Separation Management

Charlie - Delta Increments

Portfolio Overview

Enhancements to Separation Management will provide controllers with tools and procedures to manage aircraft separation in a mixed environment of varying navigation equipment and aircraft performance capabilities. Aircraft separation assurance is the cornerstone of Air Traffic Control (ATC) operations. Separation management in the National Airspace System (NAS) can be accomplished procedurally and/or by using automation support. The enhancements to aircraft separation standards based on the revision of wake turbulence separations and enhancements to the terminal and oceanic automation systems are required to support separation management. Separation management is performed in a different way in each of the domains. Controllers will be provided with guidance on how to procedurally apply wake turbulence separation criteria in the NAS. The automation changes required will assist controllers in performing separation management for specific conditions and types of operations in their respective domains.

This portfolio focuses on the following:

- Satisfying user operational needs
- Improving operational efficiency
- Increasing access to the NAS
- Enhancing sector team efficiency
- Geographically expanding current capabilities
- Maintaining and improving the safety of the NAS

Note: The dates and timelines included in the NAS Segment Implementation Plan (NSIP) are for planning purposes only. All capability schedules are tentative until their supporting programs are officially baselined.

Separation Management

Portfolio Content Summary Statistics

		Increment Status				
Segment	**Total by Segment**	**Planned**	**Concept Exploration & Maturation**	**Development**	**Initial Operational Availability**	**Completed**
*Alpha (2010 - 2015)	3	0	0	0	0	3
*Bravo (2016 - 2020)	4	0	0	0	0	4
Charlie (2021 - 2025)	8	0	2	5	0	1
Delta (2026 - 2030)	18	6	12	0	0	0
TOTAL	33	6	14	5	0	8
Segment	**% by Segment**	**% by Segment/Increment Status**				
*Alpha (2010 - 2015)	9 %	0 %	0 %	0 %	0 %	100 %
*Bravo (2016 - 2020)	12 %	0 %	0 %	0 %	0 %	100 %
Charlie (2021 - 2025)	24 %	0 %	25 %	63 %	0 %	13 %
Delta (2026 - 2030)	55 %	33 %	67 %	0 %	0 %	0 %
TOTAL	100%	18 %	42 %	15 %	0 %	24 %

* Please see Appendix A and B for information about Alpha and Bravo Increments, respectively.

Separation Management

Operational Improvements/Current Operations & Increments

Benefits

OI: [101202] Flight Management with Trajectory (2027 - 2035)

D [101202-22] Unique Attributes for UAS Flight Planning **(2031 - 2035)**

OI: [102148] Time-Based Spacing Using Interval Management (2036 - 2043)

D [102148-01] Initial Time-Based Spacing Using Interval Management **(2036 - 2040)**

D [102148-02] Advanced Time-Based Spacing using Interval Management **(2039 - 2043)**

OI: [102152] Dynamic, Pair-wise Wake Turbulence Separation (2031 - 2035)

D [102152-31] Dynamic, Pair-wise Wake Separation Standards **(2031 - 2035)**

OI: [102146] Improved Aircraft Trajectories (2033 - 2039)

D [102146-21] Increase Capacity and Efficiency Using Flight Management Computer (FMC) Route Offset **(2034 - 2039)**

D [102146-22] Air-to-Ground Trajectory Synchronization **(2033 - 2038)**

D [102146-24] Dynamic Arrival and Departure Trajectories **(2033 - 2037)**

OI: [102117] Reduced Horizontal Separation Standards, En Route - 3 Miles (2020 - 2030)

C [102117-22] Active Surveillance Collision Avoidance **(2020 - 2025)**

C [102117-23] Expanded Use of 3 NM Separation Airspace **(2020 - 2022)**

D [102117-24] En Route Wake Turbulence Encounter Mitigation **(2027 - 2030)**

OI: [102137] Automation Support for Separation Management (2014 - 2030)

C [102137-29] More Efficient Merging of Terminal Arrival Flows **(2019 - 2024)**

OI: [102118] Relative Spacing Using Interval Management (2026 - 2040)

D [102118-23] Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach **(2026 - 2030)**

COE: [102112] Current En Route Separation (N/A)

D [102112-22] UAS ATC Direct Communications **(2031 - 2035)**

External Commitment · Primary Benefit · Secondary Benefit · Operationally Available · Complete

Access & Equity · Capacity · Flexibility · Efficiency · Environment · Predictability · Safety · C Charlie · D Delta

Separation Management

OI: [104102] Optimized Oceanic Trajectories via Interactive Planning (2020 - 2039)

C [104102-30] Enhanced Conflict Probe for ATOP Surveillance Airspace **(2020 - 2025)**

D [104102-37] Improved Oceanic Weather Routes **(2035 - 2039)**

COE: [103201] Current Traffic Advisory (N/A)

C [103201-01] UAS Detect and Avoid **(2022 - 2026)**

OI: [102157] Improved Parallel Runway Operations with Airborne Applications (2020 - 2040)

C [102157-31] Operation Specific Collision Avoidance **(2020 - 2026)**

OI: [108214] UAS Airspace Access (2017 - 2024)

C [108214-02] UAS Airspace Access when Operating Beyond Visual Line of Sight **(2020 - 2024)**

OI: [102159] CSPR Paired Departure Wake Mitigation (2027 - 2030)

D [102159-01] CSPR Paired Departure Wake Mitigation **(2027 - 2030)**

OI: [102160] Advanced Automation Support for Separation Management (2031 - 2035)

D [102160-01] En Route Separation Tools to Support PBN Routes **(2031 - 2035)**

D [102160-02] Controller Tools for Managing Advanced Wake Separation Standards **(2031 - 2035)**

D [102160-03] Separation Management Tools to Increase PBN Procedure Utilization **(2031 - 2035)**

D [102160-04] En Route Separation Tools to Support Increased Utilization of Airspace **(2031 - 2035)**

OI: [102162] Automated Support for More Complex Trajectory Negotiation (2031 - 2039)

D [102162-03] Enhanced En Route Data Communications Services **(2031 - 2035)**

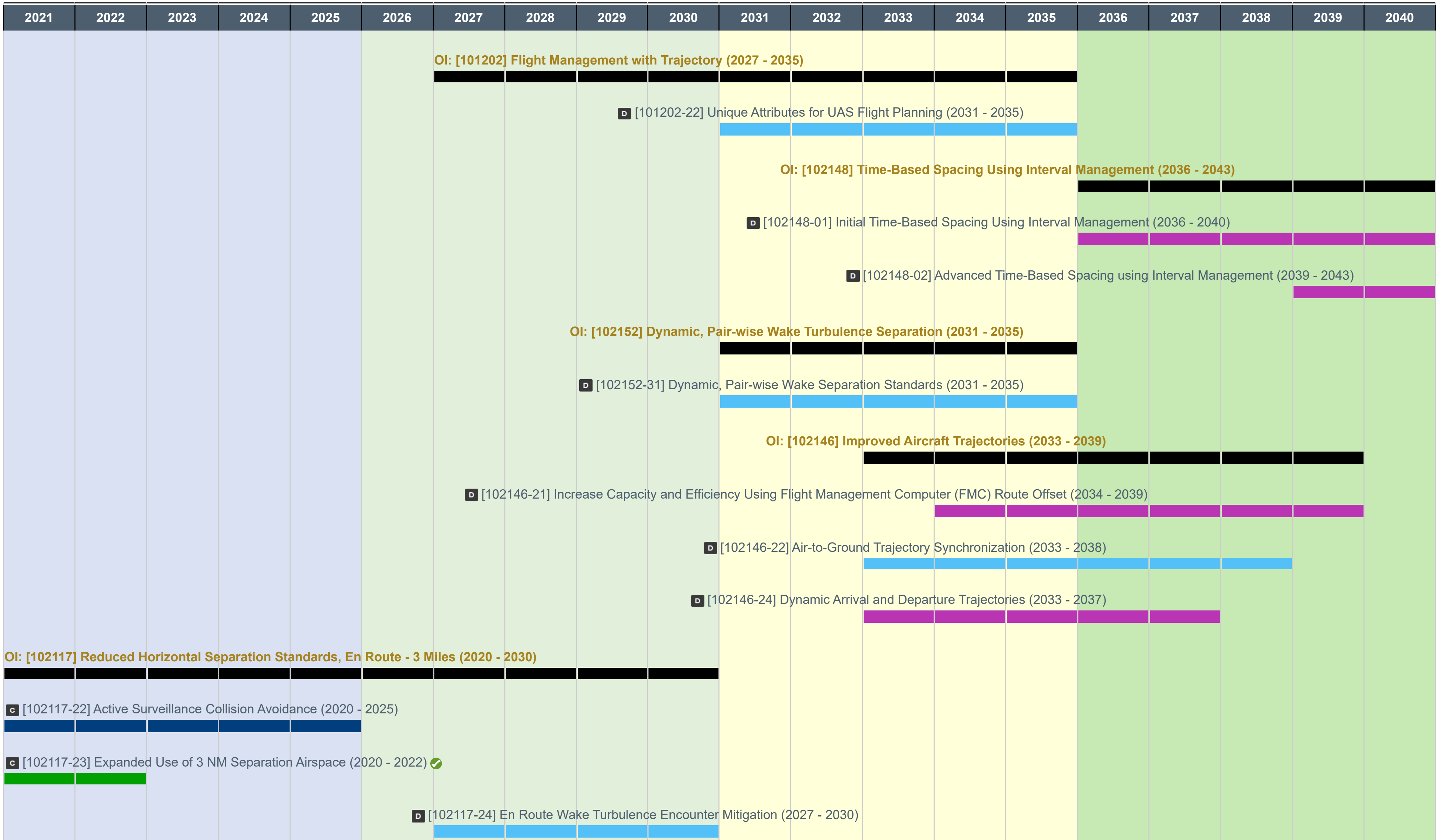
D [102162-23] Initial Air-Ground Synchronization of Aircraft Intent **(2034 - 2039)**

OI: [102109] Reduced Oceanic Separation through Advanced Surveillance (2020 - 2030)

C [102109-21] Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation **(2020 - 2025)**

External Commitment Primary Benefit Secondary Benefit Operationally Available Complete
Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety C Charlie D Delta

Separation Management



Planned | Concept Exploration & Maturation | Development | Inital Operation Available | Complete
OI | CO | COE/CBTE | C Charlie | D Delta | External Commitment

Separation Management

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040

OI: [102137] Automation Support for Separation Management (2014 - 2030)

C [102137-29] More Efficient Merging of Terminal Arrival Flows (2019 - 2024)

OI: [102118] Relative Spacing Using Interval Management (2026 - 2040)

D [102118-23] Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach (2026 - 2030)

COE: [102112] Current En Route Separation

D [102112-22] UAS ATC Direct Communications (2031 - 2035)

OI: [104102] Optimized Oceanic Trajectories via Interactive Planning (2020 - 2039)

C [104102-30] Enhanced Conflict Probe for ATOP Surveillance Airspace (2020 - 2025)

D [104102-37] Improved Oceanic Weather Routes (2035 - 2039)

COE: [103201] Current Traffic Advisory

C [103201-01] UAS Detect and Avoid (2022 - 2026)

OI: [102157] Improved Parallel Runway Operations with Airborne Applications (2020 - 2040)

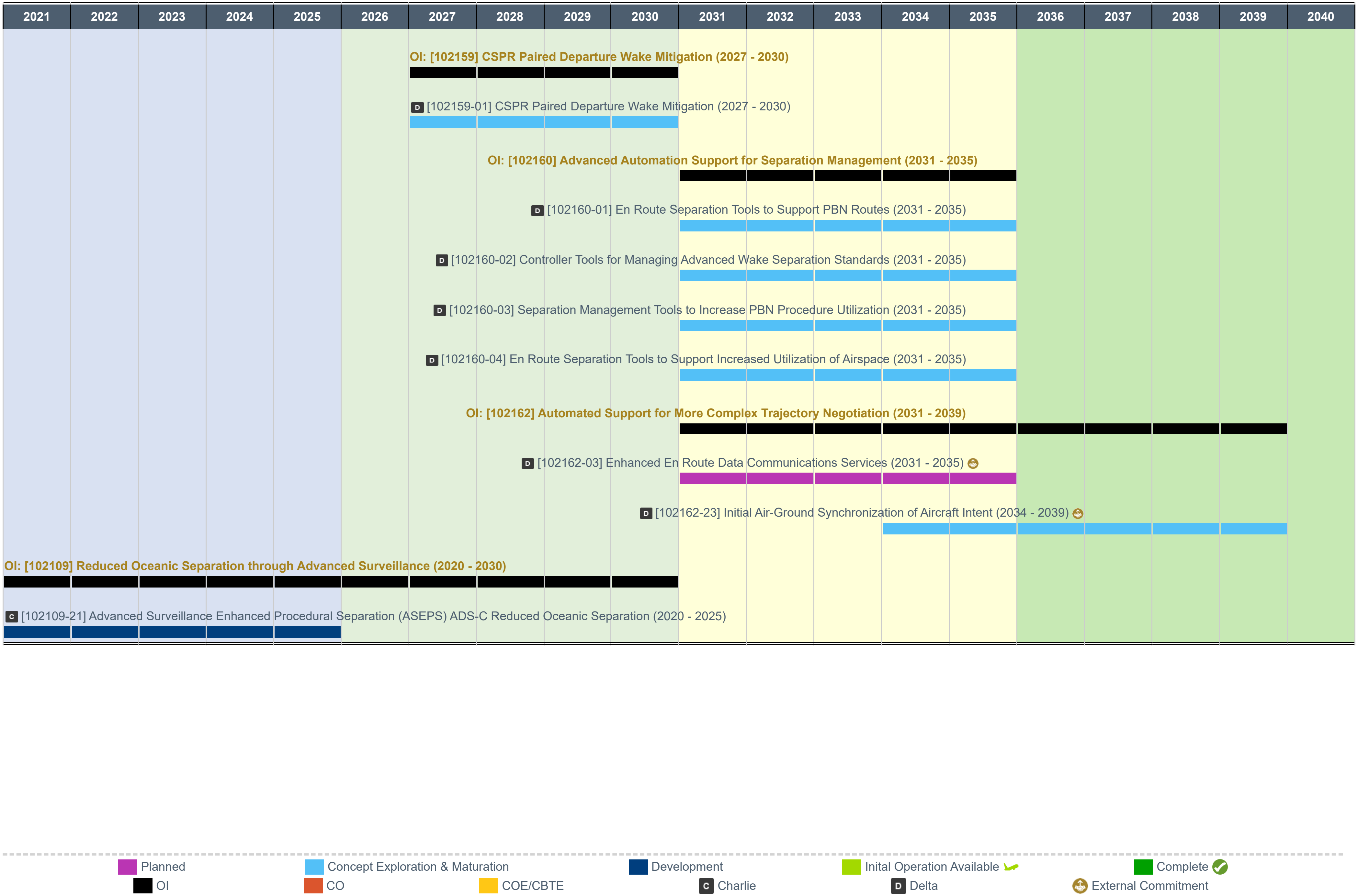
C [102157-31] Operation Specific Collision Avoidance (2020 - 2026)

OI: [108214] UAS Airspace Access (2017 - 2024)

C [108214-02] UAS Airspace Access when Operating Beyond Visual Line of Sight (2020 - 2024)

Planned | Concept Exploration & Maturation | Development | Inital Operation Available | Complete
OI | CO | COE/CBTE | C Charlie | D Delta | External Commitment

Separation Management



Separation Management

OI: [101202] Flight Management with Trajectory (2027 - 2035)

Flight Management with Trajectory develops and maintains all information about a flight and makes that information available to all decision support tools which will improve both strategic flight planning and tactical flight management. All information about a flight is presented as a 4D trajectory, either provided by the user or developed by the ground automation based on internationally standardized formats and definitions. As reroutes are selected, user preferences assessed, and approved, the trajectory flight data continues 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. Based on these capabilities, Flight Management with Trajectory also provides continuous monitoring of the status of all flights – quickly alerting the system to unexpected termination of a flight and rapid identification of last known position.

OI Benefit

Access and Equity (P): System capacity will be better utilized through the sharing of traffic management initiatives and the impact of those initiatives of individual flights which will decrease the instances of over-constrained airspace access.

Efficiency (P): Efficiency will be improved through better evaluation of arrival constraints which will enable aircraft to be delayed at higher and more fuel efficient altitudes.

Flexibility (P): Users will have increased flexibility to select preferred routes that better meet their business objectives.

Predictability (S): With the sharing of flight information throughout the system, system predictability will be improved.

Increments

Delta

(2026 - 2030)

1

D **[101202-22] Unique Attributes for UAS Flight Planning (2031 - 2035)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

D [101202-22] Unique Attributes for UAS Flight Planning (2031 - 2035)

Increment Overview

This increment enables UAS flight planners to exchange with the air traffic management system unique flight characteristics for UAS flight plans contributing to the integration of UAS into the overall ATC system. Flight data exchange with airspace users is expanded as necessary to accommodate UAS unique operational needs. The ability to provide the contingency route to controllers in case of a lost link between the UAS pilot in command and the aircraft is implemented. All of the information about the flight is made available to system stakeholders with a need to know and is available for ATM planning and operation throughout the NAS.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished via a common net-enabled information exchange service to be determined.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Predictability (P): With the sharing of flight information throughout the system, system predictability will be improved.

System Interactions

To be determined

Separation Management

OI: [102148] Time-Based Spacing Using Interval Management (2036 - 2043)

More precise inter-aircraft spacing enabled by FIM equipment increases arrival capacity and efficiency through tighter adherence to time-based spacing assignments. IM operations should result in reduced inter-aircraft distances in the terminal area. This should improve airport/runway capacity and help avoid some costly, low-altitude maneuvering without negatively impacting controller workload and task complexity in managing separation between aircraft. In addition, Interval Management operations are expected to reduce frequency congestion and the number of necessary controller traffic interventions.

Ground automation will identify initiation opportunities to the controller who can then provide a clearance to the flight crew using voice or data communications (if available) to ensure a minimum safe distance from another aircraft. Ground automation will support the controller in monitoring the operation so the controller can detect when it is necessary to intervene in the operation. The flight crews will perform IM operations along defined flight paths, including RNAV paths with turns, using new aircraft functionality that includes along-track speed. When used in conjunction with Extended Metering and Ground-based Interval Management - Spacing this operation improves aircraft efficiency by providing the opportunity for a trailing aircraft to fly an optimized descent while maintaining a specified interval behind a lead aircraft. Controllers and automation can monitor IM operations to ensure an effective and safe flow of aircraft while enabling an aircraft to fly a more efficient descent trajectory to the runway.

OI Benefit

Capacity (P):FIM equipped aircraft can space more closely to time based metering time assignments which increases airport/runway capacity.

Efficiency (P):Reduced inter-aircraft distances in the terminal will help avoid some costly, low-altitude maneuvering.

Increments

Delta

(2026 - 2030)

2

D **[102148-01] Initial Time-Based Spacing Using Interval Management (2036 - 2040)** (Planned)

D **[102148-02] Advanced Time-Based Spacing using Interval Management (2039 - 2043)** (Planned)

Separation Management

Increments/Enabling Activities

D [102148-01] Initial Time-Based Spacing Using Interval Management (2036 - 2040)

Increment Overview

Improved surveillance (i.e., ADS-B), additional automation and procedures, and precise inter-aircraft spacing enabled by FIM equipment allow equipped aircraft to more tightly adhere to time-based spacing arrival schedules when the IM and lead aircraft are scheduled to the same runway. This should improve airport/runway capacity and help avoid some costly, low-altitude maneuvering without negatively impacting controller workload and task complexity in managing separation between aircraft. When used in conjunction with Extended Metering and Ground-based Interval Management - Spacing, IM operations improve aircraft efficiency by providing the opportunity for a trailing aircraft to fly an optimized descent while maintaining a specified interval behind a lead aircraft.

Increment Status

Planned

Success Criteria

2028 : Update ADS-B Operations – Advisory Circular 90-114

Implementation Approach

This capability is a candidate to be implemented as part of Interval Management Phase 1.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P): By allowing aircraft to space closer to required spacing needed, arrival sector capacity and departure rates into TRACONs and into overhead streams are increased.

System Interactions

ERAM (P): ERAM provides IM capability indication to the controller. In a metering environment, it would use the Assigned Spacing Goal (ASG) from TBFM. ERAM enables en route controllers to monitor IM operations to ensure an effective and safe flow of aircraft while enabling an aircraft to fly an optimized descent to the runway.

TBFM (S): TBFM would provide the ASG during metering operations. TBFM will schedule aircraft based on its IM capability.

STARS (S): STARS provides terminal controllers with IM capability indication and operational state. STARS enables terminal controllers to monitor IM operations to ensure an effective and safe flow of aircraft while enabling an aircraft to fly an optimized descent to the runway.

Separation Management

Primary Systems

- ERAM: En Route Automation Modernization

Secondary Systems

- FMDS: Flow Management Data & Services
- TBFM: Time Based Flow Management
- STARS: Standard Terminal Automation Replacement System

Avionics Systems

- ADS-B In Avionics: Automatic Dependent Surveillance - Broadcast In Avionics

Separation Management

Increments/Enabling Activities

D [102148-02] Advanced Time-Based Spacing using Interval Management (2039 - 2043)

Increment Overview

Advanced time-based spacing using Interval Management extends the use of IM clearances when the IM and lead aircraft are scheduled to dependent parallel or dependent crossing and converging runways, extending the opportunity to use IM clearances. When used in conjunction with Extended Metering and Ground-based Interval Management - Spacing, this improvement will provide additional operational solutions to enable an aircraft to continue to fly an optimized descent while maintaining a required spacing interval from a lead aircraft.

Increment Status

Planned

Success Criteria

To Be Defined

Implementation Approach

This capability is a candidate for Interval Management Phase 2.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Capacity (P):FIM equipped aircraft can space more closely to time based metering time assignments which increases airport/runway capacity.

Efficiency (S):Reduced inter-aircraft distances in the terminal will help avoid some costly, low-altitude maneuvering.

System Interactions

TBFM (P): TBFM would provide the ASG during metering operations. TBFM will schedule aircraft based on its IM capability. This capability assumes TBFM has the ability to support metering operations in the TRACON and schedule to dependent parallel or crossing/converging.

ERAM (S): ERAM provides IM capability indication to the controller. In a metering environment, it would use the Assigned Spacing Goal (ASG) from TBFM. ERAM enables en route controllers the ability to monitor IM operations to ensure an effective and safe flow of aircraft while enabling an aircraft to fly an optimized descent to the runway.

STARS (S): STARS provides terminal controllers with IM capability indication and operational state. STARS enables terminal controllers

Separation Management

ADS-B In Avionics (A): ADS-B In avionics will require IM functionality.

Primary Systems

- TBFM: Time Based Flow Management

Secondary Systems

- ERAM: En Route Automation Modernization
- STARS: Standard Terminal Automation Replacement System

Tertiary Systems

- CSS-Wx: Common Support Services - Weather

Avionics Systems

- ADS-B In Avionics: Automatic Dependent Surveillance - Broadcast In Avionics

Separation Management

OI: [102152] Dynamic, Pair-wise Wake Turbulence Separation (2031 - 2035)

In both terminal and en route airspace, capacity is increased and flows made more efficient through the addition of dynamic wake turbulence separation procedures and associated controller applications. These procedures are integrated into air traffic automation to provide real-time dynamic, pairwise, lateral, longitudinal, and vertical wake separation requirements for trajectory management based on aircraft and weather conditions. Weather sensors and prediction systems will be used to monitor and forecast weather conditions, and air traffic automation systems will be used to indicate to controllers when they can safely reduce wake separation standards.

OI Benefit

Capacity (P): Reduced wake separation standards will increase airspace and airport capacity and throughput.

Efficiency (S): Increased throughput will enable increased use of more fuel efficient routes, including ascent and descent profiles, with fewer aircraft taken off of these procedures to absorb delays needed for sequencing and spacing.

Increments

Delta

(2026 - 2030)

1

D **[102152-31] Dynamic, Pair-wise Wake Separation Standards (2031 - 2035)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

D [102152-31] Dynamic, Pair-wise Wake Separation Standards (2031 - 2035)

Increment Overview

Wake turbulence improvements will increase safety en route, and throughput at capacity-constrained, high-density airports, by developing the design requirements for aircraft and ground based capabilities to provide safe, efficient, dynamic, pair-wise wake encounter mitigation separations for operations in en route and terminal area airspace. Variable wake separation criteria that optimize spacing intervals will increase safety and throughput and provide air traffic controllers and flight crews with wake-safe separation guidance. Enabling dynamic spacing based on the real-time conditions of the airspace for en route, arrival, approach, and departure operations will allow for the safe reduction of static pair-wise wake separation standards.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished through revised wake turbulence standards and controller automation to provide the dynamic spacing required between aircraft pairs. Specific implementation approach to be determined.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Capacity (P): Automation tools will take advantage of weather conditions and specific wake separations for aircraft pairs and will enable controllers to safely achieve capacity improvements.

System Interactions

Initial system dependencies have been identified for this capability. As this capability is further defined, future updates will include the associated system interaction text.

STARS (P): To be determined.

ERAM (S): To be determined.

Primary Systems

STARS: Standard Terminal Automation Replacement System

OI: [102146] Improved Aircraft Trajectories (2033 - 2039)

Automation tools assist controllers in leveraging enhanced flight capabilities that can be used to issue more optimized and economical flight trajectories. 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. Automation assists the controller with trial planning of the route using conflict probe that incorporates aircraft provided intent data to increase the accuracy of the assessment.

OI Benefit

Efficiency (P): Addition of aircraft intent information into ATC automation increases ATC confidence in the assessment, thereby increasingly enabling aircraft to fly the flight profile and route that best meets their business objectives.

Capacity (S): Increased routing options increases capacity within flow constrained airspace.

Flexibility (P): Users are increasingly able to choose the route and flight profile that best meets their business objectives.

Environment (S): More efficient routes reduce fuel burn and emissions.

Increments

Delta

(2026 - 2030)

3

D **[102146-21] Increase Capacity and Efficiency Using Flight Management Computer (FMC) Route Offset (2034 - 2039)** (Planned)

D **[102146-22] Air-to-Ground Trajectory Synchronization (2033 - 2038)** (Concept Exploration & Maturation)

D **[102146-24] Dynamic Arrival and Departure Trajectories (2033 - 2037)** (Planned)

Increments/Enabling Activities

D [102146-21] Increase Capacity and Efficiency Using Flight Management Computer (FMC) Route Offset (2034 - 2039)

Increment Overview

Increased efficiency is provided when ANSPs have the ability to issue offsets to FMS equipped aircraft. Automation capabilities allow for trial probes of offset routes and provide points in space where offset aircraft can resume original trajectories. Offsets can be used for lateral separation of same route aircraft with speed differentials, weather avoidance, or setup for sequencing.

Increment Status

Planned

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished via enhancements to ATC separation assurance automation. Specific implementation approach to be determined.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P): Easier to implement offsets allows more to be provided thereby improving flight efficiency.

Capacity (S): By creating dynamic route offsets that have been probed for conflicts, controllers will the ability to create multiple pathways for aircraft to safely transit the sector, increasing sector capacity.

Flexibility (S): Separation of climbing/descending aircraft will be enhanced by the ability to safely offset/climb/rejoin routes resulting in increased flexibility to sector controllers.

System Interactions

Initial system dependencies have been identified for this capability. As this capability is further defined, future updates will be made to the associated system interaction text.

ERAM (P): ERAM will allow for trial probes of offset routes and provide points in space where offset aircraft can resume original trajectories.

FMS (A): FMS must meet RNAV requirements.

Avionics Systems

FMS: Flight Management System

Increments/Enabling Activities

D [102146-22] Air-to-Ground Trajectory Synchronization (2033 - 2038)

Increment Overview

Estimated aircraft paths, altitudes, and arrival times along the route are improved through the use of downlinked aircraft performance and projection data for the full aircraft trajectory from the FMS via a data link. The ground based trajectory modelers used for tactical and strategic operations use this aircraft data to calibrate the predicted 4D trajectory. These improvements will result in better automated conflict detection accuracy and provide an important step towards end-to-end trajectory based operations.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished via algorithms that synchronize the aircraft's FMS Extended Projected Profile with the ATC separation assurance automation. Specific implementation approach for data exchange and defined algorithm changes in en route automation are to be determined. This increment is identified to have an International harmonization dependency.

Benefits

Access & Equity   Capacity   Flexibility   Efficiency   Environment   Predictability   Safety

Efficiency (P): Controllers and TMs always have the latest and most precise information on aircraft trajectories. This enables them to improve re-routing around weather and congestion, which in turn reduces impact of ground delay programs.

Environment (S): 4D Trajectories enables controllers to re-route aircraft more directly with fewer crossing restrictions, while tailoring arrivals. This is expected to result in significant fuel savings and therefore lower emissions

System Interactions

Initial system dependencies have been identified for this capability.As this capability is further defined, future updates will include the associated system interaction text.

ERAM (P): To be determined.

Data Communication Avionics (A): To be determined.

Data Com Avionics: Data Communication Avionics

Increments/Enabling Activities

D [102146-24] Dynamic Arrival and Departure Trajectories (2033 - 2037)

Increment Overview

The exchange of dynamic arrival and departure trajectories over data communications will enhance arrival and departure operations allowing for the use of optimized profile descents (OPD) and more optimized climb profiles by the majority of aircraft during periods of high capacity demand. OPDs can be flown today during periods of low capacity demand when aircraft are not likely to interfere with each other. This is not the case during periods of high capacity demand when aircraft must be flown at minimum separations in order to achieve high arrival rates. This capability would allow controllers to send more precise adjustments of aircraft arrival and departure streams via a data comm clearance allowing aircraft to fly OPDs and optimized climb profiles at minimum separations.

Increment Status

Planned

Success Criteria

To Be Defined

Implementation Approach

Aircraft ability to accept precise trajectory adjustments over a data communications link and ground automation enhancements to create and send the data communications messages. Specific approach to be determined. This increment is identified to have an International harmonization dependency.

Benefits

Access & Equity   Capacity   Flexibility   Efficiency   Environment   Predictability   Safety

Efficiency (P): Improves flight profile, throughput, delay distribution and reduced interruptions.

Safety (S): The ability to make precise adjustments of aircraft arrival and departure streams using strategic problem free clearances will enhance safety

System Interactions

Initial system dependencies have been identified for this capability. As this capability is further defined, future updates will include revisions to the associated system interaction text.

TFMS (P): In the en route phase of flight, TFMS is the automation system which will generate trajectory solutions to help with efficiency of flow. These solutions are communicated via data communications with the flight crew. Flight crew can used data communications to acknowledge the clearance, and the clearance is loaded into the FMS.

transmitted to aircraft for their FMS.

ATN IPS Avionics (A), Data Com Avionics (A)

FMS (A): FMS must meet RNP requirements.

Primary Systems

- TFMS: Traffic Flow Management System

Secondary Systems

- ERAM: En Route Automation Modernization
- DataComm: Data Communications

Avionics Systems

- Data Com Avionics: Data Communication Avionics
- FMS: Flight Management System

Separation Management

OI: [102117] Reduced Horizontal Separation Standards, En Route - 3 Miles (2020 - 2030)

The Air Navigation Service Provider (ANSP) provides reduced and more efficient separation between aircraft where the required performance criteria are met, regardless of location other than operations in oceanic airspace.

Advances in Air Navigation Service Provider (ANSP) surveillance (e.g. ADS-B) and automation allow procedures with lower separation minimums to be used in larger areas of the airspace. This reduces the incidence of conflicts and increases the efficiency of the conflict resolution maneuvers.

Aircraft collision avoidance systems will be improved to use the more precise data with new optimized surveillance and tracking algorithms leading to a decrease in the false alert rate for these procedures.

OI Benefit

Efficiency (P): Expanded use of three mile separation into en route airspace will result in more efficient routing and reduce the need for conflict resolution maneuvers in en route airspace.

Capacity (S): Airspace capacity will be increased through a reduction in separation standards that will increase the route options thereby increasing airspace capacity.

Safety (S): Improved collision avoidance and decreased false collision alerts combine to increase safety for aircraft under reduced separation minima.

Increments

Charlie (2021 - 2025)	Delta (2026 - 2030)
2	1

C **[102117-22] Active Surveillance Collision Avoidance (2020 - 2025)** (Development)

C **[102117-23] Expanded Use of 3 NM Separation Airspace (2020 - 2022)** (Complete)

D **[102117-24] En Route Wake Turbulence Encounter Mitigation (2027 - 2030)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

C [102117-22] Active Surveillance Collision Avoidance (2020 - 2025)

Increment Overview

Aircraft collision avoidance systems will be improved with new optimized surveillance and tracking algorithms that make use of more precise surveillance data leading to a decrease in nuisance alerts associated with reduced separation standards.

Increment Status

Development

Success Criteria

- 2018 : Completion of ACAS Xa/Xo Minimum Operational Performance Standards (MOPS) at RTCA
- 2019 : Completion of FAA Technical Standard Order (TSO)
- 2023 : Completion of FAA Advisory Circular

Implementation Approach

The ACAS Xa/Xo MOPS are published as RTCA DO-385 as part of the RTCA/EUROCAE standards development process. These MOPS will include standard components for the ACAS Xa/Xo system which include background and system overview, functional architecture, functional interfaces, gap analysis from legacy TCAS systems, test requirements and procedures, and an algorithm design description (ADD) for ACAS Xa/Xo. These MOPS will then enable manufacturers to create their own implementation of ACAS X while ensuring the intended output from the system. The ACAS Xa/Xo TSO and AC are being developed by FAA's aircraft certification (AIR) office with input from the TCAS PO and RTCA. These documents will be important for the FAA's Aviation Safety (AVS) and industry in the certification efforts for ACAS Xa/Xo systems.This increment is identified to have an International harmonization dependency.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Safety (P): Improved collision avoidance and decreased false collision alerts combine to increase safety for aircraft under reduced separation minima.

Efficiency (S): Reduced number of false alerts or nuisance Resolution Advisories (RAs) in US airspace will result in more efficient and reliable alerting to pilots and improve operational usage

System Interactions

ACAS-X (A): Interacts with onboard Mode S transponder.

Avionics Systems

Separation Management

Increments/Enabling Activities

C [102117-23] Expanded Use of 3 NM Separation Airspace (2020 - 2022)

Increment Overview

Expanded use of reduced horizontal separation minima from 5 NM to 3 NM in selected airspace in the en route environment increases capacity and flexibility. This will provide controllers with more flexibility in clearance options to maintain separation especially for departure and arrival sequencing, spacing and routing.

Increment Status

Complete

Success Criteria

2021 : Operationally available at key site (ZOA).

Implementation Approach

Enhance current NAS Infrastructure through the integration of enabling technologies, new standards and procedures into automation systems. Key automation systems impacted are: En Route Automation Modernization (ERAM).

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Capacity (P): Improved clearance options for arrivals and departures allow for greater utilization of available airspace.

System Interactions

ERAM (P): The Expanded use of 3-NM reduced horizontal separation minima separation standards and terminal procedures is enabled via ERAM to maintain separation for departure and arrival sequencing, spacing and routing.

Primary Systems

ERAM: En Route Automation Modernization

Increments/Enabling Activities

D [102117-24] En Route Wake Turbulence Encounter Mitigation (2027 - 2030)

Increment Overview

Airspace redesign and ERAM's ability to accommodate additional radar inputs enables increased opportunities to lower separation standards in en route airspace. Separating aircraft at less than 5 NM in trail when they are traveling at or transitioning to or from en route speeds may make wake separation the controlling factor for safe separation. Safety may require wake mitigation procedures such as revised wake separation minima or track offsets during in-trail, climb-through, descend-through, and other maneuvering.

Initially, procedures to permit risk-based decision making by controllers in establishing such offsets are implemented, mitigating en route wake turbulence encounter risks. Eventually, an en route wake vortex avoidance advisor capability is implemented in airspace that enhances en route automation.

Increment Status

Concept Exploration & Maturation

Success Criteria

2029 : Operationally available at key site

Implementation Approach

Initially, a procedure that will be defined in 7110.65, will be identified and implemented for controllers to use in the near term. Eventually, the identification of potential wake turbulence hazards created by aircraft pairings at en-route altitudes will be available to Air Traffic Control. ATC will then be able to issue climb and descend procedures/instructions defined in 7110.65 to aircraft to safely navigate around potential wake turbulence hazards while preserving the flow of air traffic through the sector. This capability is a candidate for ERAM Enhancement 3.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Safety (P): The ability of aircraft to climb and descend around potential wake turbulence hazards allows for safer maneuvering through en-route airspace.

Capacity (S): Reduction in separation from 5 NM to 3 NM results in higher throughput.

System Interactions

ERAM (P): The addition of a weight class indicator in the Radar-Side Full Data Block and dynamic wake encounter alerting (utilizing FAA order 7110.65 wake turbulence criterial) will heighten controller awareness of aircraft proximity to wake-generating aircraft.

Secondary Systems

- CSS-Wx: Common Support Services - Weather

Tertiary Systems

- SWIM: System Wide Information Management
- NWP: NextGen Weather Processor

Separation Management

OI: [102137] Automation Support for Separation Management (2014 - 2030)

The ANSP automation provides the controller with tools to manage aircraft separation in a mixed navigation and wake performance environment.

Aircraft (manned or unmanned) with various operating and performance characteristics will be operating within the same volume of airspace. Controllers will use ANSP automation enhancements to provide situational awareness of aircraft with differing performance capabilities (e.g., equipped vs. non-equipped aircraft, RNAV, RNP, and trajectory flight data management). For example in performance-based navigation, RNAV/RNP routes may be spaced closer than the normally required separation for the sector area. The standard system conflict alert and conflict probe for the designated area account for this reduced spacing. These enhancements enable ANSP to manage the anticipated increase in complexity and volume of air traffic. Unmanned Aircraft Systems (UAS), as well as other air vehicles (space launch, hyper-sonic, etc.) will share airspace with manned aircraft and be appropriately equipped to operate within that airspace.

OI Benefit

Efficiency (S): Decision support tools will assist controllers in ensuring eligibility and conformance for use of RNAV/RNP routes resulting in their increased use which will enable more aircraft to fly optimal trajectories.

Capacity (S): Automation support will assist in optimal aircraft spacing, resulting in increased aircraft throughput and capacity.

Safety (S): Automation support to ensure aircraft eligibility and conformance to routes will increase aircraft safety.

Increments

Charlie

(2021 - 2025)

1

C **[102137-29] More Efficient Merging of Terminal Arrival Flows (2019 - 2024)** (Development)

Separation Management

Increments/Enabling Activities

C [102137-29] More Efficient Merging of Terminal Arrival Flows (2019 - 2024)

Increment Overview

Improved terminal spacing of merging traffic flows will result in improved flight efficiency. The Converging Runway Display Aid (CRDA) controller decision support tool will be enhanced to accommodate more complex arrival flow interactions within terminal airspace including flight paths on multi-segment routes and curved Radius-to-Fix segments. Use of the enhanced merging and spacing display aid will result in flight efficiencies in the form of reduced terminal vectoring and reduced need to extend the downwind turn onto final approach. This improvement will assist controllers with merging short side-long side flows onto a common final approach path, as well as merging feeder airspace flows. Use of enhanced CRDA will enable improved flight efficiencies at airports with traffic levels that do not warrant implementation of terminal time-based management operations.

Increment Status

Development

Success Criteria

2024 : Initially available at designated key site

2026 : Operationally available NAS-Wide

Implementation Approach

This enhancement is implemented through the TAMR program as part of general software upgrades to the STARS system.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P): Improved merging of flows with more complex interactions will reduced Terminal vectoring and reduce extended downwinds.

System Interactions

STARS (P): STARS will incorporate enhanced CRDA adaptation.

Primary Systems

STARS: Standard Terminal Automation Replacement System

OI: [102118] Relative Spacing Using Interval Management (2026 - 2040)

Improved inter-aircraft spacing precision is achieved using new aircraft capabilities. This should reduce the time interval between the first and last aircraft in an overall traffic flow and help avoid some costly, low-altitude maneuvering. This should increase efficiency and throughput in capacity-constrained airspace without negatively impacting controller workload and task complexity in maintaining separation between aircraft. Increased airport throughput will also be achieved through the ability of pilots to apply visual separation in marginal VMC conditions. In addition, Interval Management operations are expected to reduce frequency congestion and the number of necessary controller traffic interventions. This capability may be used in locations where time-based metering is not in use.

The ANSP will be provided with a new set of procedures directing, for example, flight crews to establish and to maintain a given time or distance from a designated aircraft. The flight crews will perform these new tasks along defined flight paths, including RNAV paths with turns, using new aircraft functionality that includes along-track speed guidance.

Broadcast surveillance sources and improved avionics capabilities provide the ANSP and flight deck with accurate position and trajectory data. Aircraft that are equipped to receive the broadcasts and have the associated displays, avionics, and crew training are authorized to perform pair-wise Interval Management operations when assigned or approved by the controller. Controllers will determine the required relative spacing required and assign the spacing interval to the aircraft over voice. Automation will inform controllers of aircraft that are eligible to perform the operation.

OI Benefit

Efficiency (P):Improved inter-aircraft spacing precision will result in tighter separation that will reduce aircraft maneuvers needed to maintain safe separation.

Capacity (S):Aircraft throughput in capacity constrained airspace will be increased through reduced excess separation buffers.

Increments

Delta

(2026 - 2030)

1

D **[102118-23] Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach (2026 - 2030)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

D [102118-23] Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach (2026 - 2030)

Increment Overview

Appropriately equipped aircraft with trained flight crews will be able to apply visual separation under marginal weather conditions for arrival and approach operations which increases arrival throughput over that achieved with standard ATC separation. A trailing aircraft with ADS-B In Cockpit Display of Traffic Information (CDTI) Assisted Separation system functionality will follow a lead aircraft to the same runway utilizing information on the CDTI as a substitute for continuous visual observation of traffic-to-follow during approaches to the same runway. Controllers will use standard visual separation procedures by identifying opportunities to use these procedures, providing a clearance over voice, and monitoring the operation.

Increment Status

Concept Exploration & Maturation

Success Criteria

2025 : Update ADS-B Operations – Advisory Circular 90-114

Implementation Approach

This capability is a candidate for Interval Management Phase 1.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Capacity (S): Enhanced capacity is achieved through reduced spacing between aircraft and optimized descents

Efficiency (P): Enhanced efficiency is achieved through reduced spacing between aircraft and optimized descents

System Interactions

ADS-B In Avionics (A): ADS-B In Cockpit Display of Traffic Information (CDTI) Assisted Separation system provides the pilot the ability to follow a lead aircraft using standard visual separation procedures.

Avionics Systems

ADS-B In Avionics: Automatic Dependent Surveillance - Broadcast In Avionics

Separation Management

COE: [102112] Current En Route Separation (N/A)

Separation standards applied in en route airspace consist of rules and procedures for separating aircraft receiving air traffic service(s), from known traffic, from protected airspace, and from terrain. En route airspace is classified as Class A, Class E, or Class G airspace. The en route controller workstation presents a radar display, weather display, airway maps, sector boundaries, adjacent facility boundaries, special activity airspace, prohibited areas, or sector-specific information for the controller to provide air traffic services in that sector. Controllers use the flight data and radar data displayed on the controller work station to provide separation services between aircraft from various FAA automated systems.

Radar controllers must constantly scan radar data and flight data to determine aircraft position, accomplish traffic planning, and resolve conflicts. Constant scanning provides the controller an updated traffic picture to issue clearances to aircraft, to provide timely radar handoffs, traffic advisories, radar point-outs, communication transfers and to monitor compliance with clearances already delivered.

Separation standards are published rules that must be followed and maintained and both en route and terminal controllers receive en route separation standards instruction. The controller accomplishes en route separation by applying one or a combination of radar, non-radar, or visual separation rules. Radar separation is the preferred method; however, controllers are trained to apply the type of separation that will provide the greatest operational advantage. Automation provides an added layer of separation assurance by alerting radar controllers to existing or pending situations between tracked targets (known IFR or Visual Flight Rules (VFR) aircraft) requiring immediate attention.

Radar separation standards are based on equipment adaptation (single or multiple radar sites) and the distance of aircraft from the radar antenna site. The general en route standard is 5 nautical miles (NM) between aircraft at the same altitude. The radar system being used and the distance from the radar site that an aircraft is located can determine en route separation standards. Generally, en route radar comes from multiple sites and is adapted to process the best target data available from the multiple radar sites (mosaic radar adaptation). Radar separation in these instances is 5 NM between aircraft at the same altitude. Certain en route sectors are allowed to use radar separation of 3 NM between aircraft at the same altitude to increase capacity and efficiency. To use this reduced separation a single radar site must be adapted as the sole data input, and the radar separation must occur within 40 NM of that radar antenna site. In some areas radar coverage is not available below certain altitudes. In these areas, controllers apply non-radar rules to separate aircraft. Non-radar separation can be vertical, longitudinal, or lateral separation. The Next Generation Air Transportation System has implemented ADS-B capabilities in en route radar airspace as the preferred means of surveillance in those areas, while maintaining the use of existing separation standards. ADS-B has also been implemented in selected non-radar en route airspace to provide radar-like separation services in those areas, which is detailed in the current operational description for ADS-B Separation (CO number 102123).

Controllers apply vertical separation by assigning different altitudes 1,000 feet apart to a pair of aircraft operating IFR at or below Flight Level (FL) 290. Between FL290 and FL410 inclusive, separation minima increases to 2000 feet although properly equipped aircraft have reduced vertical separation minima of one thousand feet vertical separation. Above FL410, this reduced separation minima is not applicable. Controllers may assign an aircraft to an available altitude or after an aircraft previously at that altitude has reported leaving

Separation Management

Controllers apply longitudinal separation rules to ensure that no more than one aircraft occupies a geographic location at the same time and at the same altitude. Longitudinal separation can be applied to aircraft on the same, converging, or crossing courses.

Lateral separation is applied by assigning different routings or holding patterns that do not overlap and to departing aircraft using diverging headings. Visual separation is a clearance from the controller to the pilot that allows the pilot to visually separate his aircraft from another aircraft below FL180. The reported weather in the vicinity must be good enough for the pilot to maintain visual contact with the other aircraft.

Letters of agreement and local procedures between adjacent facilities, provide predicable traffic flows and increased capacity between adjacent facilities or an adjacent intra-facility controller.

Once the required separation is obtained, it must be maintained. There are times in each flight when a change from one type of separation standard to another may be required. The change can be a result of transitioning from one type of airspace to another or transitioning routes and altitudes. It can also be due to either airborne or ground based equipment limitations. Proper application of the separation standards can increase the capacity of the National Airspace System (NAS) without changing the separation standard. Procedures are sometimes changed as new separation standards are issued, traffic increases, or as evaluation of procedures mandates.

Certain information about each aircraft and its intended flight plan are required to provide en route separation and to accomplish point-outs, handoffs, and coordination. The aircraft's call sign and flight number or the aircraft's registration number is required to communicate clearances to the aircraft. The aircraft type is required information as certain en route separation minima change based on aircraft size. Routes of flight and altitude are necessary to apply lateral or vertical en route separation. Estimated times over navigational fixes are required for non-radar separation.

En route separation services originate with the pilot or the pilots' company in the form of a flight plan. The flight plans are filed with the FAA using a variety of methods and are processed by flight data processing automation. Flight data is provided by automated means to the en route controller. Generally, this data is contained in automated flight data aircraft lists at the radar associate (data controller or D-side) position. Printed flight progress strips are used in non-radar airspace or in the event of an interruption to automated flight data services. Controllers can update or amend the flight database as necessary.

En route controllers use voice switching systems for both en route air and ground radio communication. Controllers issue clearance instructions to aircraft and monitor compliance over air-to-ground radios. Ground communications are used to coordinate airspace status, relay control instructions, and to complete sector-to-sector and facility-to-facility coordination. Direct radio communications between pilots and controllers are required to use certain en route separation standards. In visual separation, the controller must be in direct radio contact with at least one of the pilots of the aircraft to apply visual separation standards. To use radar vectors to establish lateral separation between a pair of aircraft, the controller must be able to communicate with a minimum of one of the aircraft. When direct radio communications between the en route controller and the pilot are not possible, information and clearances can be relayed via an phenomena such as icing, turbulence and winds aloft at certain altitudes let the controller know which altitudes to assign aircraft. The location and movement of thunderstorm cells allow the controller to assist the pilot in finding the best routes around the weather and allows controllers to plan future separation tasks. The controller and pilot also require current weather information to determine the appropriate type of approach for an aircraft to fly at the destination airport. The type of approach an aircraft can fly determines sequencing separation from a previous or subsequent arrival. The en route controller obtains the weather via automated systems that provide a written description of the weather notice. The National Weather Service meteorologist at the Center Weather Service Unit provides certain weather to the en route controller via both automated systems that provide a paper print out of the notice and verbally through the controller's supervisor.

The traffic management mission is to balance air traffic demand with system capacity to ensure maximum efficient use of the NAS. To manage demand, it is sometimes necessary to place restrictions on aircraft to remain within the system's capacity. Historically validated restrictions and dynamic traffic management initiatives become de facto en route in-trail restrictions. Controllers must enforce these restrictions in their area of responsibility. These increases to the in-trail restrictions are generally specific to the arrival airport. Adverse weather in an en route sector can also result in a reduction of the number of aircraft entering that en route sector for a certain period of time

COE Benefit

Current operations are provided in the NAS

Increments

Delta

(2026 - 2030)

1

D **[102112-22] UAS ATC Direct Communications (2031 - 2035)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

D [102112-22] UAS ATC Direct Communications (2031 - 2035)

Increment Overview

The integration of Unmanned Aircraft Systems (UAS) into the NAS is enabled through the seamless integration of communications between pilots-in-command (PICs) of UAS and air traffic controllers. Controllers communicate to all pilots, whether via ground-to-ground communications to UAS PICs or air-to-ground communications to manned aircraft PICs, using the same systems. Latency, security, and operational availability requirements for voice communications between ATC and UAS PICs are established and met to provide seamless communication to ATC. ATC instructions to UAS PICs result in the same response times as manned aircraft.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished through voice over IP and ATC voice switch changes. Specific implementation approach to be determined.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Safety (P): Seamless voice communication with ATC would Increase safety in the NAS by reducing step-ons and allowing ATC to be in constant communication with the UAS PIC regardless of link fidelity.

System Interactions

To be determined

To be determined

Separation Management

OI: [104102] Optimized Oceanic Trajectories via Interactive Planning (2020 - 2039)

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 4-dimensional (4D) trajectory. FAA automation supports coordination and feedback on contention as well as planning and management for congested oceanic airspace. After departure, enhanced, up-to-date communication of intent information from the user allows oceanic controllers to adjust to improved 4D trajectories. Oceanic users will have access to improved weather and airspace status information for flight planning and execution. They will be able to use this information to assess their preferred trajectory against changing operational conditions and when conditions allow, request a revised clearance that better meets their business objectives.

OI Benefit

Efficiency (P): Increased granting of user preferred trajectories in Oceanic airspace both pre- and post-departure.

Increments

Charlie (2021 - 2025)	Delta (2026 - 2030)
1	1

C **[104102-30] Enhanced Conflict Probe for ATOP Surveillance Airspace (2020 - 2025)** (Development)

D **[104102-37] Improved Oceanic Weather Routes (2035 - 2039)** (Planned)

Separation Management

Increments/Enabling Activities

C [104102-30] Enhanced Conflict Probe for ATOP Surveillance Airspace (2020 - 2025)

Increment Overview

ATOP will provide a conflict probe to oceanic controllers to support the use of domestic separation standards in transition airspace that has either radar and/or ADS-B Out coverage.The improved accuracy of conflict probe will better assist the controller in identifying conflicts within a surveillance area allowing for more efficient use of airspace capacity.

Increment Status

Development

Success Criteria

2023 : Operational readiness achieved at one ATOP site

Implementation Approach

NAS Infrastructure is enhanced through the integration of enabling technologies and new standards and procedures into automation systems. The key automation system impacted is Advanced Technology Oceanic Procedures (ATOP). Software with the Enhanced Conflict Probe capability will be delivered to each ATOP site via the ATOP Enhancement 1 investment.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Safety (P): Provides a conflict probe capability to oceanic controllers using a surveillance-like separation standard within surveillance coverage areas (radar or ADS-B Out). Enhanced conflict probe will increase controller situational awareness, provide earlier alerting to potential conflicts, and reduce risk of loss of separation incidents in surveillance airspace adapted in ATOP.Earlier alerting will allow more strategic solutions to be formulated, which potentially will involve less drastic corrective measures to be implemented.

System Interactions

ATOP (P): will provide a conflict probe to oceanic controllers to support the separation standards in airspace with radar or ADS-B Out coverage.

ADS-B Out Avionics (A): To enable this increment, participating aircraft must be equipped with ADS-B Out avionics equipment.

Primary Systems

ATOP: Advanced Technologies and Oceanic Procedures

Avionics Systems

Increments/Enabling Activities

D [104102-37] Improved Oceanic Weather Routes (2035 - 2039)

Increment Overview

Oceanic users will be able to make more reliable long range route and deviation decisions under changing weather conditions, which will improve safety and increase efficiency. Near real-time rapidly updated graphical and textual oceanic weather products such as cloud top height and convective diagnosis oceanic products will be available for use by pilots in the cockpit as well as by controllers and dispatchers. These products will enable earlier identification of the threat of adverse weather providing enough look-ahead time to develop a more optimal strategic route to avoid the weather and get a revised clearance from Air Traffic Control. This will result in shorter travel distance, time, and fuel savings.

Increment Status

Planned

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished through weather information provided via commercial suppliers over the internet to the cockpit EFB. Specific implementation plans are to be determined.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P):Increased granting of user preferred trajectories in Oceanic airspace.

System Interactions

To be determined

To be determined

COE: [103201] Current Traffic Advisory (N/A)

Unless aircraft are in class A airspace, traffic advisories are issued to all aircraft (IFR or VFR) when a controller believes applicable separation minima are at risk of being breached. Where no separation minima apply, controllers issue traffic advisories to those aircraft on their frequency whose proximity to other aircraft warrants an advisory. Air traffic controllers radio traffic advisories to pilots. They help both controllers and pilots when two aircraft, in airspace or a surface area, are closer than approved separation. Traffic advisories have the effect of reducing pilot-controller radio transmissions, and thus frequency congestion, by alerting the pilot of situations he might otherwise question.

FAA surveillance and automation systems provide data used in advisories to controllers, who view processed radar on one of several types of consoles. Primary radar systems provide surveillance data generated by radar transmissions reflected back to the radar by the aircraft (i.e., primary radar returns, or paint). Secondary surveillance systems, also known as beacon systems, provide additional target information, including aircraft identification and altitude. Automatic Dependent Surveillance-Broadcast is a cooperative surveillance technology (see CO #102123). Air traffic control automation systems process and correlate data from primary and secondary surveillance systems and display the resulting surveillance reports on the controller's display.

In Air Traffic Control Towers at large airports, controllers have a surface surveillance display that allows them to track surface movement of aircraft and vehicles and alerts controllers of potential runway conflicts and provide related advisories or control instructions as needed. The Next Generation Air Transportation System has implemented additional surface surveillance systems to selected airports which is described in the current operational description for Improved Safety Situational Awareness for Controllers (CO number 103207).

Data depict a primary radar target, a limited data block and target, or a full data block and target. A limited data block provides only beacon code, ground speed readout, and altitude if available. A full data block provides the aircraft call sign, assigned altitude, reported altitude, ground-speed readout, and other data relevant to the aircraft. The controller uses the displayed data for, among other things, traffic advisories.

A primary radar target provides the least amount of information to the controller that can be passed as a traffic advisory. This type of target tells the controller only position information. A primary radar target can be identified, and the controller can obtain additional information if he is in radio contact with the aircraft. A limited data block can provide beacon code data and altitude if the aircraft has a Mode C (altitude encoding) transponder. If the controller is in radio contact with the aircraft, a limited data block provides the controller data to give a more complete traffic advisory. A full data block and the associated flight plan information also provide the data for a complete traffic advisory.

Terminal and tower controllers give non-radar traffic advisories regarding known or observed traffic in the vicinity of airports. Likewise, en route controllers and Automated Flight Service Station (AFSS) specialists provide non-radar traffic advisories regarding known traffic. As with radar traffic advisories, this information assists both pilots and controllers because they share information and avoid unnecessary frequency congestion. Controllers often use this type of advisory to assist the pilot during arrival or departure.

Separation Management

Using Digital Traffic (CO number 103206), Improved Runway Safety Situational Awareness for Pilots (CO number 103208), and Enhance Traffic Advisory Services (CO number 103209).

Federal Air Regulations require that foreign and domestic airlines and other similar transport aircraft be equipped with Traffic Alert and Collision Avoidance Systems (TCAS). This equipment enhances pilots to view surrounding aircraft and provides traffic alerts and resolution advisories when necessary. The TCAS display identifies the location of other traffic by showing relative position and altitude of targets with altitude-encoding transponders. TCAS II also provides resolutions in the vertical plane.

Information about each aircraft and its intended flight plan are useful to controllers in providing traffic advisories. The controller must know the aircraft's call sign and flight number or the aircraft's registration number to communicate with the pilot. They must also know the aircraft's type to identify the aircraft to other aircraft, and to know flight capabilities for assigning routes of flight and altitude. The flight data for traffic advisories is based on the flight plan, which originates with the pilot or the pilot's company. The controller receives flight data through automated means or the pilot gives it on the frequency. It is generally in the form of printed Flight Progress Strips in the terminal environment and contained in automated flight data aircraft lists at the radar associated (data controller or D-side) position in the en route environment.

When the radar targets of two aircraft will merge and vertical separation between the two aircraft is not more than the minimum required, the controller applies merging-target procedures and issues traffic information to both IFR aircraft. The procedures are not required for non-turbojet aircraft below 10,000 feet; however, good operating technique calls for issuing a traffic advisory.

Traffic advisories, except for the merging-target requirement, fall within the lower-priority additional services category. A controller's first priority is to separate aircraft and issue safety alerts, then he provides additional services. Aircraft flying under visual flight rules can request radar traffic advisories (flight following) from an air traffic control facility. Controllers provide traffic advisories as workload permits.

COE Benefit

Current operations are provided in the NAS.

Increments

Charlie

(2021 - 2025)

1

C **[103201-01] UAS Detect and Avoid (2022 - 2026)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

C [103201-01] UAS Detect and Avoid (2022 - 2026)

Increment Overview

This increment describes UAS capability to remain well clear from other aircraft based upon an FAA-approved airborne separation standard. This enables UAS aircraft to operate under flight rules that provide an equivalent level of safety to visual flight rules for manned aircraft. UAS Detect and Avoid capability will be interoperable with collision avoidance systems used in manned aircraft. The UAS Detect and Avoid capability accounts for limitations of speed, turn, and climb performance of the UA and characteristics of other typical participant aircraft. The UAS “self-separation” maneuvers to remain well clear of other aircraft are to be consistent with established "right of way" rules and may be used as a means of compliance to 14 CFR 91.111/113/181. ATC rules and procedures are developed and implemented to enable UAS to utilize this capability.

Increment Status

Concept Exploration & Maturation

Success Criteria

2022 : Initial small UAS BVLOS operations under 400 feet AGL within Mode C veils relying on receiving ADS-B reports of manned aircraft and with operational mitigations for avoiding non-cooperative aircraft within the Mode C veil

2022 : Initial small UAS BVLOS operations under 400 feet AGL in rural areas with very low air traffic using currently emerging sensor technology to detect manned aircraft

2023 : Initial large UAS operations in controlled airspace using DAA technology as specified in RTCA SC-228 / ASTM F38

2026 : New rules to allow technology to be used to meet the requirements of 91.111 and 91.113

Implementation Approach

To be implemented by UAS operators who achieve the required performance. This increment is identified to have an International harmonization dependency.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Access and Equity (S): Will result in UAS gaining improved access to the NAS.

Safety (P): Detect and Avoid capability will improve the safety of UAS operations.

System Interactions

ACAS Xu/ACAS sXu (A)

OI: [102157] Improved Parallel Runway Operations with Airborne Applications (2020 - 2040)

Improved flight deck capabilities allow for increased arrival capacity for parallel runway operations in Instrument Meteorological Conditions. Capacity of closely spaced parallel runways will be enhanced through reduced separation for dependent approaches through the use of aircraft avionics that assist pilots in maintaining the required interval from other aircraft. This operational improvement promotes a coordinated implementation of policies, technologies, standards and procedures to meet the requirement for increased capacity while meeting safety, security, and environmental goals.

This OI will take advantage of aircraft capabilities to enable aircraft to fly dependent approaches to parallel runways spaced less than 2500 feet apart with a CAT I and eventually CAT II decision height. It will also expand procedures to conduct Flight Interval Management (FIM) operations to dependent parallel runways spaced greater than 700 ft in less than visual conditions.

These capabilities will be achieved by integrating ground automation that identifies opportunities to the controller who can provide a clearance to the flight crew for specific lateral and longitudinal separation distance from other aircraft and aircraft technologies such as ADS-B In and Out, auto-pilot coupling to approach guidance, cockpit display of traffic information (CDTI), precision navigation, and on board equipment that ensures the required distance from other aircraft is being met.

Aircraft collision avoidance systems will be further enhanced for dependent operations by providing algorithms that calculate the lateral deviation protection area followed by the appropriate procedural maneuver to ensure that the protection area is not compromised.

OI Benefit

Capacity (P): Enabled by improved flight deck capabilities, reduced separation for dependent approaches lead to increased arrival capacity for parallel runway operations in IMC.

Safety (S): Improved lateral deviation protection algorithms increase aircraft safety.

Increments

Charlie

(2021 - 2025)

1

C **[102157-31] Operation Specific Collision Avoidance (2020 - 2026)** (Development)

Increments/Enabling Activities

C [102157-31] Operation Specific Collision Avoidance (2020 - 2026)

Increment Overview

Aircraft collision avoidance systems will be improved to use the more precise data provided by new surveillance sources using an optimized threat resolution logic leading to a decrease in nuisance alerts for closely spaced parallel operations. Aircraft participating in a closely spaced paired operation will be known to the collision avoidance system and generate a traffic advisory only for the paired aircraft under a reduced alerting volume and will generate resolution advisories for all other non-paired aircraft in the vicinity.

Increment Status

Development

Success Criteria

✔ 2018 : Completion of ACAS Xa/Xo Minimum Operational Performance Standards (MOPS) at RTCA

✔ 2019 : Completion of FAA Technical Standard Order

2023 : Completion of FAA Advisory Circular

Implementation Approach

The ACAS Xa/Xo MOPS are in the final phase of completion as part of the RTCA/EUROCAE standards development process. These MOPS will include standard components for the ACAS Xa/Xo system which include background and system overview, functional architecture, functional interfaces, gap analysis from legacy TCAS systems, test requirements and procedures, and an algorithm design description (ADD) for ACAS Xa/Xo. These MOPS will then enable manufacturers to create their own implementation of ACAS X while ensuring the intended output from the system. The ACAS Xa/Xo TSO and AC are being developed by FAA's aircraft certification (AIR) office with input from the TCAS PO and RTCA. These documents will be important for the FAA's Aviation Safety (AVS) and industry in the certification efforts for ACAS Xa/Xo systems.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Safety (S):Improved blunder protection algorithms increase aircraft safety.

System Interactions

ACAS-X (A): Supplement to Xa to allow special operational modes

Avionics Systems

ACAS-X: Airborne Collision Avoidance System X

Separation Management

OI: [108214] UAS Airspace Access (2017 - 2024)

UAS access to airspace is determined based on airspace classes and the performance level of the UAS. Rules govern the need for authorization to operate in a given class of airspace. Airspace management provides the availability status for airspace volumes as needed to prevent UAS from flying in the vicinity of manned aircraft or to segregate airspace for first responders. Requirements for UAS operators to notify other airspace users of their location and the ability to receive near real-time changes in airspace status are established for specific airspace classes and volumes. UAS operators must obtain an airspace authorization to operate beyond visual line of sight of the UAS in Class B, C, and D airspace, and Class E surface areas.

OI Benefit

Safety (P): ensure that small UAS operations do not pose a safety risk to aircraft operations.

Access and Equity (S): Provide expanded airspace access to UAS operators.

Increments

Charlie

(2021 - 2025)

1

C **[108214-02] UAS Airspace Access when Operating Beyond Visual Line of Sight (2020 - 2024)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

C [108214-02] UAS Airspace Access when Operating Beyond Visual Line of Sight (2020 - 2024)

Increment Overview

Airspace access rules require UAS operators to obtain an airspace authorization prior to operating beyond visual line of sight in Class B, C, and D airspace, and Class E surface areas.Airspace rules specify the requirements and limitations within which UAS operators can operate in different airspace areas and volumes beyond visual line of sight.The UAS must meet minimum performance requirements specified for the airspace volume and based on the complexity of the operation.

Increment Status

Concept Exploration & Maturation

Success Criteria

2021 : Establish criteria for reporting and receiving approval for performance authorizations to operate BVLOS

Implementation Approach

Regulations and guidance regarding operational use to be determined.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Safety (P): Ensure that small UAS operations do not pose a safety risk to mannedaircraft operations.

Efficiency (S): Ensures continued efficiency of ATM operations in controlled airspace with coincident sUAS operations.

Flexibility (S): Provides flexibility in methods to access airspace for sUAS BVLOS operations

Predictability (S): LAANC; provides predictability for ATM to continue to manage ATM operations for manned aircraft (makes it so sUAS are managed separately)

System Interactions

To be determined

To be determined

Separation Management

OI: [102159] CSPR Paired Departure Wake Mitigation (2027 - 2030)

Wake separation requirements for dependent operations from Closely Spaced Parallel Runways (CSPRs) will be revised. 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.

On departure, under certain crosswind conditions, departing aircraft pairs will be permitted to be separated at less than today's wake separation standards, based on wind sensing and prediction systems that indicate to the controller when the trailing departure is safe from wakes generated by the leading aircraft departing the parallel runway.

OI Benefit

Capacity (P): Reduced separation standards for departures on closely spaced parallel runways increases airport capacity.

Increments

Delta

(2026 - 2030)

1

D **[102159-01] CSPR Paired Departure Wake Mitigation (2027 - 2030)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

D [102159-01] CSPR Paired Departure Wake Mitigation (2027 - 2030)

Increment Overview

Paired departure procedures are developed for CSPR based on airport geometry and safety analyses using wake data and modeling. Paired departure procedures will ensure trailing aircraft remain clear of wake turbulence generated by lead aircraft departing the CSPR, based on observed and forecast wind strength and direction.The implementation of new technology that will enable Paired Departure procedures will safely reduce the impact of wake vortices on operations. Paired departures will apply to specific aircraft pairs, based on their weight classification or wake category and relative position.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished through revised wake turbulence standards, the integration of wake information, and controller automation to provide the dynamic spacing required between aircraft pairs. Specific implementation approach to be determined.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Capacity (P): Reduced separation standards for departures on closely spaced parallel runways increases airport capacity.

System Interactions

Initial system dependencies have been identified for this capability. As this capability is further defined, future updates will include revisions to the associated system interaction text.

TFDM (P): TFDM will provide predictive paired departure availability and departure pairs.

CSS-Wx (T): CSS-Wx is expected to give access to the Rapid Refresh Forecast Model, which provides wind forecast aloft.

ASOS (T): ASOS reports all the parameters of the AWOS-III, while also having the additional capabilities of reporting temperature and dew point in degrees Fahrenheit, present weather, icing, lightning, sea level pressure, and precipitation accumulation.

Primary Systems

Separation Management

CSS-Wx: Common Support Services - Weather

Separation Management

OI: [102160] Advanced Automation Support for Separation Management (2031 - 2035)

The ANSP automation provides the controller with tools to manage aircraft flows and separation with more advanced wake separation standards, changes to airspace status, and performance based navigation capabilities. Advanced wake procedures have the potential to increase the dynamic nature of separation standards. Automation will assist controllers with computing and executing these unique aircraft to aircraft separation standards. Automation tools will also assist en route controllers in improved management of aircraft flows related to airspace that is not statically defined and is either not accessible for a variable amount of time or has limited access for a myriad of reasons, primarily special activity airspace (SAA) or weather. With additional PBN routes and more advanced procedures, routes may be more closely spaced and aircraft will be given more flexibility in their ascent and descent profiles. Controllers will use ANSP automation enhancements to obtain additional situational awareness to decrease the cognitive workload and increase the operational benefit afforded by more closely spaced routes, optimal profile ascents and descents, the incorporation of changes to airspace status, and more dynamic separation standards.

OI Benefit

Efficiency (S): Decision support tools will assist controllers in ensuring eligibility and conformance for use of RNAV/RNP routes resulting in their increased use which will enable more aircraft to fly optimal trajectories.

Capacity (S): Automation support will assist in optimal aircraft spacing, resulting in increased aircraft throughput and capacity.

Safety (S): Automation support to ensure aircraft eligibility and conformance to routes will increase aircraft safety.

Increments

Delta

(2026 - 2030)

4

D **[102160-01] En Route Separation Tools to Support PBN Routes (2031 - 2035)** (Concept Exploration & Maturation)

D **[102160-02] Controller Tools for Managing Advanced Wake Separation Standards (2031 - 2035)** (Concept Exploration & Maturation)

D **[102160-03] Separation Management Tools to Increase PBN Procedure Utilization (2031 - 2035)** (Concept Exploration & Maturation)

D **[102160-04] En Route Separation Tools to Support Increased Utilization of Airspace (2031 - 2035)** (Concept Exploration & Maturation)

Separation Management

Increments/Enabling Activities

D [102160-01] En Route Separation Tools to Support PBN Routes (2031 - 2035)

Increment Overview

This capability will make the en route controller's conflict alert tools aware of Performance Based Navigation route and altitude restrictions so that controllers can safely allow the aircraft to remain on the flight profile and more fully achieve the benefits these procedures afford. Airspace redesigns are using the improved navigation performance of modern aircraft to place standard routing of aircraft closer together. Automation will incorporate vertical restrictions and the lateral path used in conflict detection algorithms to reduce the number of false alerts and missed/late alerts for aircraft with RNAV/RNP based on performance criteria adapted for the procedure and aircraft capabilities. This allows the users of the National Airspace System to increase PBN procedure utilization and take advantage of the reduced separation of the routes while maintaining safe operations.

Increment Status

Concept Exploration & Maturation

Success Criteria

2029 : Operationally available at key site

Implementation Approach

Candidate for ERAM Enhancement 3.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Safety (P): Automation will incorporate Conflict Alert to use the track-based vertical rate and reduce false and missed alerts by appropriate modeling of the trajectory laterally to consider the flight plan route.

System Interactions

ERAM (P): ERAM will incorporate altitude restrictions and lateral maneuvers associated with procedures and routes to reduce the number of false and missed alerts.

Primary Systems

ERAM: En Route Automation Modernization

Separation Management

Increments/Enabling Activities

D [102160-02] Controller Tools for Managing Advanced Wake Separation Standards (2031 - 2035)

Increment Overview

Controller tools will facilitate the addition of more complex wake standards for en route, single runways, and multiple runway complexes, including parallel-runway operations, increasing capacity and throughput. These tools will display the wake separation required between each aircraft pair for the type of operation, given prevailing winds and weather, and assist controllers in achieving and maintaining the required wake separation. These tools will support advanced wake concepts that dynamically adjust the required separation between aircraft based on wind and environmental factors.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This increment will be accomplished through revised wake turbulence standards and controller automation to provide the dynamic spacing required between aircraft pairs. Specific implementation approach to be determined.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Capacity (P): Automation support will assist in optimal aircraft spacing, resulting in increased aircraft throughput and capacity.

Safety (S): Automation support to ensure aircraft eligibility and conformance to routes will increase aircraft safety.

System Interactions

Initial system dependencies have been identified for this capability. As this capability is further defined, future updates will include the associated system interaction text.

STARS (P): To be determined
ERAM (S): To be determined

Primary Systems

STARS: Standard Terminal Automation Replacement System

Secondary Systems

Separation Management

Increments/Enabling Activities

D [102160-03] Separation Management Tools to Increase PBN Procedure Utilization (2031 - 2035)

Increment Overview

Automation tools will assist controllers with optimizing the benefits of additional and advanced PBN procedures. These tools will provide additional information and display capabilities that assist controllers with utilizing the PBN procedure. Tools may assist controllers in assessing whether intervention is needed to maintain safe separation such as whether crossing traffic will be adequately separated while conducting optimized profile descents and ascents and whether separation will be maintained while conducting time-based spacing operations.

Increment Status

Concept Exploration & Maturation

Success Criteria

2029 : Operationally available at key site

Implementation Approach

Candidate for ERAM Enhancement 3.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P): Updated modeling allows controllers to save fuel by keeping the flight on the procedure clearance.

Capacity (S): Improved effect on capacity through a combination of OPD and decision support tools that reduce monitoring workload. Placing routes closer together through airport design enables higher throughput.

Safety (S):Automation support to ensure aircraft eligibility and conformance to routes will increase aircraft safety.

System Interactions

ERAM (P): ERAM will update algorithms for trajectories, conflict probe, and trial planning to support PBN procedures

Primary Systems

ERAM: En Route Automation Modernization

Separation Management

Increments/Enabling Activities

D **[102160-04] En Route Separation Tools to Support Increased Utilization of Airspace (2031 - 2035)**

Increment Overview

Automation tools will assist en route controllers in improved management of aircraft flows related to airspace that is not statically defined and is either not accessible for a variable amount of time or has limited access for a myriad of reasons, primarily special activity airspace (SAA) or weather. These improvements will enhance safety by providing automation support for assessing aircraft trajectories against available airspace and alerting controllers when an aircraft's current plan (or trial plan) trajectory is predicted to violate inaccessible airspace. It will also result in more efficient traffic flows for impacted flights by assisting controllers in managing traffic through available airspace, such as faster access to space aircraft hazard areas after launches are complete or delayed and release areas within active SAAs during disruptive events, thunderstorm activity and abnormally high demand. Automation support will use NAS-wide airspace definition and schedule information to create harmonized, consistent polygons that are adapted into automation for display and processing purposes.

Increment Status

Concept Exploration & Maturation

Success Criteria

To Be Defined

Implementation Approach

This is a candidate for a future ERAM Enhancement

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Access and Equity (S): Enhances airspace access for commercial traffic allowing access to airspace to which they would not normally have access and as a result enabling reduced flight path distances.

Efficiency (P): Allows reduced flight path distances.

System Interactions

ERAM (P): This increment will allow more efficient flow of traffic by allowing use of airspace within a SAA during disruptive events such as thunderstorm activity and high demand. ERAM will support this increment by allowing the use of release areas within active SAA.

ACS (S): ACS will provide machine-readable temporary flight restriction (TFR) and altitude reservation information (ALTRV) for integration with automation processing and decision support tools such as conflict probe.

Secondary Systems

ACS: Aeronautical Common Service

OI: [102162] Automated Support for More Complex Trajectory Negotiation (2031 - 2039)

En Route sector capacity and throughput are further increased through the ability to send more dynamic and tailored route changes and instructions to the cockpit over data communications. Data communications can be used for advanced and more precise control instructions. Pilots will be able to downlink more complex route clearance requests that express aircraft operator intent and aircraft-specific constraints for the route of flight. In addition, aircraft provide state and intent data for additional points along their intended route that can be used by ground automation systems to improve their trajectory prediction resulting in the potential for fewer diversions from the preferred routing. These improvements will enable controllers to use data communications in dynamic operational situations when capacity could be constrained due to the need to send complex reroute instructions over voice. This will enable even higher density of operations, which will increase capacity as well as decrease human errors in trajectory negotiation and data entry.

OI Benefit

Efficiency (P): Increased ability to send complex reroutes over data comm provides opportunities for more efficient routes.

Capacity (P): Airspace capacity can be more fully utilized through the ability to send more complex and dynamic reroutes.

Increments

Delta

(2026 - 2030)

2

D **[102162-03] Enhanced En Route Data Communications Services (2031 - 2035)** (Planned)

D **[102162-23] Initial Air-Ground Synchronization of Aircraft Intent (2034 - 2039)** (Concept Exploration & Maturation)

Increments/Enabling Activities

D [102162-03] Enhanced En Route Data Communications Services (2031 - 2035)

Increment Overview

This improvement will provide additional capabilities to maintain flows through or increase capacity in constrained airspace. Controllers will have additional more dynamic and precise trajectory options to use for data comm equipped aircraft during changing operational conditions such as the ability to send TMC initiated reroutes around weather. In addition, controllers will be able to issue more efficient maneuvers to meet time based metering times over data comm. This capability will enable pilots and controllers to request and issue more precise route clearances, which contain some combination of lateral, vertical, and speed or time constraints at along-track waypoints over data comm. Automation tools will assist controllers with the generation of conflict free revised clearances and route messages.

Increment Status

Planned

Success Criteria

2025 : Baseline additional Data Communication capabilities for En Route utilizing the existing FANS message set. This will satisfy a NAC/NIWG Recommendation.

Implementation Approach

The Controller-Pilot Data Link Communication (CPDLC) application is fully implemented in FANS-1/A avionics. To enable additional use of the CPDLC avionics functions beyond those implemented for the Data Communication Segment 1, Phase 2 Initial / Full services, it is necessary to enhance current NAS Infrastructure through the integration of additional FANS-1/A CPDLC messages and data elements with decision support tools (e.g., conflict probe and time-based flow management) and procedures into automation systems.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Capacity (P):The ability to create dynamic and more complex reroute clearances over data comm reduces controller and pilot workloads.

Efficiency (S): The ability to send revised clearances to the cockpit that do not have to be read over voice comm increases the ability to better accommodate user preferences and issue more efficient routes, altitudes, and speeds.

Safety (S):Automated route changes sent via data comm reduces hear-back read-back errors and reduces controller workload associated with routine tasks.

Separation Management

Initial system dependencies have been identified for this capability. As this capability is further defined, future updates will be made to the associated system interaction text.

ERAM (P): ERAM will: Host the CPDLC application on the Data Comm Processor; provide the human-computer interface to the controller for 4D trajectory clearance assessment and composition; manage modification of trajectories; update the flight objects of cleared flights; enable interfaces to TFMS (via PDRR and ABRR), TBFM, and conflict probe; and, provide maintenance and control services.

TBFM (S): The Data Comm Processor in ERAM will consume the TBFM meter list; TBFM processing will take account of 4D trajectory clearances.

TFMS (S): TFMS will generate aircraft-specific, multi-dimensional trajectories to manage flows; and, provide them to ERAM for assessment, processing, and distribution to aircraft via CPDLC clearances.

Data Communication Avionics (A): Use an expanded subset of FANS 1/A messages to exchange multi-dimensional clearances with qualified flights

Primary Systems

- ERAM: En Route Automation Modernization

Secondary Systems

- TFMS: Traffic Flow Management System
- TBFM: Time Based Flow Management

Avionics Systems

- Data Com Avionics: Data Communication Avionics

Separation Management

Increments/Enabling Activities

D [102162-23] Initial Air-Ground Synchronization of Aircraft Intent (2034 - 2039)

Increment Overview

Estimated aircraft paths, altitudes, and arrival times for the next route segment(s) of a flight are improved using downlinked aircraft performance and projection data (intermediate intent profile) from the FMS via an air-to-ground data communications link. The ground based trajectory modelers used for tactical and strategic operations can use this aircraft data to calibrate the predicted 4D trajectory for the next portion of the flight and/or receive an indication that a trajectory performance parameter (altitude, time) can no longer be met. These improvements will result in better 4D trajectory composition and conflict detection accuracy and provide an important step towards full air-to-ground trajectory synchronization.

Increment Status

Concept Exploration & Maturation

Success Criteria

2026 : Baseline additional Data Com capabilities for en route utilizing the existing FANS message set. This will satisfy a NAC/NIWG Recommendation.

Implementation Approach

The Automatic Dependent Surveillance - Contract (ADS-C) application is implemented in FANS-1/A avionics. To enable use of the avionics functions, it is necessary to enhance current NAS Infrastructure through the integration of the FANS-1/A ADS-C application with decision support tools (e.g., conflict probe and time-based flow management) and procedures into automation systems.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P): By sharing its active route with ATC, the aircraft reduces uncertainty about expected behavior, thereby enabling assignment of more efficient route due to higher confidence by ATC.

Capacity (S): By sharing its active route with ATC, the aircraft reduces uncertainty about expected behavior, thereby enabling more efficient allocation of constrained airspace capacity.

Flexibility (P): By sharing its active route with ATC, the aircraft reduces uncertainty about expected behavior, thereby enabling more dynamic reactions to changes induced in airspace capacity by factors such as weather.

Environment (S): More efficient routes reduce fuel burn and emissions.

System Interactions

Separation Management

ERAM (P): ERAM will host the ADS-C application on the Data Comm Processor; provide the human-computer interface to the controller for ADS-C contract composition and response monitoring; and, manage assessment of flight adherence and conformance through the flight progress function.

ADS-C (S): ADS-C is the FANS-1/A application that embodies the flight state and intent data.

TBFM (S): TBFM will be informed of relevant intent information by ERAM.

TFMS (S): TFMS will be informed of relevant intent information by ERAM.

FANS-1/A (A): FANS-1/A will convey aircraft state and intent data using the ADS-C application between the aircraft and ERAM.

Primary Systems

- ERAM: En Route Automation Modernization

Secondary Systems

- TFMS: Traffic Flow Management System
- TBFM: Time Based Flow Management

Avionics Systems

- FANS 1/A: Future Air Navigation System 1/A

OI: [102109] Reduced Oceanic Separation through Advanced Surveillance (2020 - 2030)

Reduced oceanic separation standards will increase oceanic airspace capacity and improve operational efficiency. Separation standards will be reduced via more frequent position reporting through satellite links in oceanic or remote areas where ground infrastructure is difficult or cost-prohibitive to install. Reduced separation standards will result in the improved accommodation of route and altitude requests as well as more efficient arrival/departure services.

OI Benefit

Capacity (P): More frequent position reporting will enable air traffic controllers and pilots to reduce separation between aircraft and may enable new air routes for increased airspace capacity.

Efficiency (S): Reduced separation requirements between same track and crossing traffic will enable aircraft to increasingly be granted their most optimal altitude and route which will result in improved efficiency.

Increments

Charlie

(2021 - 2025)

1

C **[102109-21] Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation (2020 - 2025)** (Development)

Separation Management

Increments/Enabling Activities

C [102109-21] Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation (2020 - 2025)

Increment Overview

This increment will utilize ADS-C surveillance and allow reduced separation standards in oceanic areas leading to enhanced capacity and efficiency benefits. The ASEPS ADS-C Reduced Oceanic Separation increment will provide monetized benefits for improved accommodation of altitude requests, reduced "cost to carry" fuel, and more efficient arrival/departure services.

Increment Status

Development

Success Criteria

2022 : Achieve IOC for 23 NM Lateral Separation at 2 sites
2023 : Achieve IOC for 23 NM Lateral Separation at a third site
2023 : Achieve IOC for 20 NM Longitudinal Separation at the first site.
2024 : Achieve IOC for 20 NM Longitudinal Separation at 2 more sites.

Implementation Approach

Reduce oceanic separation based on more frequent ADS-C for equipped aircraft in conjunction with new ICAO oceanic separation standards.This increment is identified to have an International Harmonization dependency.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Capacity (P): Automation capabilities will enable air traffic controllers and pilots to manage increasing traffic levels in oceanic airspace (through reduced separation between aircraft).Additionally, the project may enable new air routes for increased airspace capacity.

Efficiency (S): This project will provide improved efficiency through airlines' potential to schedule departures closer together.

System Interactions

ATOP (P) - ATOP enhancements will enable the application of new International Civil Aviation Organization (ICAO) ASEPS separation standards that take advantage of appropriate aircraft communications and navigation performance and more frequent ADS-C reports (e.g., 23NM / 20NM).

FANS 1/A (A): Future Air Navigation System 1/A with the CPDLC and ADS-C communications capabilities are required for this increment.

Separation Management

FANS 1/A: Future Air Navigation System 1/A

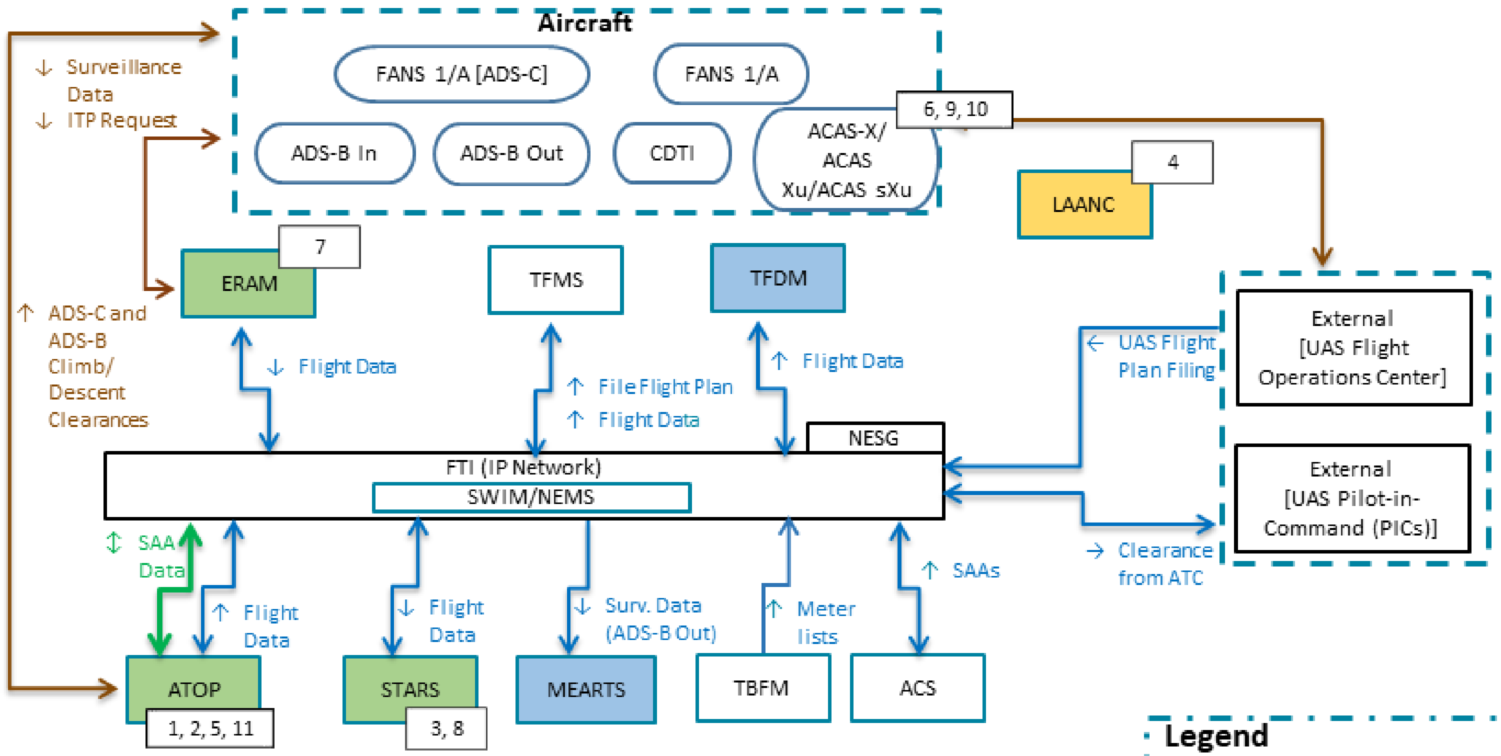
Separation Management

Systems Interactions

The Separation Management capabilities described here and in the figure below are implemented via the ATOP, ERAM and STARS automation systems and the complementary controller procedures and documentation.

Separation Management

Separation Management Portfolio
Bravo/Charlie System Interaction

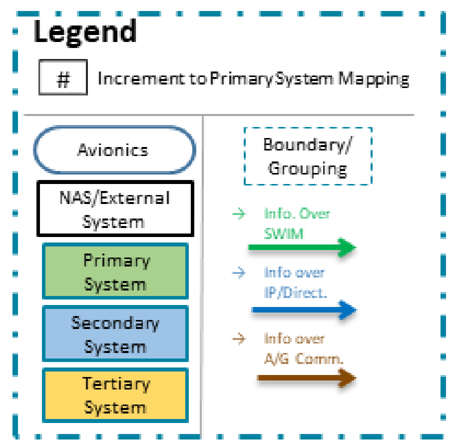


Separation Management Portfolio Bravo Increments:

1. 102108-12 Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation
2. 102108-13 Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation
3. 102154-21 Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards
4. 108214-01 UAS Airspace Access when Operating within Visual Line of Sight*

Separation Management Portfolio Charlie Increments:

5. 102109-21 Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation
6. 102117-22 Active Surveillance Collision Avoidance
7. 102117-23 Expanded Use of 3 NM Separation Airspace
8. 102137-29 More Efficient Merging of Terminal Arrival Flows
9. 102157-31 Operation Specific Collision Avoidance
10. 103201-01 UAS Detect and Avoid
11. 104102-30 Enhanced Conflict Probe for ATOP Surveillance Airspace
12. 108214-02 UAS Airspace Access when Operating Beyond Visual Line of Sight*



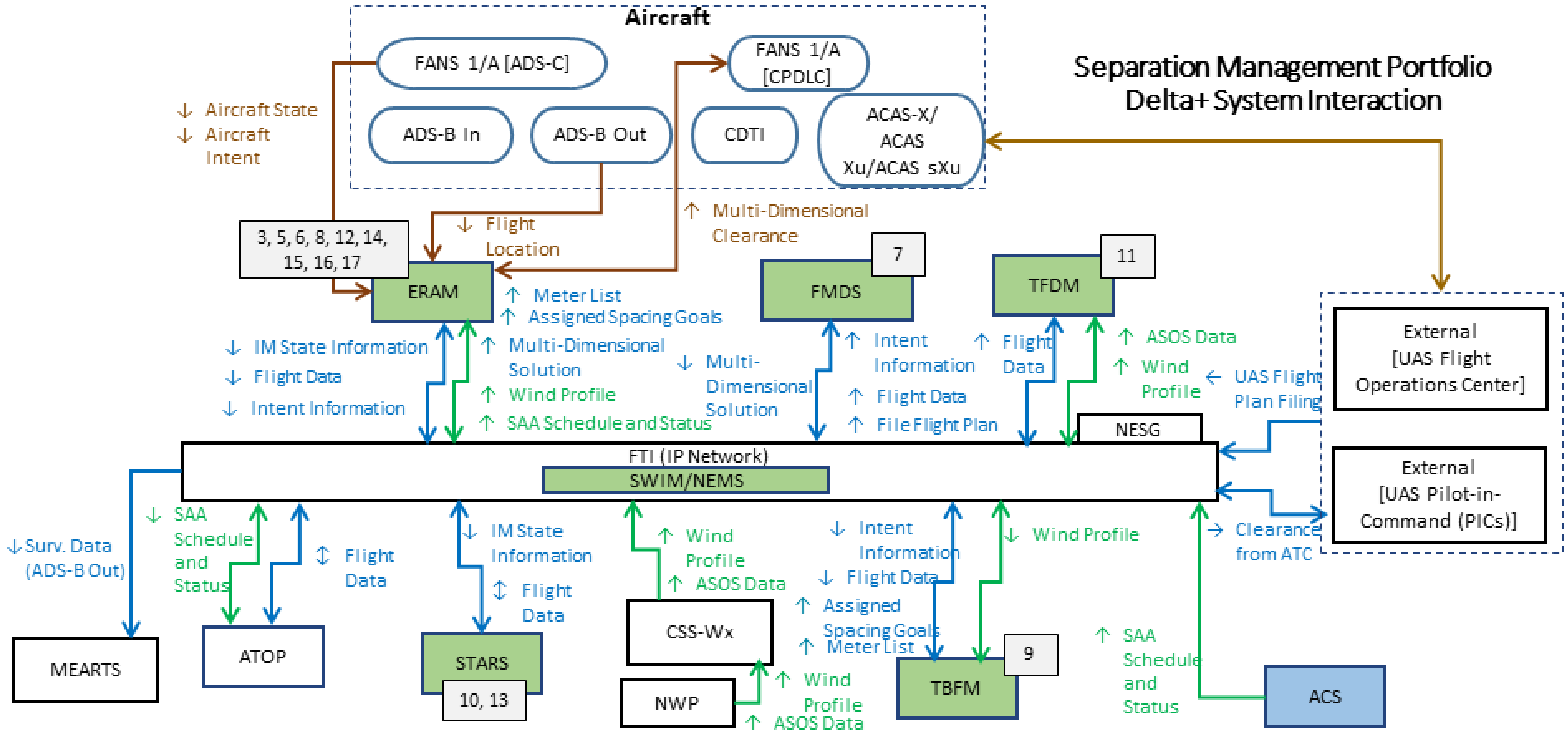
Note: *Does not currently have a primary system

Separation Management

Systems Interactions

The Separation Management capabilities described here and in the figure below are implemented via the ATOP, ERAM and STARS automation systems and the complementary controller procedures and documentation.

Separation Management

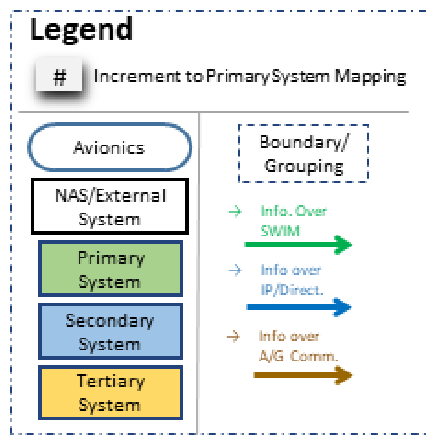


Separation Management Portfolio Delta+ Increments:

1. 101202-22 Unique Attributes for UAS Flight Planning**
2. 102112-22 UAS ATC Direct Communications**
3. 102117-24 En Route Wake Turbulence Encounter Mitigation
4. 102118-23 Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach**
5. 102146-21 Increase Capacity and Efficiency Using Flight Management Computer (FMC) Route Offset
6. 102146-22 Air-to-Ground Trajectory Synchronization
7. 102146-24 Dynamic Arrival and Departure Trajectories
8. 102148-01 Initial Time-Based Spacing Using Interval Management
9. 102148-02 Advanced Time-Based Spacing using Interval Management
10. 102152-31 Dynamic, Pair-wise Wake Separation Standards
11. 102159-01 CSPR Paired Departure Wake Mitigation

** System Dependencies are TBD

12. 102160-01 En Route Separation Tools to Support PBN Routes
13. 102160-02 Controller Tools for Managing Advanced Wake Separation Standards
14. 102160-03 Separation Management Tools to Increase PBN Procedure Utilization
15. 102160-04 En Route Separation Tools to Support Increased Utilization of Airspace
16. 102162-03 Enhanced En Route Data Communications Services
17. 102162-23 Initial Air-Ground Synchronization of Aircraft Intent
18. 104102-37 Improved Oceanic Weather Routes**



Separation Management

Increment	ACAS-X	ADS-B Out Avionics	ATOP	ERAM	FANS 1/A	STARS
C [102109-21] Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation			P		A	
C [102117-22] Active Surveillance Collision Avoidance	A					
C [102117-23] Expanded Use of 3 NM Separation Airspace ✔				P		
C [102137-29] More Efficient Merging of Terminal Arrival Flows						P
C [102157-31] Operation Specific Collision Avoidance	A					
C [103201-01] UAS Detect and Avoid	A					
C [104102-30] Enhanced Conflict Probe for ATOP Surveillance Airspace		A	P			
C [108214-02] UAS Airspace Access when Operating Beyond Visual Line of Sight						

Operationally Available ✔ Complete In Service System Planned System
P Primary Systems **S** Secondary Systems **T** Tertiary Systems **A** Avionics Systems
D Delta

Separation Management

Increment	ACS	ADS-B In Avionics	ASOS	CSS-Wx	Data Com Avionics	DataComm	ERAM	FANS 1/A	FMDS	FMS	NWP	STARS	SWIM	TBFM	TFDM	TFMS
D [101202-22] Unique Attributes for UAS Flight Planning																
D [102112-22] UAS ATC Direct Communications																
D [102117-24] En Route Wake Turbulence Encounter Mitigation				S			P				T		T			
D [102118-23] Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach		A														
D [102146-21] Increase Capacity and Efficiency Using Flight Management Computer (FMC) Route Offset							P			A						
D [102146-22] Air-to-Ground Trajectory Synchronization					A		P									
D [102146-24] Dynamic Arrival and Departure Trajectories					A	S	S			A						P
D [102148-01] Initial Time-Based Spacing Using Interval Management		A					P		S			S		S		
D [102148-02] Advanced Time-Based Spacing using Interval Management		A		T			S					S		P		
D [102152-31] Dynamic, Pair-wise Wake Separation Standards							S					P				

Operationally Available | Complete | In Service System | Planned System

P Primary Systems | **S** Secondary Systems | **T** Tertiary Systems | **A** Avionics Systems

D Delta

Separation Management

Increment	ACS	ADS-B In Avionics	ASOS	CSS-Wx	Data Com Avionics	DataComm	ERAM	FANS 1/A	FMDS	FMS	NWP	STARS	SWIM	TBFM	TFDM	TFMS
D [102159-01] CSPR Paired Departure Wake Mitigation			T	T											P	
D [102160-01] En Route Separation Tools to Support PBN Routes							P									
D [102160-02] Controller Tools for Managing Advanced Wake Separation Standards							S					P				
D [102160-03] Separation Management Tools to Increase PBN Procedure Utilization							P									
D [102160-04] En Route Separation Tools to Support Increased Utilization of Airspace	S						P									
D [102162-03] Enhanced En Route Data Communications Services					A		P							S		S
D [102162-23] Initial Air-Ground Synchronization of Aircraft Intent							P	A						S		S
D [104102-37] Improved Oceanic Weather Routes																

Operationally Available
Complete
In Service System
Planned System

P Primary Systems
S Secondary Systems
T Tertiary Systems
A Avionics Systems

D Delta

Separation Management

Stakeholders

Specific roles and responsibilities for the implementation of all capabilities in this portfolio are outlined in the RASCI (Responsible, Accountable, Supporting, Consulted, Informed) matrix below. All stakeholder organizations involved in the delivery of Segment Alpha capabilities are listed across the top. Portfolio capabilities are listed on the left side of the table, organized by OI and increment. The Oceanic pre-implementation activities for ADS-C CDP were performed through the Oceanic Project Level Agreement (PLA) and led by ANG-C and AJE-3. The ADS-B ITP trials were led by the Surveillance Broadcast Services (SBS) PO in AJM. For the increment Enhanced Oceanic CDP via ADS-C Automation, the changes to ATOP are known and requirements have been finalized. AJM-25 is the responsible office, AJT is the accountable office. AIR-100 and AFS-400 share responsibility. AOV and AEE provide support. For ADS-B ITP and Automation, AJM-23 is the accountable office. AIR-100, and AFS-400 share responsibilities. AOV and AEE provide support. APO supports all oceanic increments in developing policies for incentivizing operators. For Wake Re-Categorization, AJT-2 is the accountable and responsible office. ANG-C and AFS-440 are also responsible offices. AJM-24 provides support. ARP also provides support, as it will need to update airport capacity planning guidance and studies to incorporate the updated wake categories. For the increment ASEPS for the Ocean, AJM-23 is the accountable and responsible office. AJM-25 is also a responsible office for ATOP software enhancements. AJV, AFS, and APO provide support for air traffic procedures and concepts, SASP representation, and development of policies, respectively. For the increment UAS Airspace Access when operating in Visual Line of Site, requirements are known and development of an automation solution has been initiated. AJM-113 is accountable and responsible for implementing the automation solution, known as low altitude authorization and notification capability-automation platform (LAANC AP). AJV-0 is the accountable office for a solution to providing access. AJT, AJV-115, AJV-8, and AJI-2, and AJI-1 all support the implementation of the solution For the increment UAS Airspace Access When operating Beyond Visual Line of Site, concept development and requirements will developed by AJV-7. AJM-113 will be accountable and responsible for implementing the automation solution. AJM-1 is the accountable office for a solution to providing access. AJT, AJV-115, AJV-8, and AJI-2, and AJI-1 all support the implementation of the solution.

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Separation Management

RASCI Matrix	ANG				AOV	AJI			AJT		AJM								AIR	AJR	AFS	AJV	AUS	AAE	APO	ARP
	B	C7	C5	C6	C	001	1	2	3	2	0	2100	4	22	23	2	3	24	25	001	1	001	0	001	001	001	001
C [102109-21] Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation (2020 - 2025)		C					S	S	S				A/R							S							
C [102117-22] Active Surveillance Collision Avoidance (2020 - 2025)		C											A/R														
C [102117-23] Expanded Use of 3 NM Separation Airspace (2020 - 2022)		C	A/R			C	S	S	S	S																	
C [102137-29] More Efficient Merging of Terminal Arrival Flows (2019 - 2024)		C														A/R											
C [102157-31] Operation Specific Collision Avoidance (2020 - 2026)		C											A/R														
C [103201-01] UAS Detect and Avoid (2022 - 2026)	R	A																									
C [104102-30] Enhanced Conflict Probe for ATOP Surveillance Airspace (2020 - 2025)		C					S	S	S			A/R							S	R		R			S	S	
C [108214-02] UAS Airspace Access when Operating Beyond Visual Line of Sight (2020 - 2024)		C	A/R		C		S	S		S	S													I			
D [101202-22] Unique Attributes for UAS Flight Planning (2031 - 2035)		R	A																								
D [102112-22] UAS ATC Direct Communications (2031 - 2035)	R	A																									
D [102117-24] En Route Wake Turbulence Encounter Mitigation (2027 - 2030)		C	A/R													C						S	R				
D [102118-23] Extended Use of Pilot-Applied Visual Separation in Marginal VMC Conditions - Arrivals and Approach (2026 - 2030)		C					S	S	S	S			A/R							S							

Operationally Available | Complete | External Commitment | C Charlie | D Delta

Separation Management

RASCI Matrix	ANG					AOV	AJI			AJT		AJM								AIR	AJR	AFS	AJV	AUS	AAE	APO	ARP
	B	C7	C5	C6	C	001	1	2	3	2	0	2100	4	22	23	2	3	24	25	001	1	001	0	001	001	001	001
• D [102146-21] Increase Capacity and Efficiency Using Flight Management Computer (FMC) Route Offset (2034 - 2039)		C	S			C	S	S	S	S																	
• D [102146-22] Air-to-Ground Trajectory Synchronization (2033 - 2038)	R	A																									
• D [102146-24] Dynamic Arrival and Departure Trajectories (2033 - 2037)		C					S	S	S	S				R	A						S						
• D [102148-01] Initial Time-Based Spacing Using Interval Management (2036 - 2040)		C					S	S	S	S			A/R							S							
• D [102148-02] Advanced Time-Based Spacing using Interval Management (2039 - 2043)		C					S	S	S	S			A/R							S							
• D [102152-31] Dynamic, Pair-wise Wake Separation Standards (2031 - 2035)		C	A/R			C					S							S	S				R				
• D [102159-01] CSPR Paired Departure Wake Mitigation (2027 - 2030)		C	A/R																								
• D [102160-01] En Route Separation Tools to Support PBN Routes (2031 - 2035)		C	A/R			C	S	S	S	S																	
• D [102160-02] Controller Tools for Managing Advanced Wake Separation Standards (2031 - 2035)	C	C	A/R																								
• D [102160-03] Separation Management Tools to Increase PBN Procedure Utilization (2031 - 2035)	R	A																									

Operationally Available   Complete   External Commitment   C Charlie   D Delta

Separation Management

RASCI Matrix	ANG					AOV	AJI			AJT		AJM								AIR	AJR	AFS	AJV	AUS	AAE	APO	ARP
	B	C7	C5	C6	C	001	1	2	3	2	0	2100	4	22	23	2	3	24	25	001	1	001	0	001	001	001	001
D [102160-04] En Route Separation Tools to Support Increased Utilization of Airspace (2031 - 2035)		C	S			C	S	S	S	S		A/R															
D [102162-03] Enhanced En Route Data Communications Services (2031 - 2035)	R	A																									
D [102162-23] Initial Air-Ground Synchronization of Aircraft Intent (2034 - 2039)	C	C	A/R																								
D [104102-37] Improved Oceanic Weather Routes (2035 - 2039)				A/R																							

Operationally Available | Complete | External Commitment | C Charlie | D Delta

Appendix A

Alpha Increments

Portfolio Overview

Enhancements to Separation Management will provide controllers with tools and procedures to manage aircraft separation in a mixed environment of varying navigation equipment and aircraft performance capabilities. Aircraft separation assurance is the cornerstone of Air Traffic Control (ATC) operations. Separation management in the National Airspace System (NAS) can be accomplished procedurally and/or by using automation support. The enhancements to aircraft separation standards based on the revision of wake turbulence separations and enhancements to the terminal and oceanic automation systems are required to support separation management. Separation management is performed in a different way in each of the domains. Controllers will be provided with guidance on how to procedurally apply wake turbulence separation criteria in the NAS. The automation changes required will assist controllers in performing separation management for specific conditions and types of operations in their respective domains.

This portfolio focuses on the following:

- Satisfying user operational needs
- Improving operational efficiency
- Increasing access to the NAS
- Enhancing sector team efficiency
- Geographically expanding current capabilities
- Maintaining and improving the safety of the NAS

Note: The dates and timelines included in the NAS Segment Implementation Plan (NSIP) are for planning purposes only. All capability schedules are tentative until their supporting programs are officially baselined.

Portfolio Content Summary Statistics

		Increment Status				
Segment	**Total by Segment**	**Planned**	**Concept Exploration & Maturation**	**Development**	**Initial Operational Availability**	**Completed**
*Alpha (2010 - 2015)	3	0	0	0	0	3
TOTAL	3	0	0	0	0	3
Segment	**% by Segment**	**% by Segment/Increment Status**				
*Alpha (2010 - 2015)	100%	0 %	0 %	0 %	0 %	100 %
TOTAL	100%	0 %	0 %	0 %	0 %	100 %

Separation Management

Operational Improvements/Current Operations & Increments | Benefits

OI: [102137] Automation Support for Separation Management (2014 - 2030)

A [102137-15] Automated Terminal Proximity Alert (ATPA) for In Trail Separation **(2010 - 2014)**

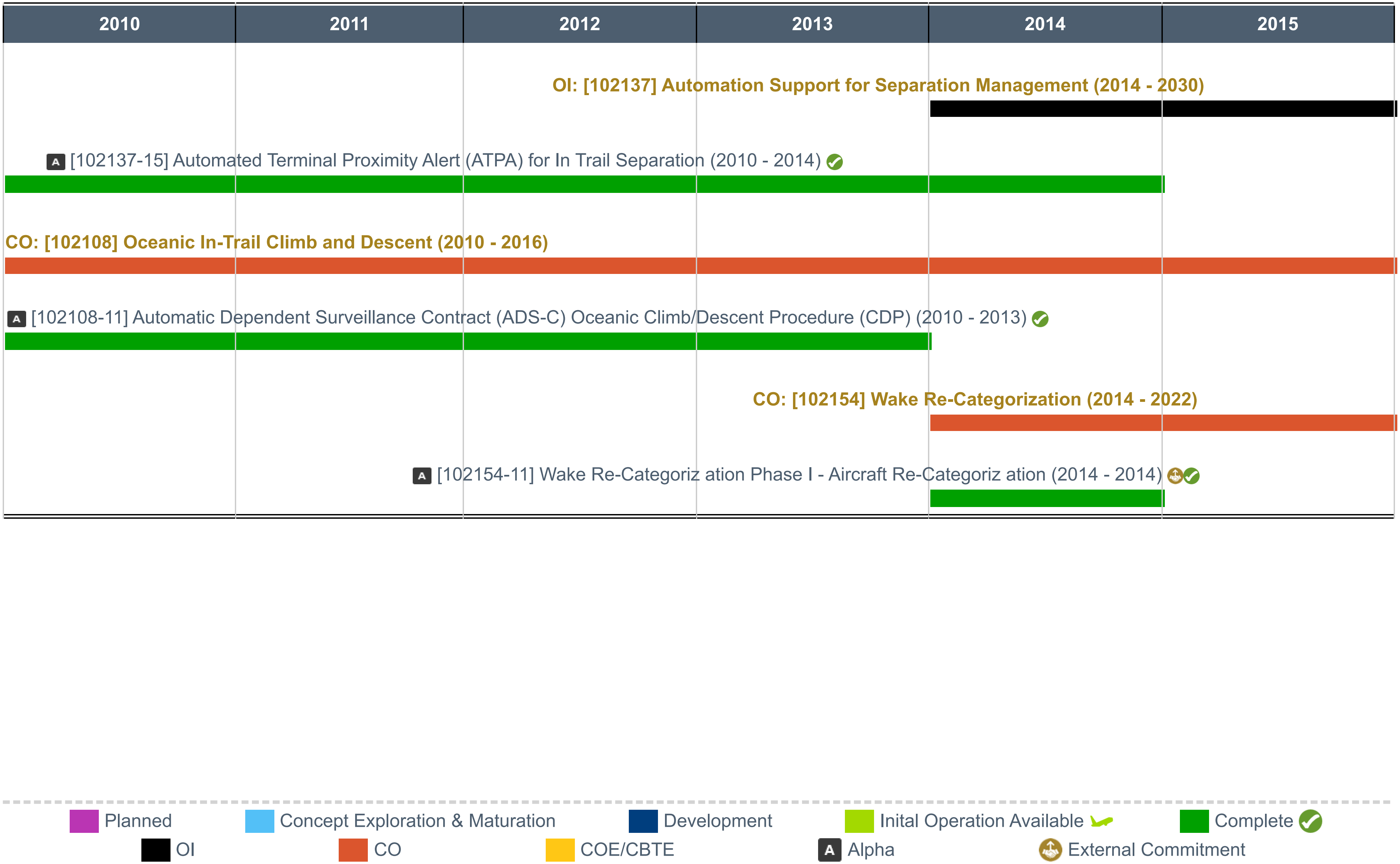
CO: [102108] Oceanic In-Trail Climb and Descent (2010 - 2016)

A [102108-11] Automatic Dependent Surveillance Contract (ADS-C) Oceanic Climb/Descent Procedure (CDP) **(2010 - 2013)**

CO: [102154] Wake Re-Categorization (2014 - 2022)

A [102154-11] Wake Re-Categorization Phase I - Aircraft Re-Categorization **(2014 - 2014)**

Separation Management



Separation Management

OI: [102137] Automation Support for Separation Management (2014 - 2030)

The ANSP automation provides the controller with tools to manage aircraft separation in a mixed navigation and wake performance environment.

Aircraft (manned or unmanned) with various operating and performance characteristics will be operating within the same volume of airspace. Controllers will use ANSP automation enhancements to provide situational awareness of aircraft with differing performance capabilities (e.g., equipped vs. non-equipped aircraft, RNAV, RNP, and trajectory flight data management). For example in performance-based navigation, RNAV/RNP routes may be spaced closer than the normally required separation for the sector area. The standard system conflict alert and conflict probe for the designated area account for this reduced spacing. These enhancements enable ANSP to manage the anticipated increase in complexity and volume of air traffic. Unmanned Aircraft Systems (UAS), as well as other air vehicles (space launch, hyper-sonic, etc.) will share airspace with manned aircraft and be appropriately equipped to operate within that airspace.

OI Benefit

Efficiency (S): Decision support tools will assist controllers in ensuring eligibility and conformance for use of RNAV/RNP routes resulting in their increased use which will enable more aircraft to fly optimal trajectories.

Capacity (S): Automation support will assist in optimal aircraft spacing, resulting in increased aircraft throughput and capacity.

Safety (S): Automation support to ensure aircraft eligibility and conformance to routes will increase aircraft safety.

Increments

Alpha

(2010 - 2015)

1

A **[102137-15] Automated Terminal Proximity Alert (ATPA) for In Trail Separation (2010 - 2014)** (Complete)

Separation Management

Increments/Enabling Activities

A [102137-15] Automated Terminal Proximity Alert (ATPA) for In Trail Separation (2010 - 2014)

Increment Overview

ATPA displays a controller visual proximity situational awareness for arrivals to the same runway. ATPA is a decision-support tool that helps controllers avoid compression errors on the final approach course. ATPA alerts controllers when compression between subsequent aircraft is projected to result in unsafe separation. In providing that safety information, ATPA also provides information to controllers to make spacing adjustments needed to safely achieve optimal final approach spacing and efficiency. ATPA is an Air Traffic Control Automation tool that provides situational awareness and alerts controllers on color displays.

Increment Status

Complete

Success Criteria

✔ 2014 : Proposed for Automation Change: Initial Daily Use (IDU) of CART/STARS automation to provide ATPA to selected airports listed below by the NextGen Alpha Segment goal date of 2014.RTCA TF5 OA 1-A3.

o Chicago TRACON (C90): MDW, ORD
o Denver TRACON (D01): DEN
o Memphis TRACON (M03): MEM
o MIA
o Minneapolis TRACON (M98): MSP
o Northern California TRACON (NCT): OAK, RNO, SFO, SJC, SMF
o Potomac TRACON (PCT): BWI, DCA, IAD, RIC
o Southern California TRACON (SCT): BUR, CRQ, HHR, LAX, LGB, MYF, NKX, ONT, PSP, SAN, SNA, VNY
o SDF
o St. Louis TRACON (T75): STL
o New York (N90)
o Atlanta TRACON (A80)

Implementation Approach

AJM-21 is accountable and responsible for implementing ATPA through CARTS with color displays and STARS. AJM-21 provides automation development, testing, demonstrations, and deployment. AJT-2 provides support, and AOV is consulted.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Capacity(P), Efficiency (P), Safety (P): ATPA will improve flight capacity, efficiency, and safety by helping controllers consistently maintain an optimal final approach operation with reduced separation error, and responding to airspace/traffic change events.

System Interactions

STARS (P): Provides additional decision information to controllers by displaying cones that represent minimum separation zones between each flight as it executes the final approach leg. ATPA will assist in maintaining spacing after aircraft enter a merge point and on final. This capability was provided in STARS in 2013.

Primary Systems

CO: [102108] Oceanic In-Trail Climb and Descent (2010 - 2016)

ANSP automation enhancements will take advantage of improved communication, navigation, and surveillance coverage in the oceanic domain. When authorized by the controller, pilots of equipped aircraft use established procedures for climbs and descents.

Improved ANSP automation provides the opportunity to use new procedures and reduce longitudinal spacing for the duration of the procedure. Aircraft are able to fly the most advantageous trajectories with climb and descent maneuvers.

CO Benefit

Efficiency (P): Aircraft can fly closer to optimal trajectories as a result of reduced in-trail spacing during climb and descent in Oceanic airspace.

Access and Equity (P): New procedures that reduce longitudinal spacing during climb and descent maneuvers allow for better use of existing oceanic airspace capacity for appropriately equipped aircraft.

Environment (S): Optimal climb and descent maneuvers will reduce fuel burn and emissions.

Increments

Alpha

(2010 - 2015)

1

A **[102108-11] Automatic Dependent Surveillance Contract (ADS-C) Oceanic Climb/Descent Procedure (CDP) (2010 - 2013)** (Complete)

Separation Management

Increments/Enabling Activities

A [102108-11] Automatic Dependent Surveillance Contract (ADS-C) Oceanic Climb/Descent Procedure (CDP) (2010 - 2013)

Increment Overview

The ADS-C CDP is a new concept that allows a properly equipped aircraft (e.g., Future Air Navigation System (FANS) 1/A equipage) to climb or descend through the altitude of another properly equipped aircraft with a reduced longitudinal separation distance (compared with the required longitudinal separation minima for same-track, same-altitude aircraft). This procedure allows more aircraft to reach their preferred altitudes. Once implemented, ADS-C CDP will increase the benefits from the use of advanced communication, navigation, and surveillance (CNS) capabilities through Controller-Pilot Data link Communications (CPDLC), Required Navigation Performance (RNP), and ADS-C.

The ADS-C CDP operational trial to validate the safety case was completed in February 2012. The safety case report and business case analysis have been completed. Results of the trial have been technology transferred to the PMO for automation implementation as described in increment 102108-12, below. This increment has achieved its success criteria.

Increment Status

Complete

Success Criteria

2012 : Operationally available in selected oceanic airspace

Implementation Approach

Operational trial has been successfully conducted.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Capacity (P): ADS-C Oceanic CDP allows aircraft to change altitude with a smaller separation distance than allowed by currently approved procedures, by taking advantage of improved avionics capabilities and performance levels. Specifically, for properly equipped aircraft that are both on the same track, oceanic air traffic controllers will have an additional option for granting clearances when other separation standards do not allow for a climb or descent. This option, when utilized, would allow more oceanic flights to achieve their preferred vertical profiles.

Efficiency (P): When efficiency is improved due to reduced separation, reduced fuel burn and emissions normally result.

Environment (S): Environmental benefits accrue from reduced fuel burn at optimum altitudes, as compared to non-optimum cruise, where the aircraft is blocked by other traffic under current procedures.

Separation Management

Primary Systems

- ATOP: Advanced Technologies and Oceanic Procedures

Avionics Systems

- ADS-B: Automatic Dependent Surveillance - Broadcast
- FANS 1/A: Future Air Navigation System 1/A

Separation Management

CO: [102154] Wake Re-Categorization (2014 - 2022)

Legacy wake separation categories are updated based on analysis of wake generation, wake decay, and encounter effects for representative aircraft. Eventually, static wake separation standards are established that consider model specific leader-follower aircraft pairings, replacing categorical standards and increasing capacity. ANSP automation supports application of standards as needed.

CO Benefit

Capacity (P): Wake separation standards based on specific leader-follower aircraft pairings will further reduce separation and increase airport throughput and capacity.

Environment (S): Reduction in time-to-taxi and time-to-fly in TRACON airspace that results from reduced congestion associated with wake re-categorization reduces fuel consumption and carbon emissions.

Increments

Alpha

(2010 - 2015)

1

A **[102154-11] Wake Re-Categorization Phase I - Aircraft Re-Categorization (2014 - 2014)** (Complete)

External Commitment Primary Benefit Secondary Benefit Operationally Available Complete
Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety A Alpha

Separation Management

Increments/Enabling Activities

A [102154-11] Wake Re-Categorization Phase I - Aircraft Re-Categorization (2014 - 2014)

Increment Overview

Wake re-categorization provides improved throughput at capacity-constrained, high-density airports, while maintaining or improving safety. The approved wake turbulence categories replace the previous weight based categories and more optimally group aircraft based on their wake turbulence characteristics and the current fleet mix for US (and European) airports.

Increment Status

Complete

Success Criteria

- 2013 : Operational readiness of TAMRand CARTS completed MEM, SDF. This will satisfy a NAC/NIWG Commitment.
- 2014 : Operational readiness at selected CARTS and TAMR sites CVG, A80, I90. This will satisfy a NAC/NIWG Commitment.
- 2015 : Operational readiness at selected CARTS and TAMR sites CLT, JFK/EWR/LGA, ORD/MDW. This will satisfy a NAC/NIWG Commitment.

Implementation Approach

AJT-2C is the accountable and responsible office. ANG-C and AFS-440 are also responsible offices. AJM-24 and AJM-25 provide support. ARP also provides support, as it will need to update airport capacity planning guidance and studies to incorporate the updated wake categories. AOV is consulted.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Capacity (P):The establishment of new wake categories provide more accurate grouping of like aircraft based on their wake turbulence characteristics, resulting in reduced inter-arrival and inter-departure spacing, thus improving airport capacity during Instrument Flight Rules (IFR) operations due to reduced required longitudinal spacing.

Environment (S): Reduction in time-to-taxi and time-to-fly in TRACON airspace that results from reduced congestion associated with wake re-categorization reduces fuel consumption and carbon emissions.

System Interactions

STARS (P): RECAT requires an adaptation change in STARS to display the RECAT wake category.
CARTS (P): RECAT requires a functional change to the displays in CARTS to display the RECAT wake category.
AEFS (S): RECAT requires an adaptation change to display the RECAT wake category.
EFSTS (S): RECAT requires an adaptation change to display the RECAT wake category.

Separation Management

Primary Systems

- STARS: Standard Terminal Automation Replacement System

Secondary Systems

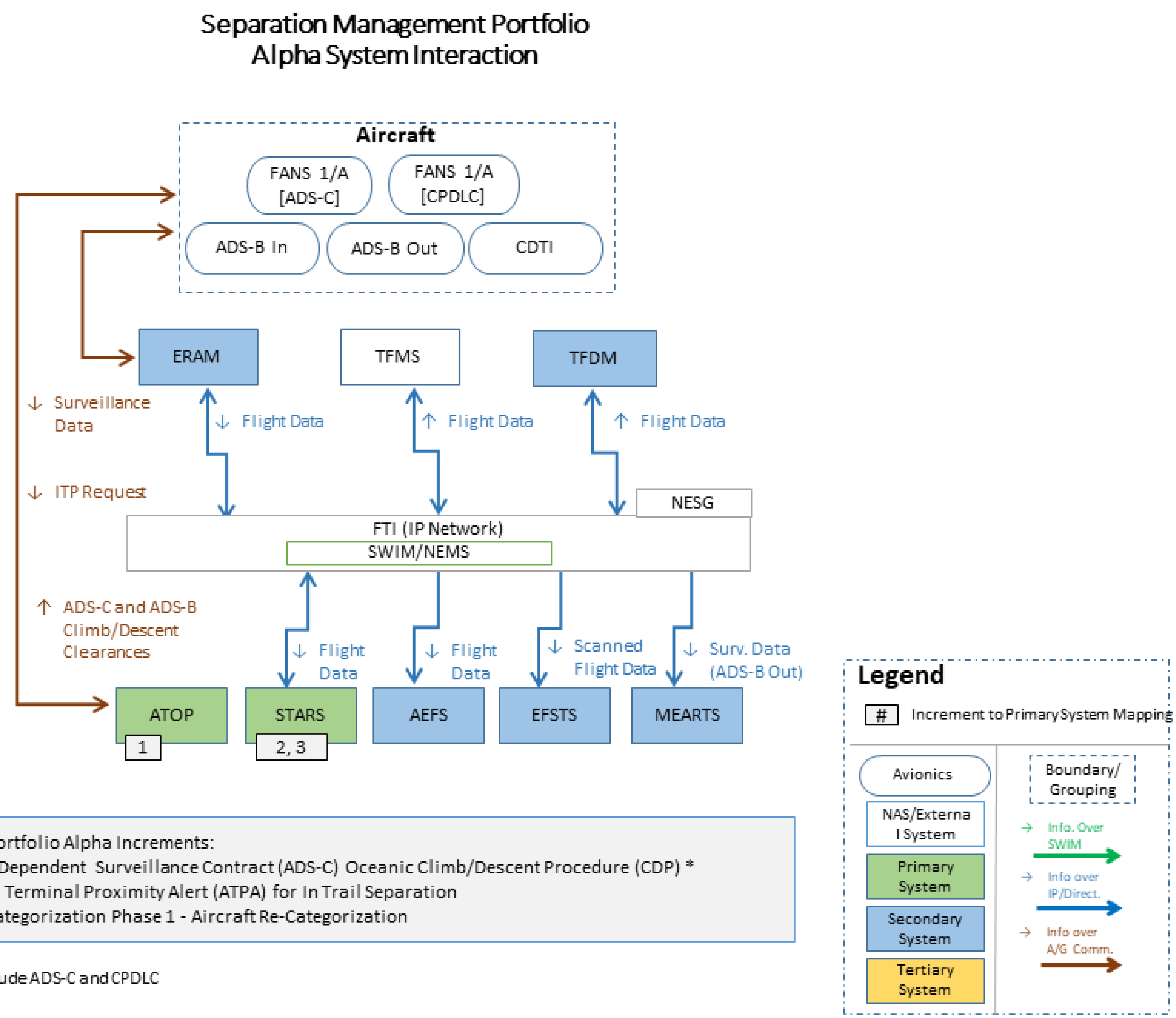
- ERAM: En Route Automation Modernization
- TFDM: Terminal Flight Data Manager
- MEARTS: Microprocessor-En Route Automated Radar Tracking System
- EFSTS: Electronic Flight Strip Transfer System
- AEFS: Advanced Electronic Flight Strip

Separation Management

Systems Interactions

The Separation Management capabilities described here and in the figure below are implemented via the ATOP, ERAM and STARS automation systems and the complementary controller procedures and documentation.

Separation Management



Separation Management Portfolio Alpha Increments:
1. 102108-11 Automatic Dependent Surveillance Contract (ADS-C) Oceanic Climb/Descent Procedure (CDP) *
2. 102137-15 Automated Terminal Proximity Alert (ATPA) for In Trail Separation
3. 102154-11 Wake Re-Categorization Phase 1 - Aircraft Re-Categorization

Note: * FANS applications include ADS-C and CPDLC

Separation Management

Increment	ADS-B	AEFS	ATOP	EFSTS	ERAM	FANS 1/A	MEARTS	STARS	TFDM
A [102108-11] Automatic Dependent Surveillance Contract (ADS-C) Oceanic Climb/Descent Procedure (CDP)	A		P			A			
A [102137-15] Automated Terminal Proximity Alert (ATPA) for In Trail Separation								P	
A [102154-11] Wake Re-Categorization Phase I - Aircraft Re-Categorization		S		S	S		S	P	S

Operationally Available | Complete | In Service System | Planned System

P Primary Systems | S Secondary Systems | T Tertiary Systems | A Avionics Systems

A Alpha

Stakeholders

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Separation Management

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• A [102108-11] Automatic Dependent Surveillance Contract (ADS-C) Oceanic Climb/Descent Procedure (CDP) (2010 - 2013)		C			R		S	S	S										R	R		R			S	S	
• A [102137-15] Automated Terminal Proximity Alert (ATPA) for In Trail Separation (2010 - 2014)		C				C	S	S	S	S																	
• A [102154-11] Wake Re-Categorization Phase I - Aircraft Re-Categorization (2014 - 2014)		C					S	S	S	A/R								S				R	A/R				S

Operationally Available   Complete   External Commitment   A Alpha

Appendix B

Bravo Increments

Portfolio Overview

Enhancements to Separation Management will provide controllers with tools and procedures to manage aircraft separation in a mixed environment of varying navigation equipment and aircraft performance capabilities. Aircraft separation assurance is the cornerstone of Air Traffic Control (ATC) operations. Separation management in the National Airspace System (NAS) can be accomplished procedurally and/or by using automation support. The enhancements to aircraft separation standards based on the revision of wake turbulence separations and enhancements to the terminal and oceanic automation systems are required to support separation management. Separation management is performed in a different way in each of the domains. Controllers will be provided with guidance on how to procedurally apply wake turbulence separation criteria in the NAS. The automation changes required will assist controllers in performing separation management for specific conditions and types of operations in their respective domains.

This portfolio focuses on the following:

- Satisfying user operational needs
- Improving operational efficiency
- Increasing access to the NAS
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- Maintaining and improving the safety of the NAS

Note: The dates and timelines included in the NAS Segment Implementation Plan (NSIP) are for planning purposes only. All capability schedules are tentative until their supporting programs are officially baselined.

Portfolio Content Summary Statistics

		Increment Status				
Segment	**Total by Segment**	**Planned**	**Concept Exploration & Maturation**	**Development**	**Initial Operational Availability**	**Completed**
*Bravo (2016 - 2020)	4	0	0	0	0	4
TOTAL	4	0	0	0	0	4
Segment	**% by Segment**	**% by Segment/Increment Status**				
*Bravo (2016 - 2020)	100%	0 %	0 %	0 %	0 %	100 %
TOTAL	100%	0 %	0 %	0 %	0 %	100 %

Separation Management

Operational Improvements/Current Operations & Increments

Benefits

[CO: [102108] Oceanic In-Trail Climb and Descent (2010 - 2016)]

B [102108-12] Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation **(2016 - 2016)**

B [102108-13] Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation **(2011 - 2016)**

[CO: [102154] Wake Re-Categorization (2014 - 2022)]

B [102154-21] Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards **(2016 - 2022)**

[OI: [108214] UAS Airspace Access (2017 - 2024)]

B [108214-01] UAS Airspace Access when Operating within Visual Line of Sight **(2017 - 2018)**

External Commitment Primary Benefit Secondary Benefit Operationally Available Complete
Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety B Bravo

Separation Management

2016	2017	2018	2019	2020

CO: [102108] Oceanic In-Trail Climb and Descent (2010 - 2016)

B [102108-12] Enhanced Oceanic Climb/Descen t Procedure via ADS-C Automation (2016 - 2016)

B [102108-13] Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation (2011 - 2016)

CO: [102154] Wake Re-Categorization (2014 - 2022)

B [102154-21] Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards (2016 - 2022)

OI: [108214] UAS Airspace Access (2017 - 2024)

B [108214-01] UAS Airspace Access when Operating within Visual Line of Sight (2017 - 2018)

Planned | Concept Exploration & Maturation | Development | Inital Operation Available | Complete
OI | CO | COE/CBTE | B Bravo | External Commitment

Separation Management

CO: [102108] Oceanic In-Trail Climb and Descent (2010 - 2016)

ANSP automation enhancements will take advantage of improved communication, navigation, and surveillance coverage in the oceanic domain. When authorized by the controller, pilots of equipped aircraft use established procedures for climbs and descents.

Improved ANSP automation provides the opportunity to use new procedures and reduce longitudinal spacing for the duration of the procedure. Aircraft are able to fly the most advantageous trajectories with climb and descent maneuvers.

CO Benefit

Efficiency (P): Aircraft can fly closer to optimal trajectories as a result of reduced in-trail spacing during climb and descent in Oceanic airspace.

Access and Equity (P): New procedures that reduce longitudinal spacing during climb and descent maneuvers allow for better use of existing oceanic airspace capacity for appropriately equipped aircraft.

Environment (S): Optimal climb and descent maneuvers will reduce fuel burn and emissions.

Increments

Bravo

(2016 - 2020)

2

B **[102108-12] Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation (2016 - 2016)** (Complete)

B **[102108-13] Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation (2011 - 2016)** (Complete)

Increments/Enabling Activities

B [102108-12] Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation (2016 - 2016)

Increment Overview

The ADS-C CDP will enable aircraft equipped with ADS-C and appropriate on-board automation to climb and descend through altitudes where current non-ADS-C separation standards would prevent desired altitude changes.Automation enhancements to Advanced Technologies and Oceanic Procedures (ATOP) would maximize the benefits of ADS-C CDP as the number of equipped aircraft increase. Automation enhancements include capabilities that allow controllers to select two aircraft and ensure they are eligible for ADS-C CDP, send concurrent on-demand position reports to two aircraft, determine if the minimum separation distance between the two aircraft is greater than the ADS-C CDP separation distance (e.g., greater than 15 nm), display the conflict probe results to a controller, and build an uplink clearance message to the requesting aircraft. Uplink traffic advisory message are sent to the blocking aircraft.

The objective of the CDP is to enable aircraft to achieve, on a reliable and more frequent basis, user-preferred flight level changes in what is currently procedural airspace, thus improving flight efficiency. CDP permits a climb-through or descend-through maneuver between properly equipped aircraft, using a new CDP-enabled distance-based longitudinal separation minimum.

Increment Status

Complete

Success Criteria

- 2016 : Operational readiness at Oakland (ZOA)
- 2017 : Operational at readiness New York (ZNY) and Anchorage (ZAN)

Implementation Approach

AJM-23 is the accountable office. NAS Infrastructure is enhanced through the integration of enabling technologies and new standards and procedures into automation systems. The key automation systems impacted is Advanced Technology Oceanic Procedures (ATOP). Software will be delivered to each ATOP site. Each site will enable this capability when the appropriate proceduresand training are in place.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Efficiency (P): ADS-C Oceanic CDP allows aircraft to change altitude with a smaller separation distance than allowed by currently approved procedures, by taking advantage of improved avionics capabilities and performance levels. When efficiency is improved due to reduced separation, reduced fuel burn and emissions normally result.

System Interactions

ADS-C (A): To be eligible for ADS-C CDP, both aircraft must be ADS-C and CPDLC equipped.

FANS-1/A (A)

Primary Systems

- ATOP: Advanced Technologies and Oceanic Procedures

Avionics Systems

- Data Com Avionics: Data Communication Avionics
- FANS 1/A: Future Air Navigation System 1/A

Increments/Enabling Activities

B [102108-13] Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation (2011 - 2016)

Increment Overview

ADS-B In-Trail Procedures (ITP) will enable aircraft equipped with ADS-B and appropriate on-board automation to climb and descend through altitudes where current non-ADS-B separation standards would prevent desired altitude changes. The reference aircraft is required to have ADS-B Out capability (the maneuvering aircraft should also have ADS-B Out to serve as a reference aircraft for other aircraft). The pilot of the aircraft desiring a maneuver uses the ADS-B information received to determine if the ITP criteria have been met before requesting the maneuver.

The objective of the ITP is to enable aircraft to achieve, on a reliable and more frequent basis, user-preferred flight level changes in what is currently procedural airspace, thus improving flight efficiency and safety. ITP permits a climb-through or descend-through maneuver between properly equipped aircraft, using a new ITP-enabled distance-based longitudinal separation minimum. It is initiated by the flight crew using criteria designed such that the in-trail minimum separation is not infringed upon during the maneuver.

Increment Status

Complete

Success Criteria

- 2016 : Operational readiness achieved at Oakland
- 2017 : Operational readiness at New York (ZNY) and Anchorage (ZAN)

Implementation Approach

NAS Infrastructure is enhanced through the integration of enabling technologies and new standards and procedures into automation systems. The key automation systems impacted is Advanced Technology Oceanic Procedures (ATOP). Software will be delivered to each ATOP site. Each site will enable this capability when the appropriate procedures and training are in place.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Efficiency (P): This capability provides for an increased ability to reach optimal aircraft performance altitude, which translates to fuel cost savings.

System Interactions

ATOP (P): This ATOP automation enhancement allowsfor aircrew initiated maneuvers to be validated by the controller.

ADS-B In (A): To be eligible for ADS-B ITP, both aircraft must be ADS-B in/outand CPDLC equipped.The requesting aircraft must also be

Separation Management

CPDLC (A)

FANS 1/A (A)

Primary Systems

- ATOP: Advanced Technologies and Oceanic Procedures

Avionics Systems

- FANS 1/A: Future Air Navigation System 1/A
- ADS-B In Avionics: Automatic Dependent Surveillance - Broadcast In Avionics
- ADS-B Out Avionics: Automatic Dependent Surveillance - Broadcast Out Avionics

Separation Management

CO: [102154] Wake Re-Categorization (2014 - 2022)

Legacy wake separation categories are updated based on analysis of wake generation, wake decay, and encounter effects for representative aircraft. Eventually, static wake separation standards are established that consider model specific leader-follower aircraft pairings, replacing categorical standards and increasing capacity. ANSP automation supports application of standards as needed.

CO Benefit

Capacity (P): Wake separation standards based on specific leader-follower aircraft pairings will further reduce separation and increase airport throughput and capacity.

Environment (S): Reduction in time-to-taxi and time-to-fly in TRACON airspace that results from reduced congestion associated with wake re-categorization reduces fuel consumption and carbon emissions.

Increments

Bravo

(2016 - 2020)

1

B **[102154-21] Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards (2016 - 2022)** (Complete)

Separation Management

Increments/Enabling Activities

B [102154-21] Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards (2016 - 2022)

Increment Overview

Wake re-categorization (RECAT) Phase II provides improved throughput at capacity-constrained, high-density airports, while maintaining or improving safety by defining pair-wise wake separation standards for each aircraft leader-follower pair. Implementation of these standards can then uniquely address the needs of a given airport based on the local fleet mix to increase site-specific benefits beyond RECAT Phase I classes.

Increment Status

Complete

Success Criteria

- 2015 : SFO/NCT implemented. This has satisfied a NAC/NIWG Commitment.
- 2016 : Phase II key site SCT implemented on Sept 2016 and key site PHL Q4 2016. This has satisfied a NAC/NIWG Commitment.
- 2017 : Phase II implemented at MSP in Q1 of 2017 and MIA in Q2 of 2017
- 2018 : Implementation at DTW, IAD, LAS, PHX, HNL, SAT, SEA. This will satisfy a NAC/NIWG Commitment.
- 2019 : Consolidated Wake Turbulence (CWT) separation standards at six sites. (DFW, BOS, MSP, MIA, LAX, SCT). This will satisfy a NAC/NIWG commitment.
- 2020 : Consolidated Wake Turbulence (CWT) separation standard at seven sites. (DTW, IAH, CVG, ANC, SDF, CLT, PHL). This will satisfy a NAC/NIWG commitment.
- 2022 : Consolidated Wake Turbulence (CWT) separation standards at six sites (MEM, IND, C90, A80, N90 and D01). This will satisfy a NAC/NIWG commitment.

Implementation Approach

Airport capacity planning guidance and studies will be updated to incorporate the updated wake categories.

Benefits

Access & Equity | Capacity | Flexibility | Efficiency | Environment | Predictability | Safety

Capacity (P): The establishment of new wake categories provide more accurate grouping of like aircraft based on their wake turbulence characteristics, resulting in reduced inter-arrival and inter-departure spacing, thus improving airport capacity during Instrument Flight Rules (IFR) operations due to reduced required longitudinal spacing.

Environment (S): Reduction in time-to-taxi and time-to-fly in TRACON airspace that results from reduced congestion associated with wake re-categorization reduces fuel consumption and carbon emissions.

System Interactions

EFSTS (S): RECAT requires an adaptation change to display the RECAT wake category.

TFDM (S): RECAT may require a change to display the RECAT wake category.

ERAM (S): RECAT requires an adaption change to utilize the RECAT wake category in transition airspace.

MEARTS (S): RECAT requires a functional change as well as adaptation changes.

Primary Systems

- STARS: Standard Terminal Automation Replacement System

Secondary Systems

- MEARTS: Microprocessor-En Route Automated Radar Tracking System
- TFDM: Terminal Flight Data Manager
- ERAM: En Route Automation Modernization
- AEFS: Advanced Electronic Flight Strip
- EFSTS: Electronic Flight Strip Transfer System

OI: [108214] UAS Airspace Access (2017 - 2024)

UAS access to airspace is determined based on airspace classes and the performance level of the UAS. Rules govern the need for authorization to operate in a given class of airspace. Airspace management provides the availability status for airspace volumes as needed to prevent UAS from flying in the vicinity of manned aircraft or to segregate airspace for first responders. Requirements for UAS operators to notify other airspace users of their location and the ability to receive near real-time changes in airspace status are established for specific airspace classes and volumes. UAS operators must obtain an airspace authorization to operate beyond visual line of sight of the UAS in Class B, C, and D airspace, and Class E surface areas.

OI Benefit

Safety (P): ensure that small UAS operations do not pose a safety risk to aircraft operations.

Access and Equity (S): Provide expanded airspace access to UAS operators.

Increments

Bravo

(2016 - 2020)

1

B **[108214-01] UAS Airspace Access when Operating within Visual Line of Sight (2017 - 2018)** (Complete)

Separation Management

Increments/Enabling Activities

B [108214-01] UAS Airspace Access when Operating within Visual Line of Sight (2017 - 2018)

Increment Overview

Airspace access rules require UAS operators to obtain an airspace authorization prior to operating within visual line of sight in Class B, C, and D airspace, and Class E surface areas.

Increment Status

Complete

Success Criteria

- 2017 : Released 141 CFR Part 107 rule; release 14 CFR part 101 rule.
- 2018 : Beta Fielding at 291 Sites
- 2019 : Beta Fielding of 110 of 250 Contract Towers; investment commitment decision from operations governance board (OGB) for LAANC. LAANC enhancements to enable recreational UAS flyers to obtain authorizations in controlled airspace in accordance with Section 44809
- 2020 : Completion of remaining 140 federal contract towers (FCT).

Implementation Approach

The Low Altitude Authorization and Notification Capability (LAANC) application will be developed and hosted on FAA cloud services, with an external data exchange via application program interface (API). External providers known as UAS Service Suppliers (USS) provide user facing services. Authorizations are automatically processed by exchanging data with USS. FAA provides authoritative source UAS facility map data to USS and the USS use the data to check and authorize operations in controlled airspace (Airspace classes B, C, D,and surface E). USS send the authorization to the FAA for storage. FAA maintains a record of the flight authorization. In 2019, LAANC was enhanced to authorize Section 44809, recreational UAS flyers requests for authorizations as well. In addition, LAANC also provides a mechanism for external operators to request further coordination (FC) for flights below 400 feet but above approved altitudes.

Benefits

Access & Equity Capacity Flexibility Efficiency Environment Predictability Safety

Safety (P): Ensure that small UAS operations do not pose a safety risk to mannedaircraft operations.

Efficiency (S): Ensures continued efficiency of ATM operations in controlled airspace with coincident sUAS operations.

Flexibility (S): Provides flexibility in methods to access airspace for sUAS VLOS operations

Predictability (S): LAANC; provides predictability for ATM to continue to manage ATM operations for manned aircraft (makes it so

Separation Management

Software Application hosted on FAA cloud services (FCS)

FCS (T) - LAANC (T): LAANC will be implemented as a software application hosted on FAA cloud services. LAANC is a NAS like administrative service for air traffic managers at ATC facilities. LAANC is provided via the FAA's mission support network and is accessed via PIV card by named ATMs or their designated representative.

Tertiary Systems

LAANC: Low Altitude Authorization and Notification Capability

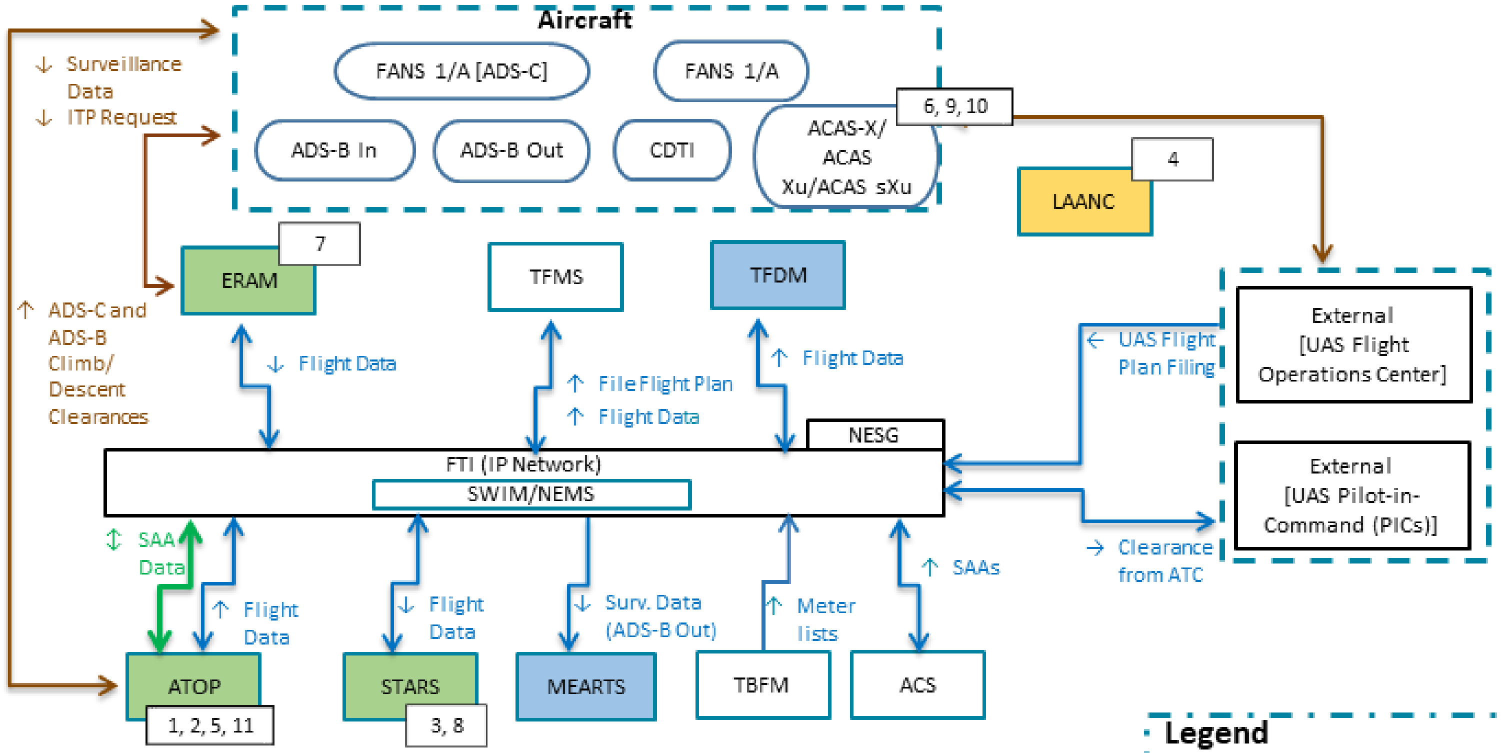
Separation Management

Systems Interactions

The Separation Management capabilities described here and in the figure below are implemented via the ATOP, ERAM and STARS automation systems and the complementary controller procedures and documentation.

Separation Management

Separation Management Portfolio
Bravo/Charlie System Interaction

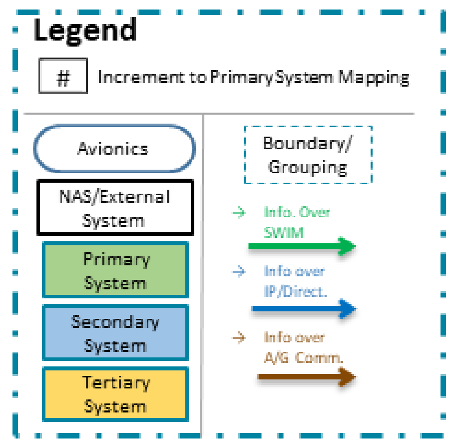


Separation Management Portfolio Bravo Increments:

1. 102108-12 Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation
2. 102108-13 Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation
3. 102154-21 Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards
4. 108214-01 UAS Airspace Access when Operating within Visual Line of Sight*

Separation Management Portfolio Charlie Increments:

5. 102109-21 Advanced Surveillance Enhanced Procedural Separation (ASEPS) ADS-C Reduced Oceanic Separation
6. 102117-22 Active Surveillance Collision Avoidance
7. 102117-23 Expanded Use of 3 NM Separation Airspace
8. 102137-29 More Efficient Merging of Terminal Arrival Flows
9. 102157-31 Operation Specific Collision Avoidance
10. 103201-01 UAS Detect and Avoid
11. 104102-30 Enhanced Conflict Probe for ATOP Surveillance Airspace
12. 108214-02 UAS Airspace Access when Operating Beyond Visual Line of Sight*



Note: *Does not currently have a primary system

Separation Management

Increment	ADS-B In Avionics	ADS-B Out Avionics	AEFS	ATOP	Data Com Avionics	EFSTS	ERAM	FANS 1/A	LAANC	MEARTS	STARS	TFDM
B [102108-12] Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation				P	A			A				
B [102108-13] Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation	A	A		P				A				
B [102154-21] Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards			S			S	S			S	P	S
B [108214-01] UAS Airspace Access when Operating within Visual Line of Sight									T			

Operationally Available — Complete — In Service System — Planned System

P Primary Systems — S Secondary Systems — T Tertiary Systems — A Avionics Systems

B Bravo

Stakeholders

Specific roles and responsibilities for the implementation of all capabilities in this portfolio are outlined in the RASCI (Responsible, Accountable, Supporting, Consulted, Informed) matrix below. All stakeholder organizations involved in the delivery of Segment Alpha capabilities are listed across the top. Portfolio capabilities are listed on the left side of the table, organized by OI and increment. The Oceanic pre-implementation activities for ADS-C CDP were performed through the Oceanic Project Level Agreement (PLA) and led by ANG-C and AJE-3. The ADS-B ITP trials were led by the Surveillance Broadcast Services (SBS) PO in AJM. For the increment Enhanced Oceanic CDP via ADS-C Automation, the changes to ATOP are known and requirements have been finalized. AJM-25 is the responsible office, AJT is the accountable office. AIR-100 and AFS-400 share responsibility. AOV and AEE provide support. For ADS-B ITP and Automation, AJM-23 is the accountable office. AIR-100, and AFS-400 share responsibilities. AOV and AEE provide support. APO supports all oceanic increments in developing policies for incentivizing operators. For Wake Re-Categorization, AJT-2 is the accountable and responsible office. ANG-C and AFS-440 are also responsible offices. AJM-24 provides support. ARP also provides support, as it will need to update airport capacity planning guidance and studies to incorporate the updated wake categories. For the increment ASEPS for the Ocean, AJM-23 is the accountable and responsible office. AJM-25 is also a responsible office for ATOP software enhancements. AJV, AFS, and APO provide support for air traffic procedures and concepts, SASP representation, and development of policies, respectively. For the increment UAS Airspace Access when operating in Visual Line of Site, requirements are known and development of an automation solution has been initiated. AJM-113 is accountable and responsible for implementing the automation solution, known as low altitude authorization and notification capability-automation platform (LAANC AP). AJV-0 is the accountable office for a solution to providing access. AJT, AJV-115, AJV-8, and AJI-2, and AJI-1 all support the implementation of the solution For the increment UAS Airspace Access When operating Beyond Visual Line of Site, concept development and requirements will developed by AJV-7. AJM-113 will be accountable and responsible for implementing the automation solution. AJM-1 is the accountable office for a solution to providing access. AJT, AJV-115, AJV-8, and AJI-2, and AJI-1 all support the implementation of the solution.

- **A** Accountable for the completion of NextGen capability. The highest level within the RASCI matrix, this office is charged by the FAA to deliver a particular capability. Typically, this designation is provided via an AcquisitionProgram Baseline. To foster a clear line of accountability, two different offices can never be Accountable for the same increment, andAccountability can never be delegated to another office.
- **R** Responsible for the successful completion of NextGen capability or a critical component of the capability. This office is responsible to theAccountable office. The Responsible office is responsible for initiating an actual change to the NAS such as automation changes, and is often also designated as the Accountable office for that increment. However, there are examples in the NSIP where one office is Accountable for an increment while another office (or offices) is actually making a change in the NAS on behalf of the Accountable office.
- **A/R** Accountable for the completion of NextGen capability as well as Responsible for its implementation.
- **S** Supports the Responsible office in the implementation of NextGen capability.Typically, this support is in the form of subject matter expertise, procedural guidance, or training activities.
- **C** Consulted for input during the implementation of NextGen capability. Provides input on a specific aspect in the development and implementation of a capability, such as safety analysis or approval. Input may or may not be used as determined by the Responsible and Accountable offices.
- **I** Informed about the progress of implementation.

Separation Management

RASCI Matrix	ANG				AOV	AJI			AJT		AJM								AIR	AJR	AFS	AJV	AUS	AAE	APO	ARP
	B	C7	C5	C6	C	001	1	2	3	2	0	2100	4	22	23	2	3	24	25	001	1	001	0	001	001	001	001
• B [102108-12] Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation (2016 - 2016)		C			R		S	S	S										R	R		R			S	S	
• B [102108-13] Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation (2011 - 2016)		C			R	S	S	S	S						A				R	R		R			S	S	
• B [102154-21] Wake Re-Categorization Phase II - Static, Pair-wise Wake Separation Standards (2016 - 2022)		C				C				A								S	S			S	R				
• B [108214-01] UAS Airspace Access when Operating within Visual Line of Sight (2017 - 2018)		C			C		R	S		S	S						A/R						R	I			

Operationally Available   Complete   External Commitment   B Bravo