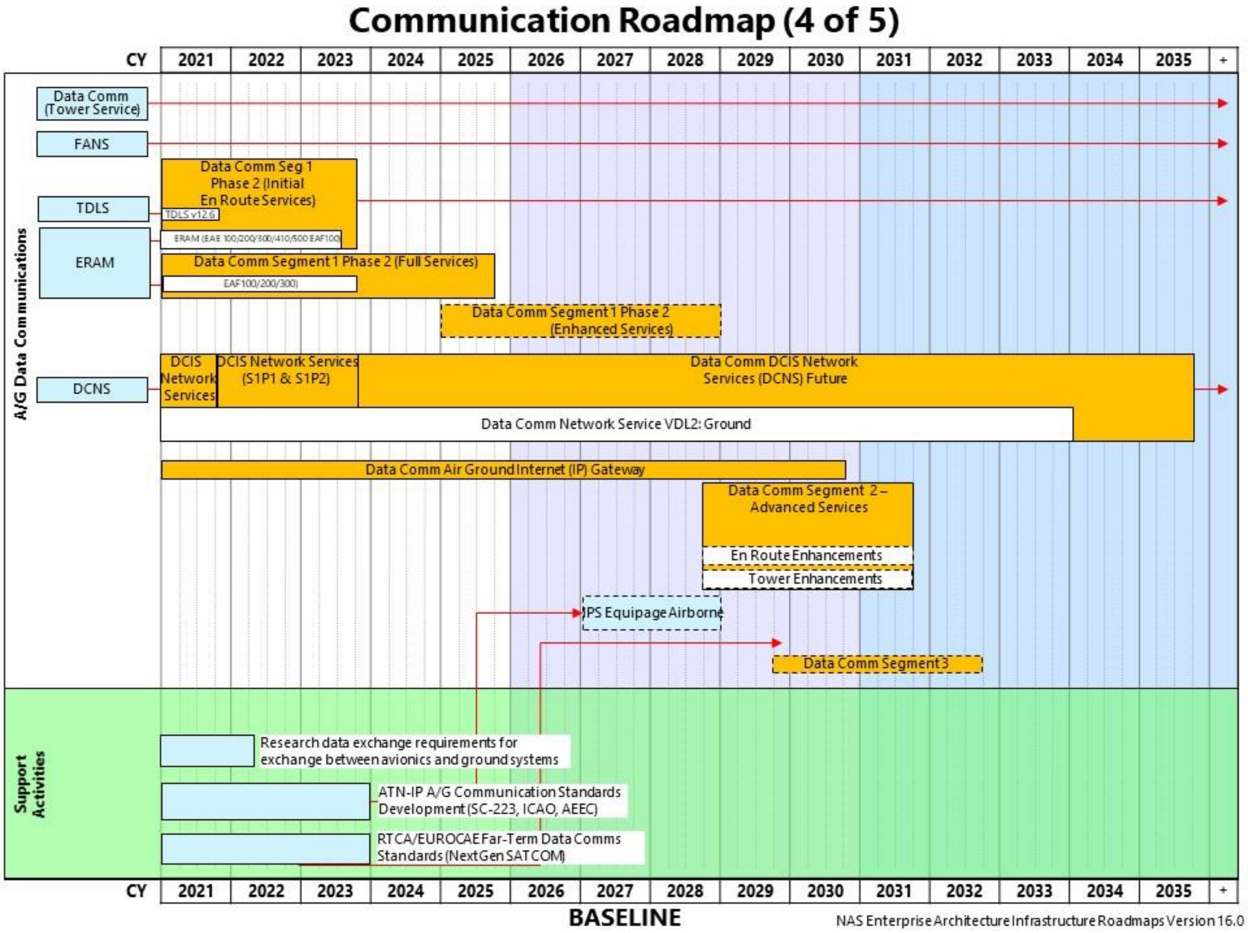


Figure 5-8 Air-to-Ground Data Communications Roadmap

Capital investment Programs for Air-to-Ground Data Communications include:

- Data Communications – Segment 1 Phase 2 Initial En Route Services
- Data Communications – Segment 1 Phase 2 Full En Route Services
- Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services
- Data Communications – Segment 1 Phase 1 & Phase 2 Data Comm Integrated Services (DCIS) Network Services Future
- Data Communications – Air-to-Ground Internet Protocol (IP) Gateway

5.2.5 System Wide Information Management Messaging Infrastructure

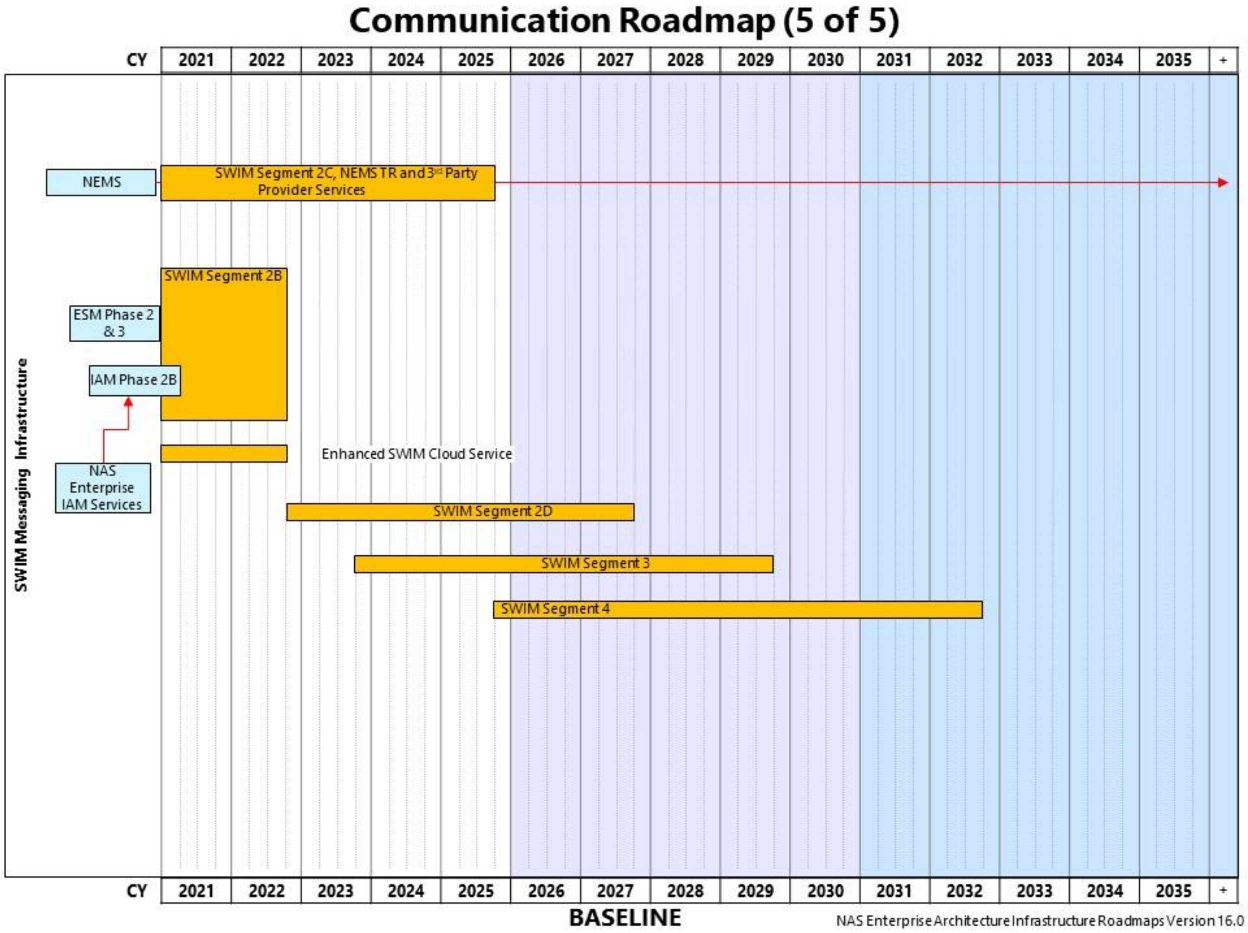


Figure 5-9 System Wide Information Management Messaging Infrastructure Roadmap

Capital investment Programs for System Wide Information Management Messaging Infrastructure include:

- System Wide Information Management (SWIM) – Segment 2B
- System Wide Information Management (SWIM) – Segment 2C, NAS Enterprise Messaging Service (NEMS) Technology Refresh Infrastructure, and 3rd Party Provider Services
- System Wide Information Management (SWIM) – Enhanced SWIM Cloud Service
- System Wide Information Management (SWIM) – Segment 3

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:

- Non-Cooperative Surveillance (primary radar) – the radar beam is bounced off the aircraft and reflected back to the radar receiver.
- Cooperative Surveillance (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 Global Positioning System (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 that process the data and send it to controller displays.
- En Route and terminal facilities normally use Secondary radars for traffic separation, either the Air Traffic Control Beacon Interrogators (ATCBI) or the Mode Select (Mode S). Using ATCBI or Mode S enhances the controller's ability to separate traffic because speed and altitude information supplement the position display for each aircraft.

Surveillance systems are shown on three different roadmaps:

- Roadmap 1 (Figure 5-10) - Broadcast Services and Cooperative Surveillance
- Roadmap 2 (Figure 5-11) - Non-Cooperative Surveillance and Interfaces
- Roadmaps 3 and 4 (Figure 5-12) - Surface and Approach Surveillance

5.3.1 Broadcast Services and Cooperative Surveillance

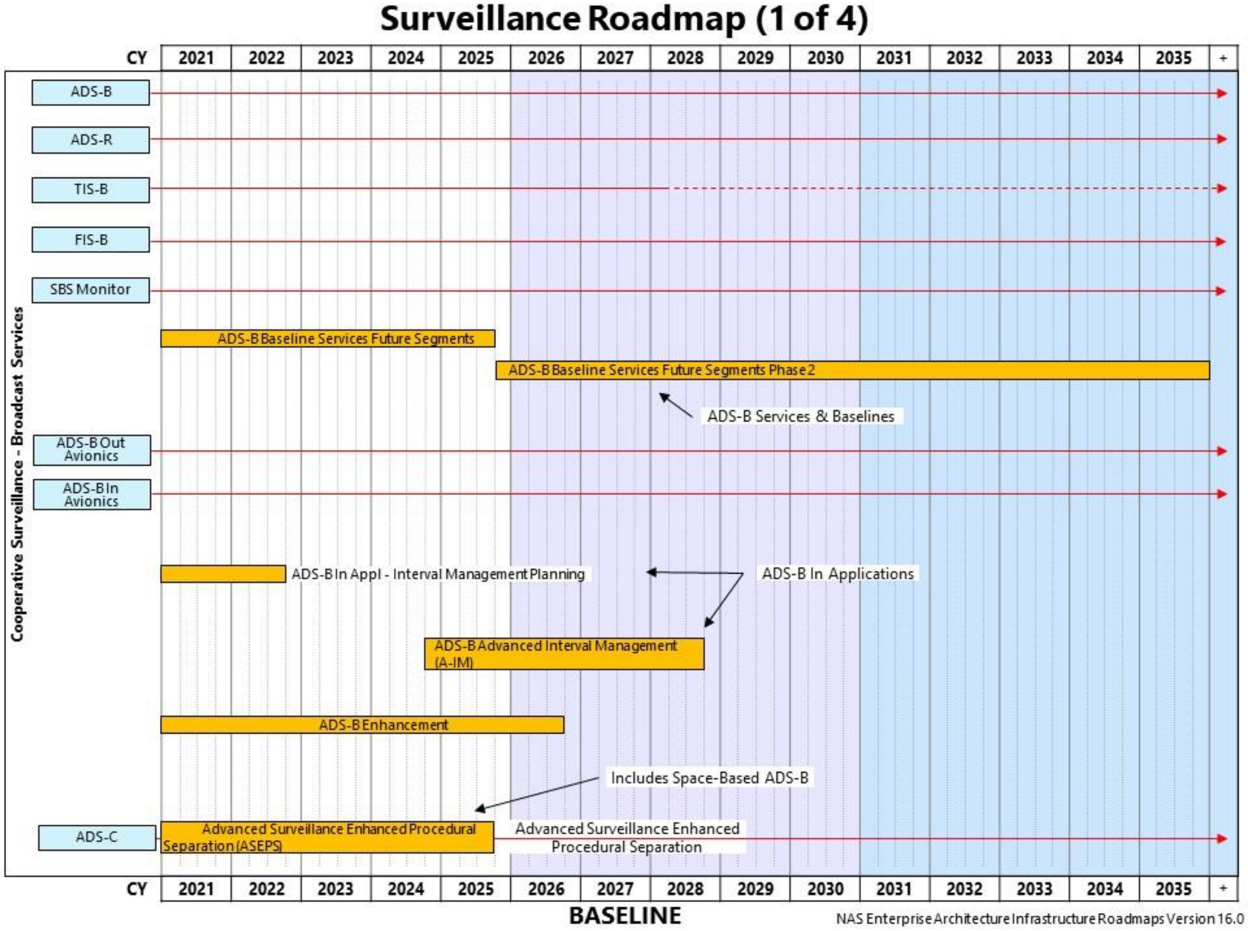


Figure 5-10 Broadcast Services and Cooperative Surveillance Roadmap

Capital investment Programs for Broadcast Services and Cooperative Surveillance include:

- Automatic Dependent Surveillance-Broadcast (ADS-B) – Baseline Services Future Segments -(BSFS)
- Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Enhancement
- Automatic Dependent Surveillance-Broadcast (ADS-B) NAS Wide Implementation – Advanced Interval Management (A-IM)
- Advanced Surveillance Enhanced Procedural Separation (ASEPS)
- ATC Beacon Interrogator Model-5 (ATCBI-5) – Sustainment 1
- ATC Beacon Interrogator Model-6 (ATCBI-6) – Sustainment
- Mode Select (Mode S) – Beacon Replacement System Phase 1A
- Mode Select (Mode S) – Beacon Replacement System Phase 1B

5.3.2 Non-Cooperative Surveillance and Interfaces

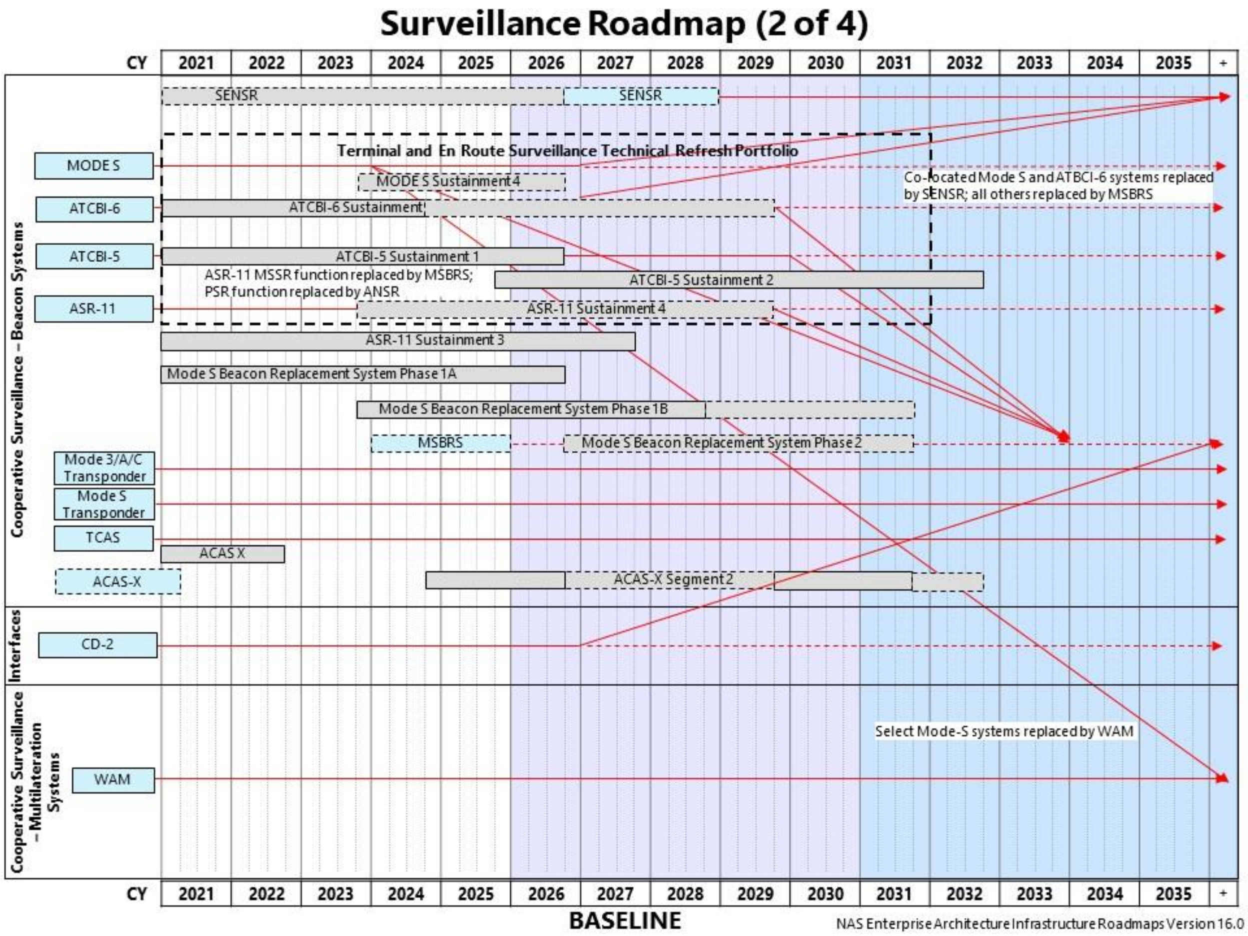
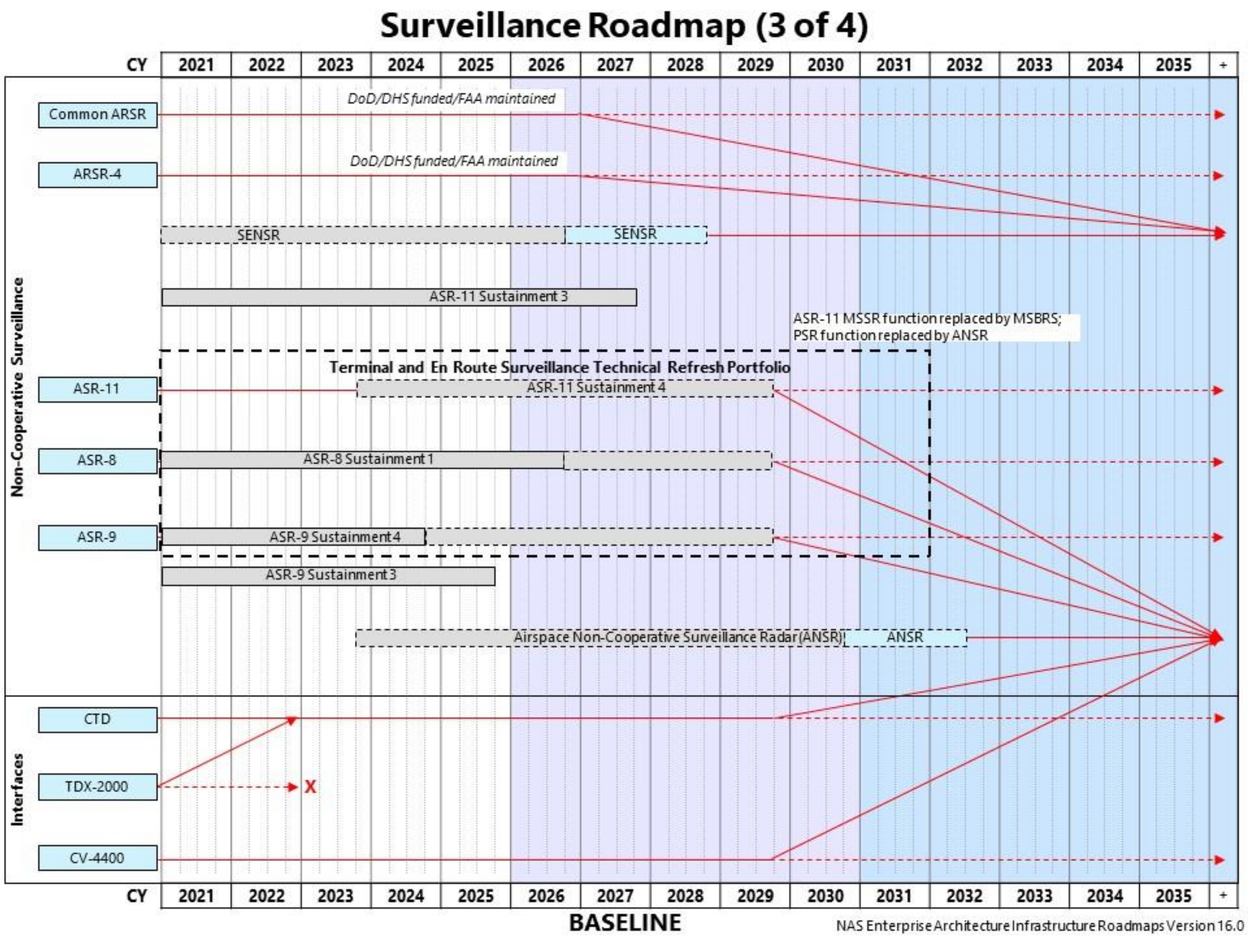


Figure 5-11 Non-Cooperative Surveillance and Interfaces Roadmap

Capital investment Programs for Non-Cooperative Surveillance and Interfaces include:

- Airport Surveillance Radar Model-8 (ASR-8) – Sustainment 1
- Airport Surveillance Radar Model-9 (ASR-9) – Sustainment 3
- Airport Surveillance Radar Model-9 (ASR-9) – Sustainment 4

5.3.3 Surface and Approach Surveillance



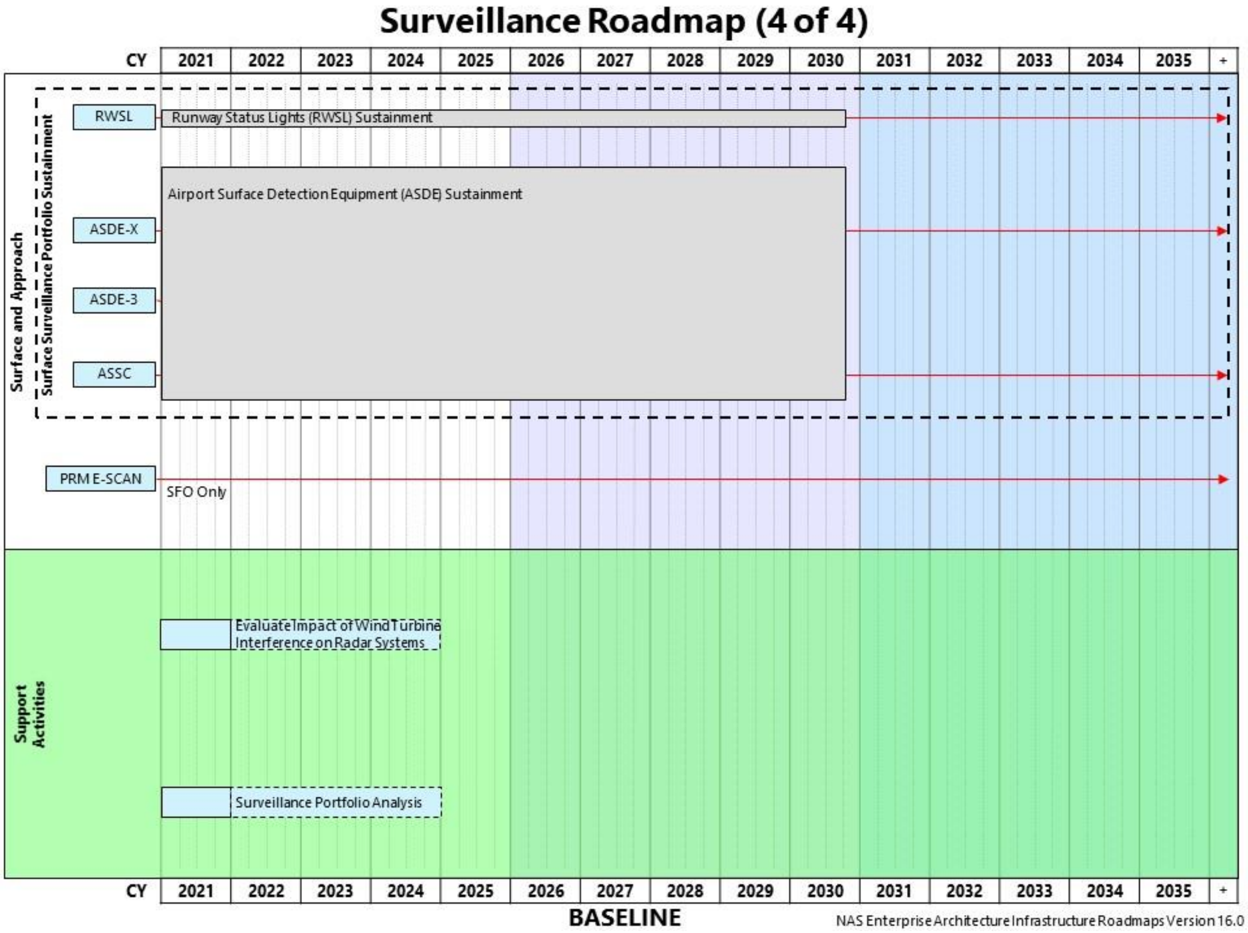


Figure 5-12 Surface and Approach Surveillance Roadmaps

Capital investment Programs that support Surface and Approach Surveillance include:

- Airport Surface Movement Detection (ASDE) Sustainment
- Runway Status Lights (RWSL) Sustainment

5.4 Navigation Roadmaps

Navigation Aids (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 Omni-directional Range (VOR) with Distance Measuring Equipment (DME). Aircraft equipped with GPS navigation systems are now able to navigate departure to destination routes without the use of 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/Wide Area Augmentation System (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 altitude that an aircraft can descend before committing to land; the pilot must be able to see the runway at that altitude before descending further. Non-precision approaches use NAVAIDS, other than ILS, and usually provide only lateral, not vertical guidance.

Navigational aid programs are portrayed in two different roadmaps:

- Roadmap 1 (Figure 5-13) – Navigation Infrastructure, and Safety and Enhancements
- Roadmaps 2 and 3 (Figure 5-14) – En Route/Terminal/Non-Precision Approach, Cross Environment, Precision Approach.

5.4.1 Navigation Infrastructure, and Safety and Enhancements

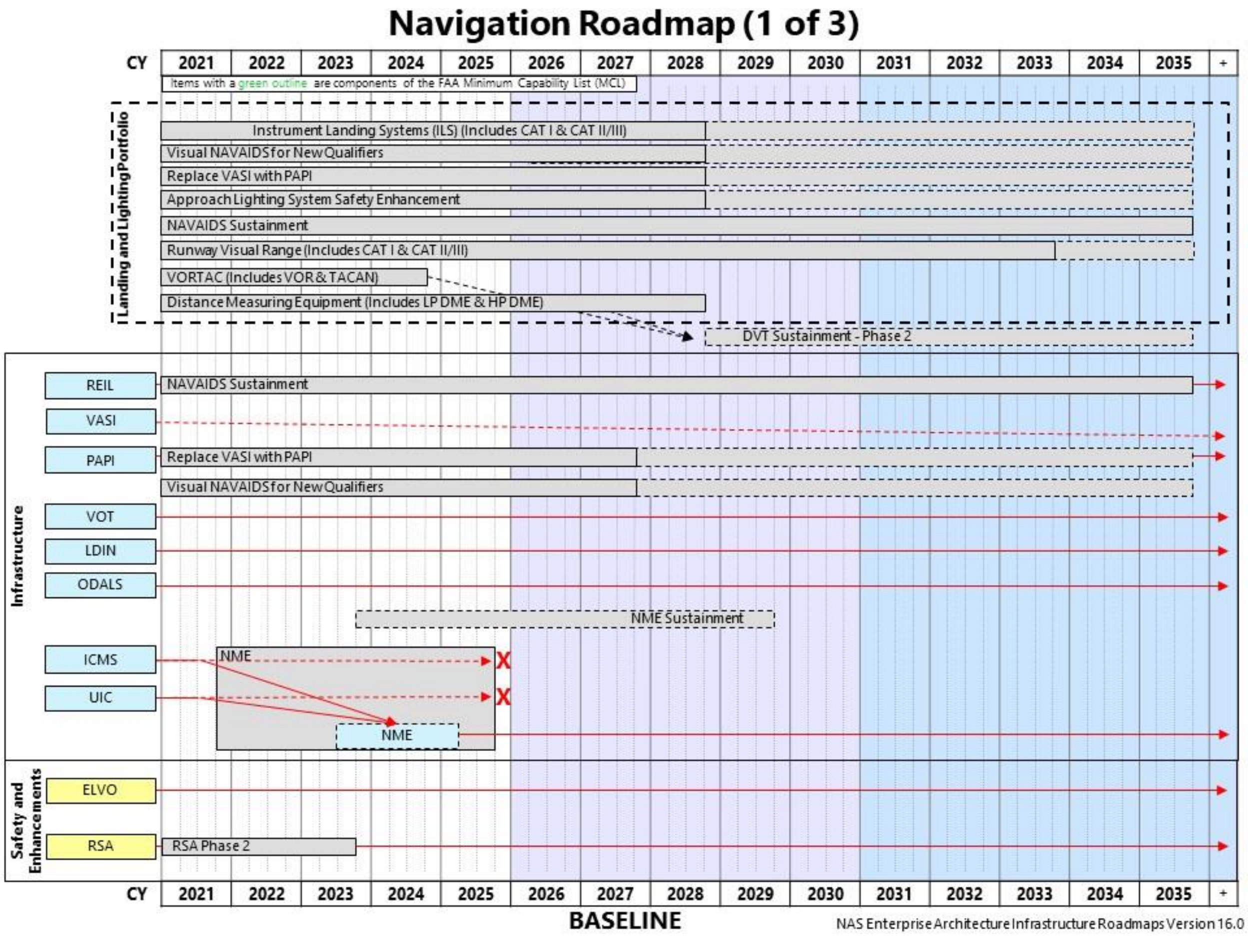
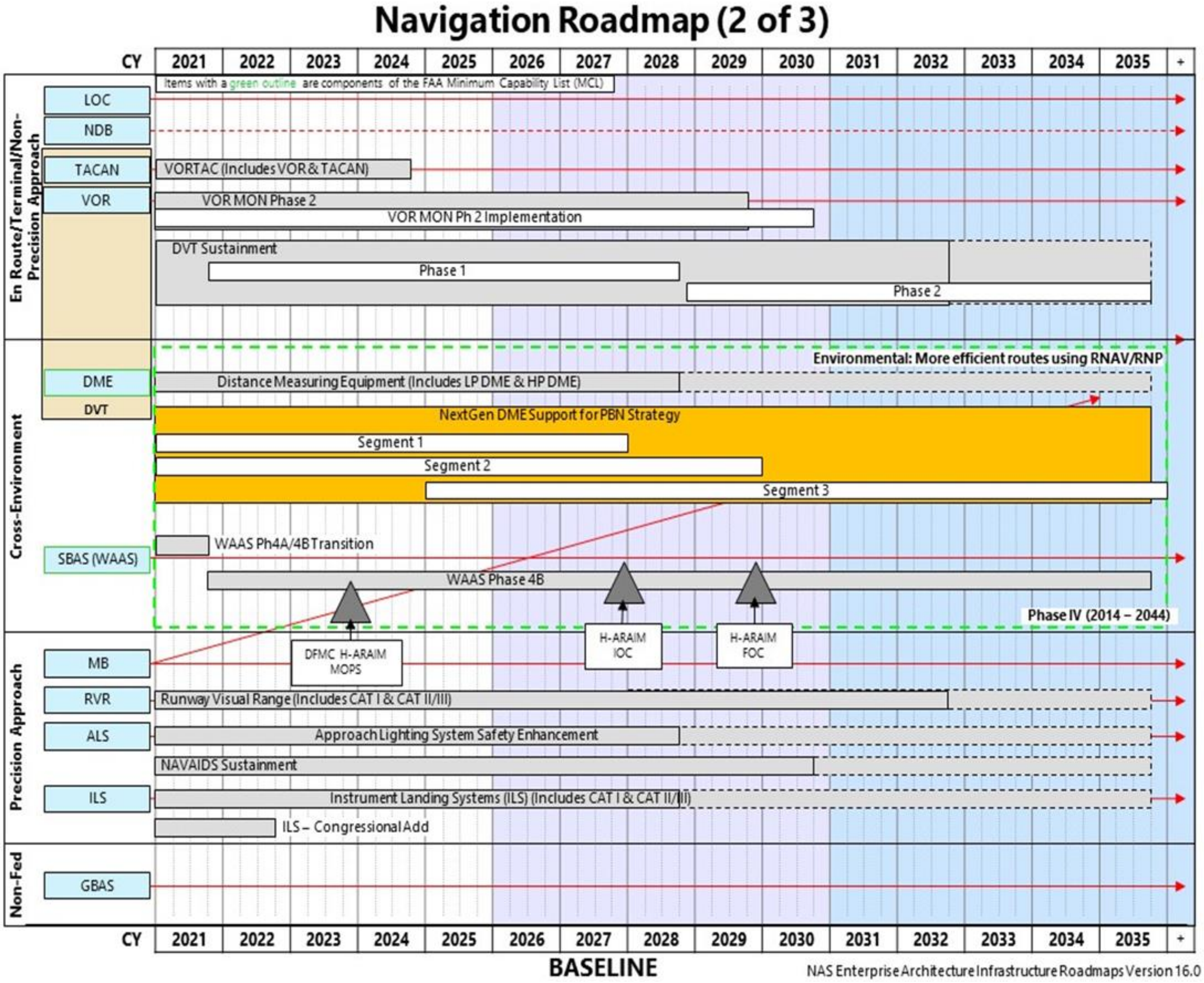


Figure 5-13 Navigation Infrastructure, and Safety and Enhancements Roadmap

Capital investment Programs for Navigation Infrastructure, Safety and Enhancements include:

- Runway Safety Area Phase 2
- NAVAIDS Sustainment
- Visual Navaids - Visual Navaids for New Qualifiers -
- Replace Visual Approach Slope Indicator (VASI) with Precision Approach Path Indicators (PAPI)

5.4.2 En Route/Terminal/Non-Precision Approach, Cross Environment, Precision Approach



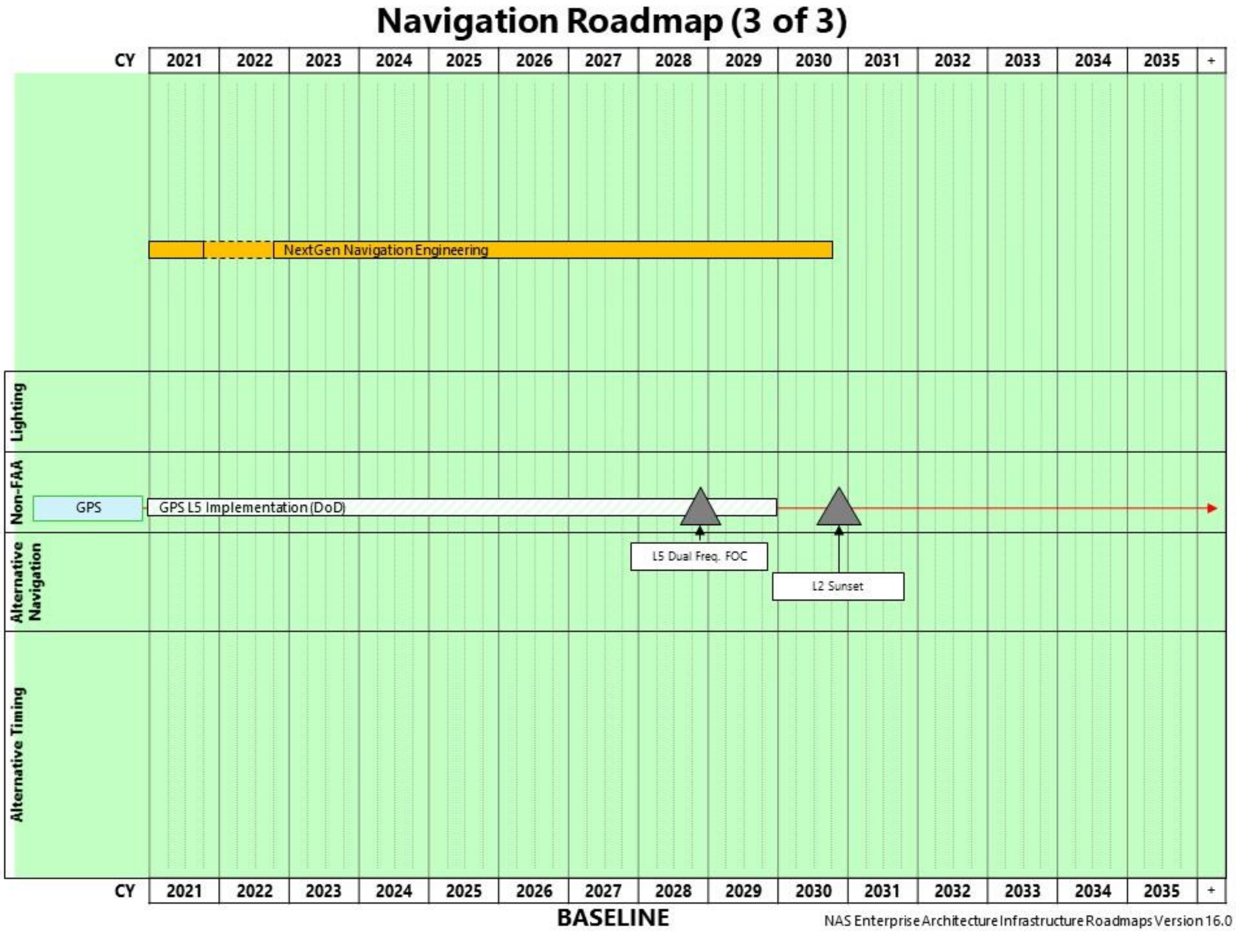


Figure 5-14 En Route/Terminal Nav and Non-Precision/Precision Approach Roadmaps

Capital investment Programs for En Route/Terminal Nav/Non-Precision/Precision Approach, Cross Environment, Precision Approach, and Non-Fed include:

- Very High Frequency Omni-Directional Range (VOR) – Minimum Operational Network
- Wide Area Augmentation System (WAAS) – Phase 4A/4B Transition
- Wide Area Augmentation System (WAAS) – Phase 4B
- Very High Frequency Omni-Directional Range (VOR) Tactical Air Navigation (TACAN)
- Instrument Landing Systems (ILS)
- Distance Measuring Equipment (DME)
- Runway Visual Range (RVR)
- Approach Lighting System Safety Enhancement
- Distance Measuring Equipment (DME) / Very High Frequency Omni-Directional Range

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 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 are 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 data. The FAA distributes hazardous weather information from its own systems and uses both the FAA and National Weather Service (NWS) computer forecast models based on data available from FAA and NWS sensors to develop forecasts for use by air traffic control facilities, pilots, airline operations centers, and other aviation-related facilities.

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

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

An extensive network of camera systems which broadcasts near real-time weather images, works to improve aviation safety and efficiencies in the NAS, reduces weather-related aviation accidents and flight interruptions, and improves aviation flight decision making. General and commercial aviation pilots, dispatchers, helicopter operators, military, Flight Service Specialists, and National Weather Service Forecasters are provided with up-to-date weather visuals at airports, mountain passes and other strategic locations along regular-use air routes, and areas with elevated accident rates. This service better enables informed flight planning and flight decision-making by increasing knowledge about whether it is safe to fly before becoming airborne, and also during flight. When combined with other available textual weather products, weather camera images on the Internet become a powerful tool to aid to improve pilot situational awareness and flight decision-making.

Weather system implementation is broken down into two different roadmaps:

- Roadmap 1 (Figure 5-15) - Weather Sensors
- Roadmaps 2, 3 and 4 (Figure 5-16) - Weather Dissemination, Processing, and Display

5.5.1 Weather Sensors

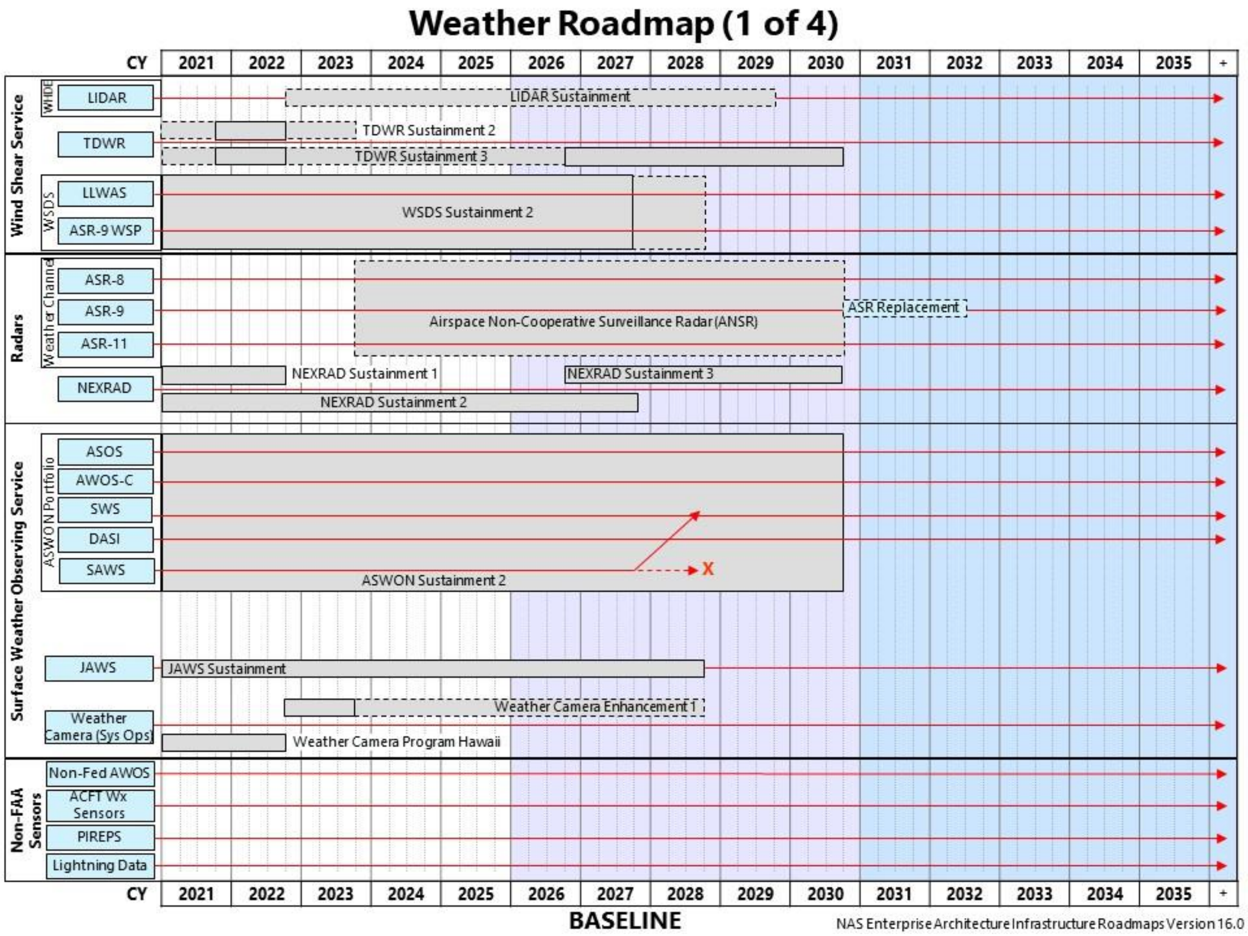
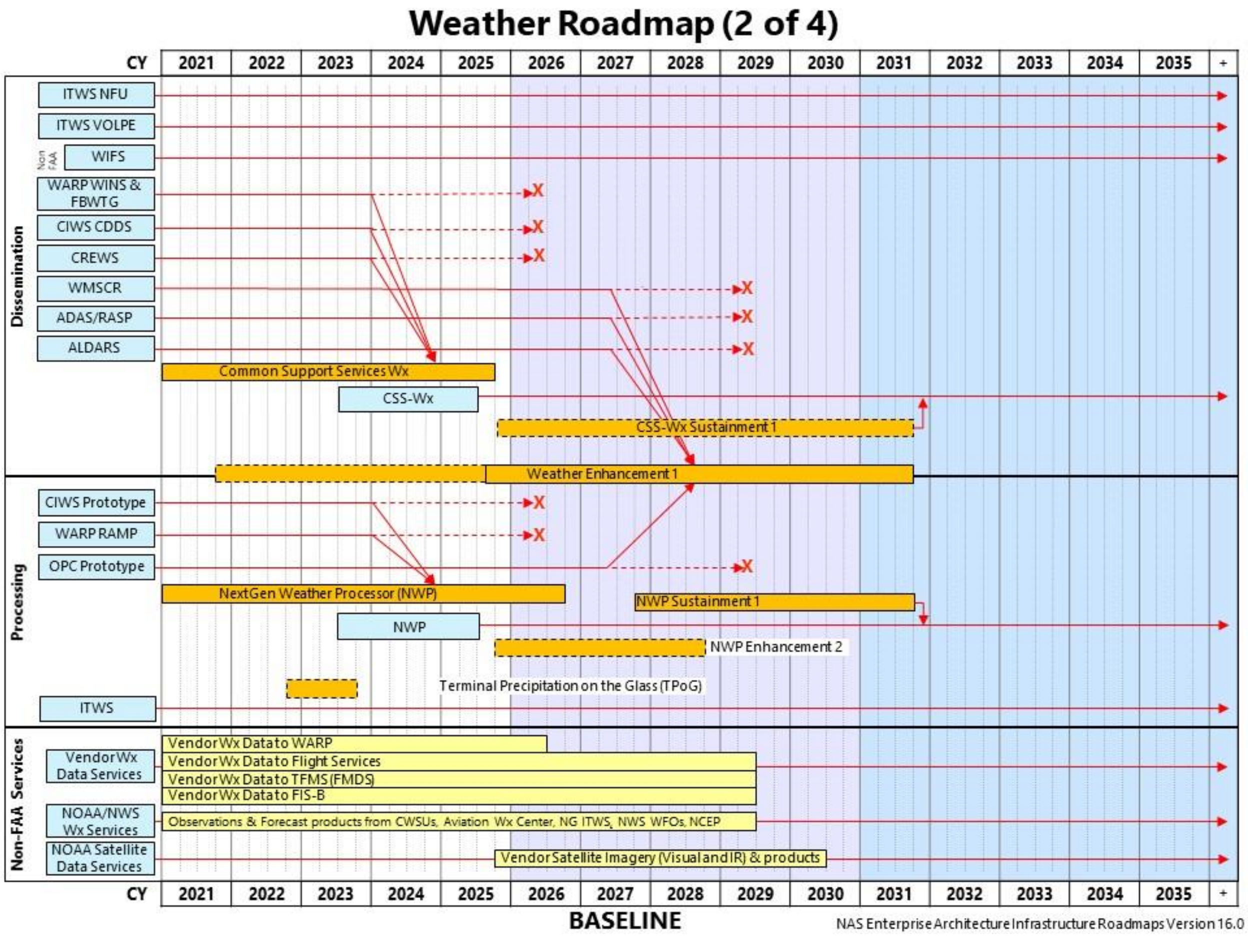


Figure 5-15 Weather Sensors Roadmap

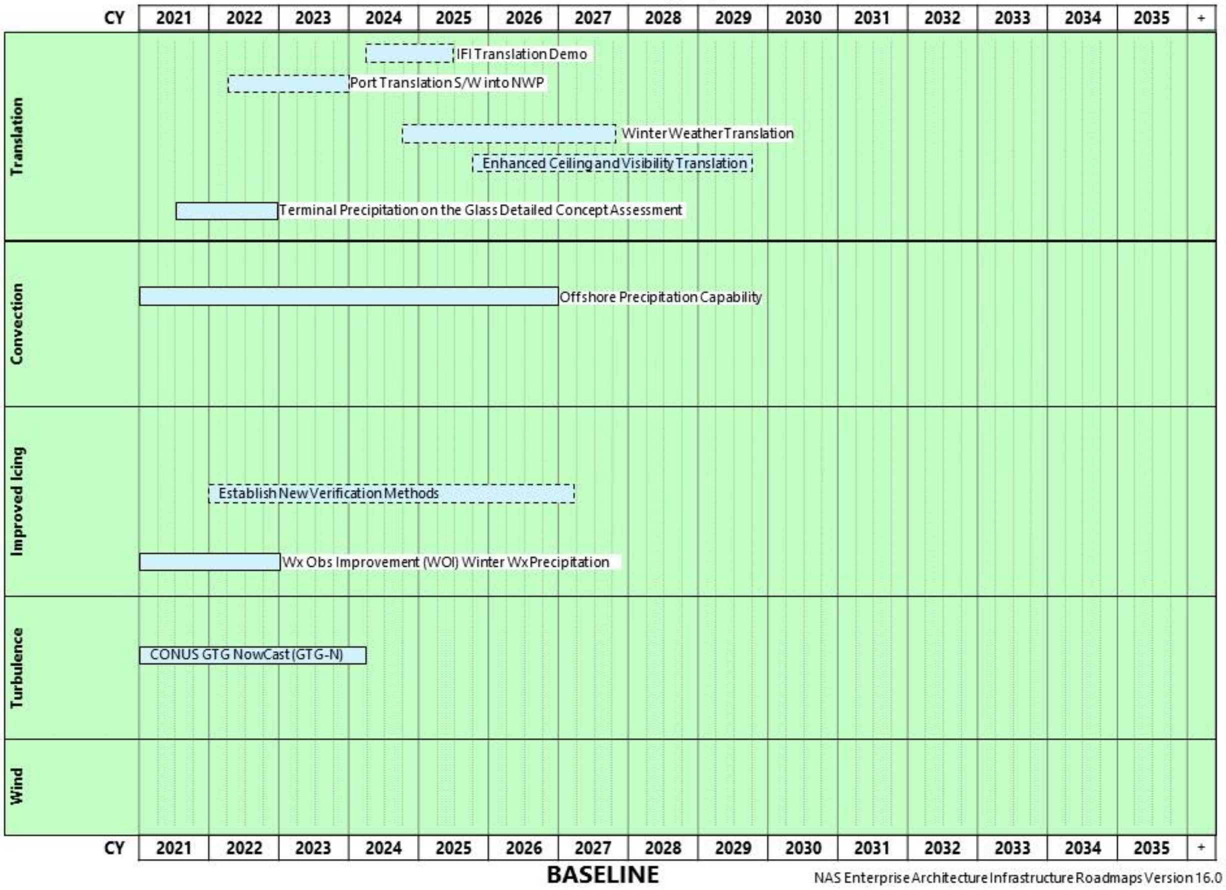
Capital investment Programs for Weather Sensors include:

- Next Generation Weather Radar (NEXRAD) – Sustainment 1
- Next Generation Weather Radar (NEXRAD) – Sustainment 2
- Wind Shear Detection Services – Sustainment 2
- Aviation Surface Weather Observation Network (ASWON) – Sustainment 2
- Juneau Airport Wind System (JAWS) – Sustainment
- Weather Camera - Hawaii Enhancement 1

5.5.2 Weather Dissemination, Processing, and Display



Weather Roadmap (3 of 4)



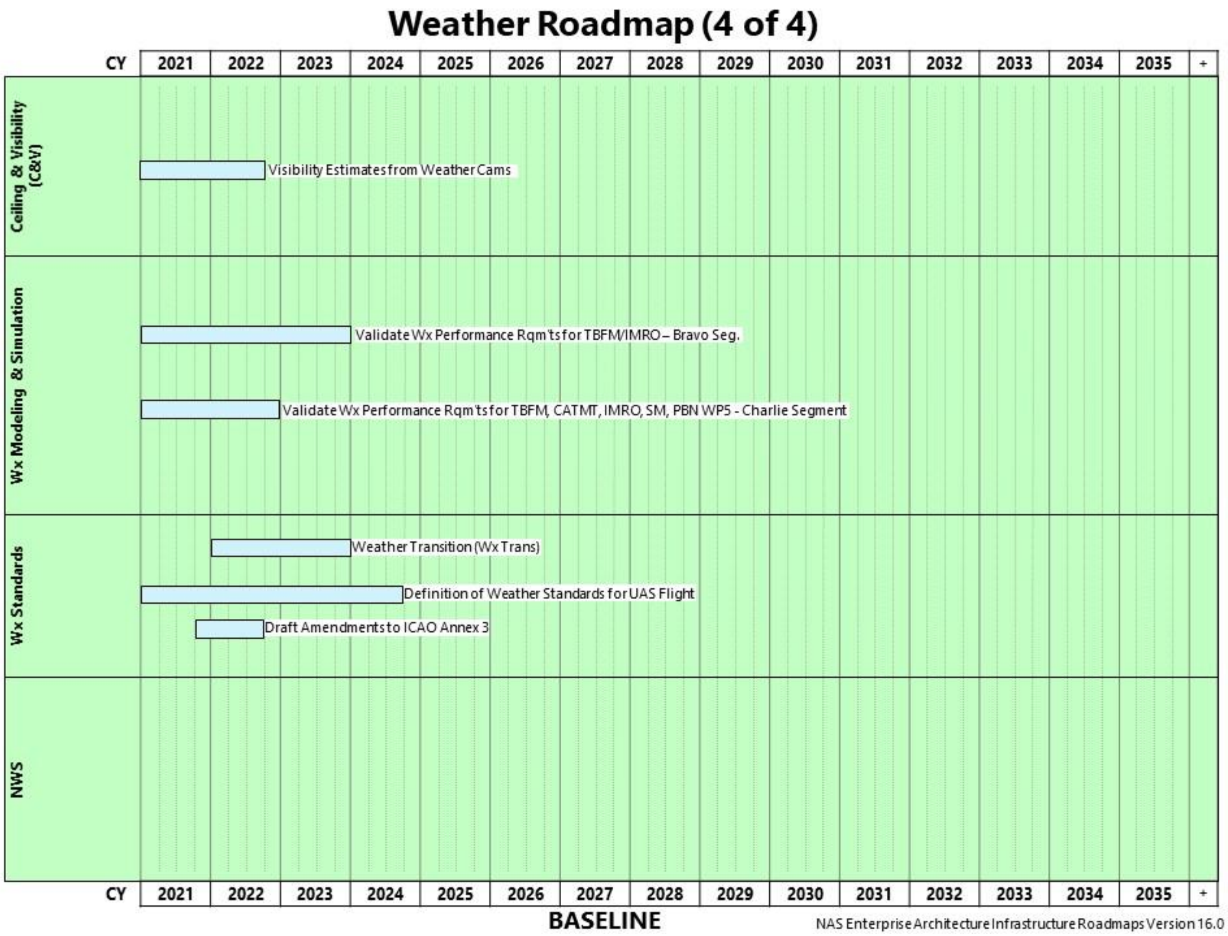


Figure 5-16 Weather Dissemination, Processing, and Display Roadmaps

Capital investment Programs for Weather Dissemination, Processing, and Display include:

- System Wide Information Management (SWIM) Common Support Services Weather (CSS-Wx)
- NextGen Weather Processor (NWP)

6 Facilities

The FAA has thousands of staffed and unstaffed operational facilities that must be maintained and modernized. The largest staffed facilities are the 21 En Route centers that house hundreds of employees and the systems and equipment to control aircraft in the en-route environment. Other operational facilities with significant staff include 352 Terminal facilities that control arrival and departure traffic to and from airports and are maintained by the FAA. There are also four CCF facilities staffed and maintained by the FAA that provide a combination of services that may include controlling aircraft in the en route environment, arriving and departing the terminal environment, and landing at and departing from one or more airports.

More than 12,000 unstaffed facilities and shelters house systems essential for communications, navigation, surveillance, and weather monitoring. Much of this equipment is located in remote areas and housed in aging buildings that require renovation. Many of these facilities have deteriorating steel towers and foundations. Some newer unstaffed buildings and structures require more frequent renovation because they are located in harsher conditions near the ocean or on a mountaintop. Replacing roofing, electric power generators, heating/cooling, and structural and security components is essential to sustaining full operation of these facilities in the NAS.

Both the WJHTC in Atlantic City, NJ, and the MMAC in Oklahoma City, OK, have many buildings. Each year these complexes receive funds to conduct lifecycle sustainment of facilities, upgrade and/or replace infrastructure, and to improve and modernize buildings that support research and development, test and evaluation, operational and second level field support, training, logistics, and management functions. The MMAC operates under a lease from the Oklahoma City Airport Trust. The requested funds are used to pay the cost of the annual lease and to renovate buildings and supporting infrastructure, such as electrical and mechanical equipment. The WJHTC provides the integrated NAS platform and campus infrastructure used for research, development, test, evaluation, and field support for all NAS and NextGen acquisition programs within the FAA. Annual funding is required to upgrade and reconfigure the laboratories to accommodate acceptance testing for new equipment and to test modifications to existing equipment. Funding will improve infrastructure lifecycle planning as well as update facilities and facility support systems to ensure that the campus infrastructure and associated buildings operate properly and are capable of handling the utility loads of the systems being tested.

The ATCT / TRACON Replacement program includes planned funding for the replacement of existing ATCT and TRACON facilities. The projects are funded in five segments and are scheduled based on FAA priorities. A project typically spans a period of 5-10 years from inception to completion depending upon its size and complexity.

The ATCT / TRACON Sustainment program renovates or replaces specific exterior or interior components of existing towers and TRACONs, such as elevators, heating ventilation and cooling equipment, roofs, or other infrastructure that the FAA must upgrade to keep these facilities functioning.

The ARTCC and CCF Sustainment program supports en route air traffic operations and service-level availability by providing life cycle management of the physical plant infrastructure at the ARTCC and CCF facilities. The FAA upgrades and improves these facilities by replacing heating and cooling systems, upgrading electrical power distribution systems, replacing obsolete fire detection and protection systems, and sustaining other facility infrastructure components to meet current and new mission requirements.

The Alaska Flight Service Facility Modernization program sustains, replaces, or relocates Flight Service facilities in Alaska to ensure security, continuity of flight service operations, and adapt to geographical changes in service demand. The program corrects deficiencies such as substandard lightning, grounding, and bonding protection; electrical systems; and heating and cooling systems that could disrupt flight service operations.

Funding is necessary to replace additional facilities and address the sustainment backlog over the coming years and decades. The FAA has 377 FAA-maintained facilities that will need to be replaced at some point in their life cycle, and many of them are over 40 years old. There has never been a facility replacement of any of the 21 air traffic control En Route centers, which are on average almost 60 years old. Consequently and importantly, this is ongoing work. Each year, new issues arise and additional technologies reach the end of their life cycles.[8]

Capital investment Programs for Facilities include:

- William J. Hughes Technical Center Laboratories
- William J. Hughes Technical Center Building & Plant Sustainment
- Air Route Traffic Control Center (ARTCC) and Combined Control Facility (CCF) Sustainment
- Long Range Radar (LRR) Infrastructure Sustainment
- Air Traffic Control Tower (ATCT)/ Terminal Radar Approach Control (TRACON) Replacement
- Air Traffic Control Tower (ATCT)/ Terminal Radar Approach Control (TRACON) Sustainment
- Facility Realignment Implementation
- Environmental & Occupational Safety & Health (EOSH)
- Alaska Flight Service Facility Modernization (AFSFM)
- Fuel Storage Tank Sustainment
- Unstaffed Infrastructure Sustainment (UIS)
- FAA Employee Housing & Life Safety Shelter System Services
- Real Property Disposition
- Energy Management and Compliance (EMC)
- Power Systems Sustainment 3
- Child Care Center Sustainment
- Environmental Cleanup / Hazardous Materials (HAZMAT)
- Facility Security Risk Management (FSRM) Sustainment 3
- Mobile Asset Sustainment
- Logistics Support Systems & Facilities (LSSF) - Logistics Center Support System (LCSS) Segment 2
- Logistics Support Systems & Facilities (LSSF) - Logistics Center Support System (LCSS) Enhancement
- Aeronautical Center Infrastructure Sustainment
- Aeronautical Center Lease

7 Mission Support

Mission support capabilities are essential to accomplishing the FAA’s mission, contribute to the safe and efficient operation of the NAS, and provide resources and support to other capital programs. As the NAS continues to evolve, mission support programs play an important role in achieving the program objectives of CIP programs on schedule and on budget.

Some of the capabilities provided by mission support programs include: airspace analysis and design, tools for procedures development, improved cyber technology, and information security; acquisition of test equipment for maintenance of NAS systems; acquisition of aircraft to support FAA’s mission; airborne flight inspection of navigational aids, surveillance systems, and instrument flight procedures; emergency response and transportation; analysis and modeling of operational data to improve system efficiency; enhancements to aviation safety; improved workforce training capabilities (such as distance learning); and services provided by Technical Support Services Contract, NAS Integration Support Contract, and Center for Advanced Aviation System Development to meet requirements for other capital programs.

Capital investment Programs for Mission Support include:

- Runway Incursion Reduction - Advanced Technology Development and Prototyping (ATDP)
- ATDP - System Capacity, Planning, and Improvements
- ATDP - Operations Concept Validation and Infrastructure Evolution
- Major Airspace Redesign - Advance Technology Development and Prototyping (ATDP)
- ATDP - Strategy and Evaluation
- ATDP - Dynamic Capital Planning - Resource Management Tool
- Enterprise, Management, Integration, Planning and Performance Evaluation for NextGen
- Operational Modeling Analysis and Data
- Enterprise Information Management (EIM) Platform
- Aircraft Related Equipment (ARE) Sustainment
- Flight Program Fleet Modernization
- Operational Analysis and Reporting System (OARS) Phase 1
- FAA Critical Infrastructure for System Safety (FCISS)
- Critical Infrastructure Cybersecurity Enhancement
- National Test Equipment Sustainment
- Configuration Management Automation (CMA) Phase 1
- Distance Learning
- CIP Systems Engineering & Development Support - Systems Engineering Contract
- Provide ANF/ATC Support (Quick Response)
- NAS Regional/Center Logistics Support Services (LSS)
- NAS Implementation Support Contract (NISC)
- Technical Support Services Contract (TSSC)
- Resource Tracking Program (RTP)
- CIP Systems Engineering & Architecture - Center for Advanced Aviation System Development (CAASD)

8 Summary

The FAA's FY 2023-2027 CIP provides a balanced portfolio of capital programs to modernize and sustain critical NAS infrastructure and deliver systems and capabilities in support of NextGen. NextGen has completed the fundamental infrastructure modernization of the NAS across communication, navigation, surveillance, automation, and information exchange domains. NextGen will now focus on utilizing modernized infrastructure and technologies to realize integrated operational changes to deliver TBO.

Acquiring new generations of NAS systems present several challenges including the estimation of resources and time required to develop, design, engineer, test, and deliver emerging technologies. Ultimately, these systems will provide new or improved capabilities and benefits to the aviation industry, service providers, and the flying public. By successfully identifying, managing, and delivering new opportunities, the FAA will remain as the global leader in civil aviation for the foreseeable future.

9 Acronyms and Abbreviations

--Number--	
4D	four dimensional
--A--	
ACAT	acquisition category
ACE-IDS	ASOS controller equipment-information display system
ACFT	aircraft
ACS	aeronautical common services
ADAS	AWOS (automated weather observation system) data acquisition system
ADS-B	automatic dependent surveillance-broadcast
ADS-R	automatic dependent surveillance-rebroadcast
AEFS	advanced electronic flight strips
AFSS	automated flight service station
A/G	air-to-ground
AGIS	airport geographic information system
AIM	aeronautical information management
AIMM	aeronautical information management modernization
AIR	FAA Aircraft Certification Service
AISR	aeronautical information system replacement
AIXM	aeronautical information exchange model
ALDARS	automated lightning detection and reporting system
ALS	approach lighting system
ALSF-2	approach lighting system with sequenced flashing lights
AMASS	airport movement area safety system
AMEN	aerospace medical equipment needs
AMMS	automated maintenance management system
AMS	acquisition management system
AMSIS	aerospace medicine safety information system
ANICS	Alaskan national airspace system interfacility communications system
ANSP	air navigation service provider
ARMT	airspace resource management tool
ARSR	air route surveillance radar
ARTCC	air route traffic control center
ARTS IE/IIE	automated radar terminal system (model IE or IIE)
ASDE-3	airport surface detection equipment model 3 (primary radar)
ASDE-X	airport surface detection equipment model x
ASEPS	advanced surveillance enhanced procedural separation
ASKME	aviation safety knowledge management environment
ASOS	automated surface observing system
ASR-8, 9 or 11	airport surveillance radar model 8, 9 or 11
ASSC	airport surface surveillance capability
AST	FAA's Office of Commercial Space Transportation
ASTI	Alaskan satellite telecommunication infrastructure
ASWON	aviation surface weather observation network
ATC	air traffic control
ATCBI-5, 6	ATC beacon interrogator model 5or 6
ATCSCC	Air Traffic Control System Command Center

ATCT	air traffic control tower
ATIS	automated terminal information service
ATM	air traffic management
ATN	aeronautical telecommunications network
ATO	Air Traffic Organization
ATOP	advanced technologies and oceanic procedures
AVS	FAA Office of Aviation Safety
AWIPS	advanced weather interactive processing system
AWOS	automated weather observation system
AWOS-C	AWOS model C
--B--	
BLI	Budget Line Items
BUEC	back up emergency communications
BWM	bandwidth manager
--C--	
CAMI	Civil Aerospace Medical Institute
CARF	central altitude reservation function
CARSR	common air route surveillance radar
CAST	commercial aviation safety team
CAT (I, II, or III)	category of precision approach capability
CCF	combined control facility
CCS-W	conference control system – Warrenton
CD-2	common digitizer – model 2
CDDS	CIWS data distribution system
CEA	compliance enforcement actions
CFR	code of federal regulations
CFS	communication facilities sustainment
CIP	capital investment plan
CIWS	corridor integrated weather system
CONUS	continental United States
COTS	Commercial-off-the-shelf
CPDLC	controller-pilot data link communications
CRDRD	concept and requirements definition readiness decision
CREWS	CTAS remote weather system
CSSD	common status and structure data
CSS-FD	common support services – flight data
CSS-Wx	common support services – weather
CTAS	center/TRACON automation system
CTD	common terminal digitizer
CTS	coded time source
CV-4400	allows use of terminal radar information in en route automation systems
--D--	
DALR	digital audio legal recorder
DASI	digital altimeter setting indicator
Data Comm	data communications
DCIS	data communications integrated services

DCL	departure clearance
DCNS	data comm network services (air/ground)
DME	distance measuring equipment
DME/DME	RNAV using multiple DMEs
DMN	data multiplexing network or data exchange messaging nodes
DoD	Department of Defense
DOT	Department of Transportation
DOTS+	dynamic ocean tracking system plus
D-side	radar associate position controller
DSP	departure spacing program
DUATS	direct user access terminal system
DVARS	data visualization, analysis and reporting system
DVOR	Doppler VOR
--E--	
EA	enterprise architecture
ECG	en route communications gateway
ECS	emergency communication system
EDDS	en route data distribution system
EFSTS	electronic flight strip transfer system
E-IDS	enterprise information display system
ELITE	enhanced local integrated tower equipment
ELVO	enhanced low visibility operations
EMC	energy management and compliance
EOL	end-of-life
ERAM	en route automation modernization
ERIDS	en route information display system
E-Scan	electronic scan version of PRM (precision runway monitor)
ETR	emergency transmitter replacement
ETVS	enhanced terminal voice switch
EWD	enhanced weather information network server (WINS) distribution
--F--	
F-420	wind sensor series F-420
FAA	Federal Aviation Administration
FANS	future air navigation system
FBWTG	FAA bulk weather telecommunication gateway
FDIO	flight data input/output
FDP	flight data processing
FDPS	flight data processing system
FDP2K	flight data processing 2000
FENS	FAA enterprise network services
F&E	facilities and equipment
FFS	future flight services
FFSP	future flight services program
FID	final investment decision
FIS-B	flight information services – broadcast
FNS	federal NOTAM system
FS	FAA’s Flight Standards Service

FSS	flight service station
FTI	FAA telecommunications infrastructure
FY	fiscal year
--G--	
G1/G2	STARS generation 1/2
GA	general aviation
GAO	Government Accountability Office
GBAS	ground-based augmentation system
GDP	gross domestic product
GNSS	global navigation satellite system
GOM	Gulf of Mexico
GPS	global positioning system
--H--	
HF	high frequency or human factors
HOST	Host computer system
--I--	
IAM	identity and access management
IARD	investment analysis readiness decision
ICAO	International Civil Aviation Organization
ICMS	Interlock control and monitoring system
ICSS	integrated communication switching system
IDAC	integrated departure/arrival capability
IDS	integrated display system
IESP	integrated enterprise service platform
IID	initial investment decision
IFR	instrument flight rules
ILS (I, II, or III)	instrument landing system (category I, II, or III)
IM	interval management
IOC	initial operational capability
IP	internet protocol
IRU	inertial reference unit
ITWS	integrated terminal weather system
IVSR	interim voice switch replacement
--J--	
JAWS	Juneau airport wind system
JRC	joint resources council
--K--	
--L--	
L1 C/A	GPS legacy civil frequency
L5	GPS second civil frequency
L1/L5	GPS dual frequency for WAAS users
LDIN	lead in light system
LDRCL	low-density radio communication link

LIDAR	light detection and ranging
LITE	local integrated tower equipment
LLWAS	low level wind shear alert system
LOC	localizer
LP	localizer performance or low power
LPV	localizer performance with vertical guidance
--M--	
MALSR	medium-intensity approach lighting system with runway alignment indicator lights
MASR	mobile airport surveillance radar
MB	marker beacons
MDR	multimode digital radios
Micro-EARTS	microprocessor en route automated radar tracking system
MMAC	Mike Monroney Aeronautical Center
Mode S	mode select
MON	minimum operating (or operational) network
MSN	message switching network
--N--	
NADIN MSN	national airspace data interchange network – message switching network
NADIN PSN	national airspace data interchange network – package switching network
NAIMES	NAS aeronautical information management enterprise system
NAS	national airspace system
NASE	NAS adaptation services environment
NAS EA	NAS enterprise architecture
NASR	national airspace system resources
Navaids	navigation aids
NDB	non-directional beacon
NEMS	NAS enterprise messaging service
NEXCOM	next generation air/ground communications
NEXRAD	next generation weather radar
NextGen	next generation air transportation system
NIDS	NAS information display system
NM	nautical miles
NME	navaids monitoring equipment
NOAA	National Oceanic and Atmospheric Administration
NOP	national offload program
NOTAM	notices to missions
NSG	navigation service group
NVR	NAS voice recorder
NVS	NAS voice system
NWP	NextGen weather processor
NWS	National Weather Service
--O--	
OASIS	operational and supportability implementation system
ODALS	omnidirectional airport lighting system
OEAAA	obstruction evaluation/airport airspace analysis

OFDPS	offshore flight data processing system
OMB	Office of Management and Budget
OPC	offshore precipitation capability
OPSNET	operations network
OSHA	Occupational Safety and Health Administration
--P--	
PAPI	precision approach path indicator
PBN	performance-based navigation
PC	personal computer
PDARS	performance data analysis and reporting system
PDC	pre-departure clearance
PIREPS	pilot reports
PRM E-SCAN	precision runway monitor – electronic scan radar
PSN	package switching network
--Q--	
--R--	
RAMP	radar acquisition and mosaic processor
RASP	regional AWOS data acquisition system (ADAS) service processor
RCAG	remote center air/ground
RCE	radio control equipment
RCF	remote communication facilities
RCISS	regulation and certification infrastructure for system safety
RCL	radio communication link
RCO	remote communications outlet
RCOM	NAS recovery communications
RDVS	rapid deployment voice switch
REIL	runway end identifier lights
RMLS	remote monitoring and logging system
RNAV	area navigation
RNP	required navigation performance
RPM	revenue passenger miles
RSA	runway safety area
R-Side	radar position controller
RTR	remote transmitter/receiver
RVR	runway visual range
RWSL	runway status lights
--S--	
S1P1	segment 1, phase 1
S1P2	segment 1, phase 2
SAA	special activity airspace
SAMS	special use airspace management system
SAS	safety assurance system
SASO	system approach for safety oversight
SAWS	standalone weather sensors
SBA	space-based ADS-B

SBAS	satellite based augmentation system
SDAT	sector design and analysis tool
SDI	space data integrator
SENSR	spectrum efficient national surveillance radar
SFMEE	strategic flow management engineering enhancement
SIGMETS	significant meteorological information
SLEP	service life extension program
SMA	surface movement advisor
SMS	safety management system
SOA	service oriented architecture
STARS	standard terminal automation replacement system
STARS E	STARS enhanced local integrated tower equipment (ELITE)
STVS	small tower voice switch
SWIM	system wide information management
SWS	surface weather system
--T--	
TACAN	tactical air navigation
TAMR	terminal automation modernization replacement
TBFM	time based flow management
TBO	trajectory based operations
TCW	terminal control workstation
TDLS	tower data link service
TDM	time division multiplexing
TDM-to-IP	time division multiplexing to internet protocol
TDW	tower display workstation
TDWR	terminal Doppler weather radar
TDX-2000	target data extractor–2000 (converts analog radar data to digital)
Tech Ops	Technical Operations (part of ATO)
TFDM	terminal flight data manager
TFM	traffic flow management
TFM-I	TFM improvements
TFMS	TFM system
TFR Bldr	temporary flight restriction builder
TIS-B	traffic information services-broadcast
TMI	traffic management initiatives
TMU	traffic management units
TR	technology refresh
TRACON	terminal radar approach control
TSAS	terminal sequencing and spacing
TVS	terminal voice switch
--U--	
UAS	unmanned aircraft systems
UHF	ultra high frequency
UIC	universal interlock controller
USNS	United States NOTAM (notice to airmen) system
--V--	

VASI	visual approach slope indicator
VCS	voice communications systems
VDL	VHF data link
VHF	very high frequency
VoIP	voice over internet protocol
Volpe	Volpe National Transportation Center in Cambridge, MA
VOR	very high frequency omnidirectional range
VOT	VOR test
VORTAC	VOR collocated with TACAN
VSCS	voice switching and control system
VSBP	voice switch by pass
VTABS	VSCS training and backup switch
--W--	
WAAS	wide area augmentation system
WAFS	world area forecast system
WAM	wide area multilateration
WARP	weather and radar processor
WCAM	weather camera system
WEF	wind equipment series F-420
WIFS	WAFS internet file service
WINS	weather information network server
WiWAVES	wind and wave evacuation, and survival
WJHTC	William J. Hughes Technical Center
WME	wind measuring equipment
WMSCR	weather message switching center replacement
WP	work package
WSDD	web service description documents
WSDS	wind shear detection services
WSP	wind shear processor
WSRF	water survival research facility
Wx	weather
–X–	
–Y–	
–Z–	