US Federal Aviation Administration (FAA) Implementation of Performance-Based Separation Minima

Presented to: BOBTFRG/5
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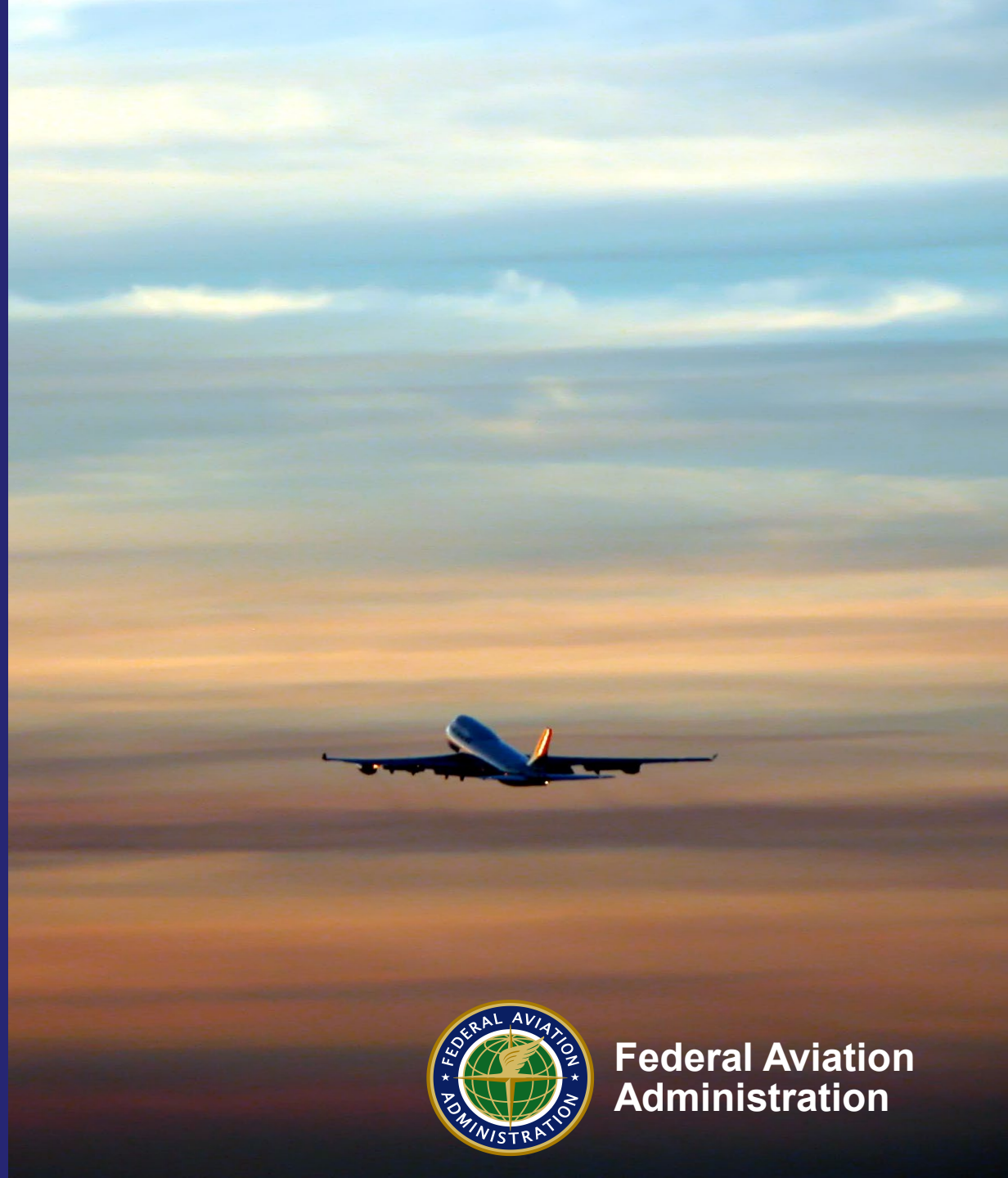


Federal Aviation Administration

FAA Implementation of Performance-Based Separation Minima

- **The FAA wanted to implement the Performance-Based ADS-C 50 NM longitudinal minimum (D50) and 30 NM lateral and 30 NM longitudinal minima (30/30).**
- **The FAA first Automation System dedicated to Oceanic Control, ODAPS, was not capable of those ADS-C Performance- Based (PB) separation minima.**
- **A decision was made to replace ODAPS with a new Automation System.**

Advanced Technologies and Oceanic Procedures (ATOP) Program

- **The FAA created the ATOP Program to:**
  - Evaluate existing Oceanic ATC Automation Systems and
  - Procure the desired System
- **ATOP Program Goals:**
  - Leverage the work done to create existing Oceanic Control Systems.
  - Allow for the Implementation of ADS-C Performance-Based Reduced Separation Minima.
  - Enhance FAA Oceanic Control Capabilities.
  - Automate Oceanic Control Tasks where possible.
  - 24/7 Operations

Advanced Technologies and Oceanic Procedures (ATOP) Program

- The FAA selected an Oceanic System in use in New Zealand.
- Many software enhancements were still needed to meet the FAA vision for the new FAA ATOP System.
- From 2001 to 2004, the FAA conducted extensive testing and evaluations of the new ATOP system software.
- In 2004, the FAA conducted IDU testing of the ATOP system at Oakland ARTCC.
- In 2005, the ATOP system was ready for full 24/7 implementation

ATOP Controller Training

- **ATOP Training Courses were developed by FAA and New Zealand Subject Matter Experts (SME).**
- **ATOP Controller Training First Course Conduct**
- **Validated ATOP Controller Training Course for Certified Oceanic Controllers was 1 week long.**
- **Controller Course Content:**
  - ATOP System Use
  - ADS-C Use Instruction
  - Application of ADS-C Performance-Based ADS-C Reduced Separation Minima

ATOP Controller Training

- **After completion of the ATOP Controller Training Course, controllers received a skills evaluation.**
- **It took months to train all the controllers at each facility.**
- **Controllers that had completed the ATOP Training Course, received weekly refresher training until the facility transition to ATOP to ensure they retained their skills and knowledge.**

ATOP Facility Implementation

- **An ODAPS to ATOP transition plan was developed for each site.**
  - During a slow traffic period, Oceanic Control Sectors were transitioned to ATOP control, one sector at a time.
  - ATOP Oceanic ATC Operations were mirrored for a period of time with the legacy ODAPS Control System.
  - ATOP System SMEs were available 24/7 to answer any controller questions.

ATOP ADS-C PB Reduced Separation Implementation at Oakland ARTCC

- Shortly after the initial transition to ATOP in October 2005, controllers were authorized to use D50 separation.
- In December 2005, 30/30 separation was initially implemented in only one sector (OC3) for evaluation.
- The D50 and 30/30 implementations revealed that there were several Ground Earth Station (GES) failures that impacted the application of those minima.
- In 2006, 30/30 separation was expanded to all sectors at Oakland ARTCC but limited to climb or descend through the altitude of another aircraft to mitigate the risk of the GES Failures

ATOP ADS-C PB Reduced Separation Implementation at Oakland ARTCC

- **Over the next 2 years the FAA worked with the Data Link Service Providers (DLSP) to improve the reliability of the GES and data link network.**
- **In June 2007, the data link network reliability had improved to the point that allowed continued application of the D50 and 30/30 minima between aircraft maintaining the same altitude.**
- **The FAA continued with the application of the D50 and 30/30 minima for over 12 years.**

FAA Targets of Opportunity

- **The FAA applies the PB ADS-C reduced minima to Targets of Opportunity.**
- **Targets of Opportunity means that a controller may apply the PB minima to an aircraft pair if the opportunity exists.**
- **Route Structures are not designed based on the reduced minima.**
  - Exception NOPAC Redesign discussed later

Implementation of PBCS requirements to apply PB ADS-C reduced minima

- **On March 29, 2018, ICAO globally implemented additional PBCS requirements to apply the D50 and 30/30 minima.**
- **Many aircraft previously eligible for D50 and 30/30 did not have PBCS approvals and were no longer eligible for the minima when first implemented.**

FAA Implementation of the PBLS 20 NM Minimum

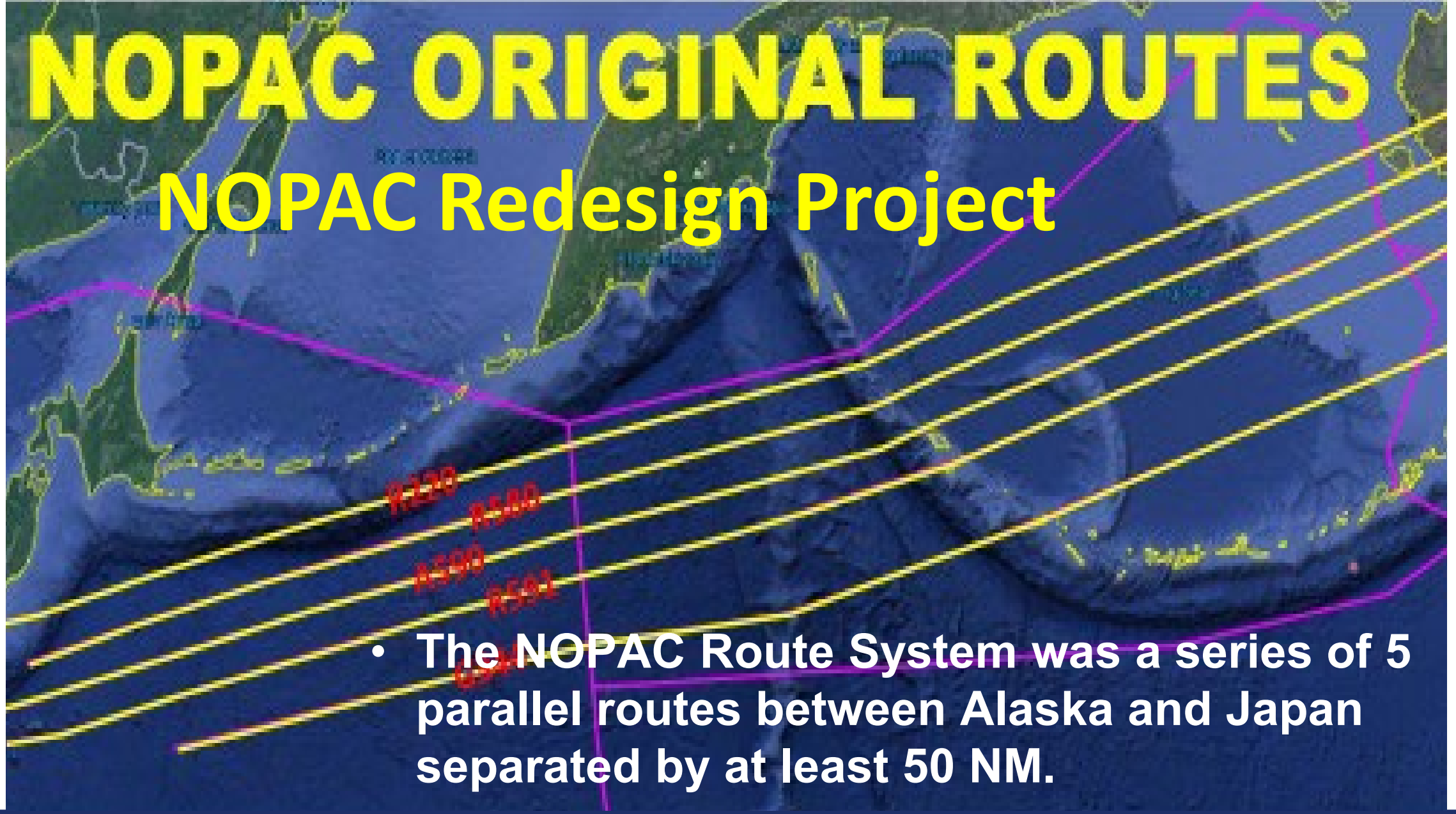
- **In November 2020, ICAO published a new 20 NM minimum in addition to the 30 NM PBLS minimum.**
- **The 30 NM PBLS minimum requires an ADS-C Periodic Contract rate of a maximum of 12 minutes.**
- **The 20 NM PBLS minimum requires an ADS-C Periodic Contract rate of a maximum of 3.2 minutes.**
  - The 3.2-minute periodic contract rate is not supposed to be used as a default reporting rate for an FIR.
- **After COVID-19 delays, the FAA is targeting 2024 for implementation of the 20 NM PBLS minimum.**

FAA Implementation of the PBLS 20 NM Minimum

- **The ATOP system will increase the ADS-C periodic rate to 3.2 minutes when the controller enables application of the 20 NM PBLS minimum.**
  - Controller responses to aircraft requests will be delayed until the ADS-C periodic reporting rate can be increased.
  - Controllers will move on to other tasks while waiting for the ADS-C periodic rate to be modified.
  - The 20 NM PBLS minimum will improve airspace efficiency, but some benefits will be delayed while the periodic rates are changed.

FAA Trial for a 3.2-min. default ADS-C periodic rate.

- **ICAO Doc 4444 5.4.2.9.2 has a note the 3.2-minute rate "is not intended for use as a default rate" over concerns that a 3.2-minute default rate could adversely affect PBCS network performance.**
- **During the development of the 20 NM PBLS minimum, the FAA conducted testing of the 3.2-minute periodic rate at Oakland ARTCC, multiple aircraft periodic rates were increased to 3.2 minutes.**
  - No impact to PBCS performance was observed.
- **The FAA is planning to conduct a 3.2-minute default ADS-C periodic rate in the future.**



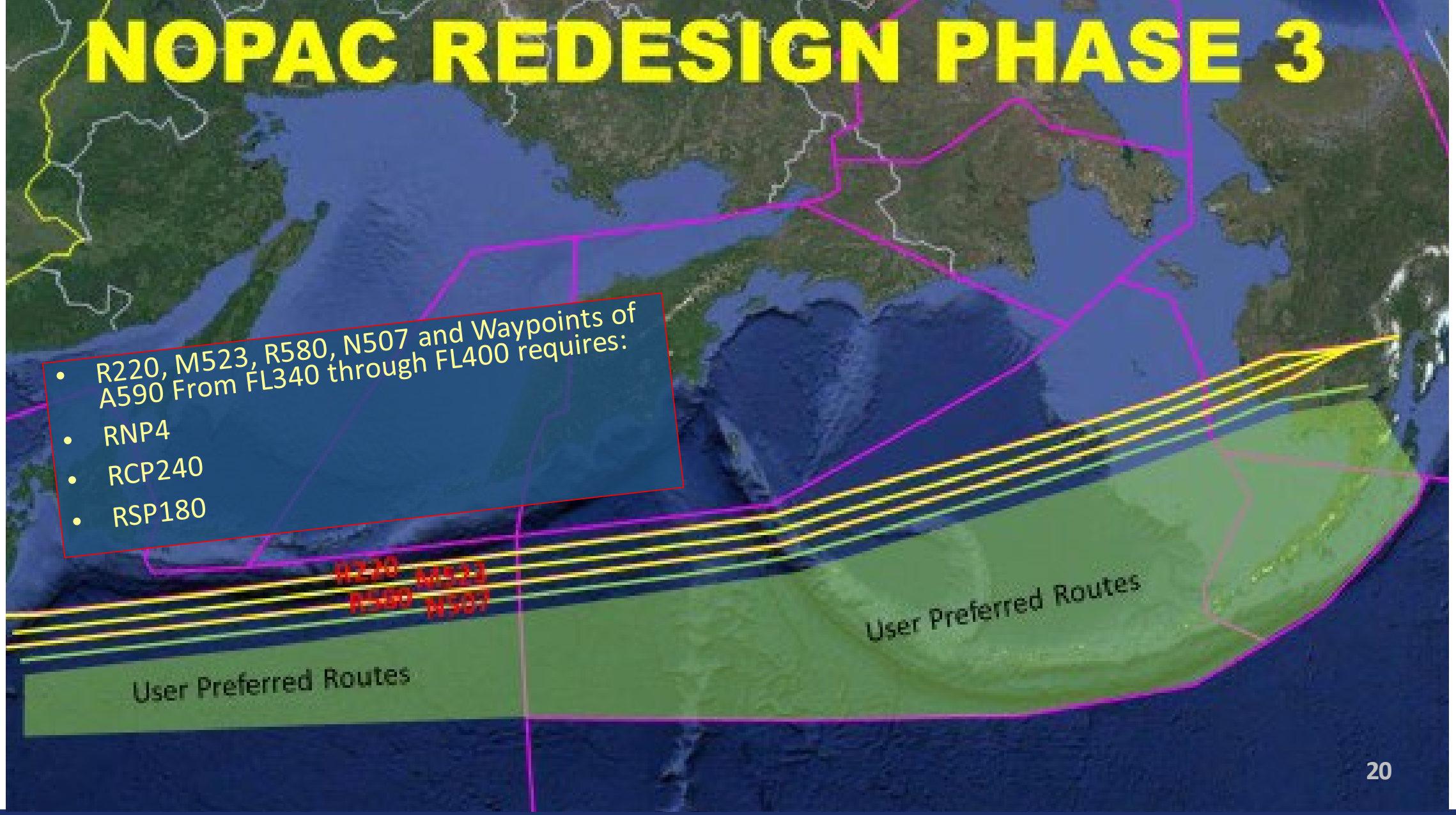
NOPAC Redesign Project

- The NOPAC Route System was a series of 5 parallel routes between Alaska and Japan separated by at least 50 NM.

NOPAC REDESIGN PROJECT

- **Prior to the NOPAC Redesign Project, the NOPAC Routes had remained basically unchanged since 1974.**
- **The FAA, JCAB, IATA and the operators have been working on a collaborative project to reduce the lateral spacing between the routes to 25 NM and open more airspace for User Preferred Routes and Flexible Routes.**

NOPAC REDESIGN PHASE 3



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NOPAC REDESIGN PROJECT

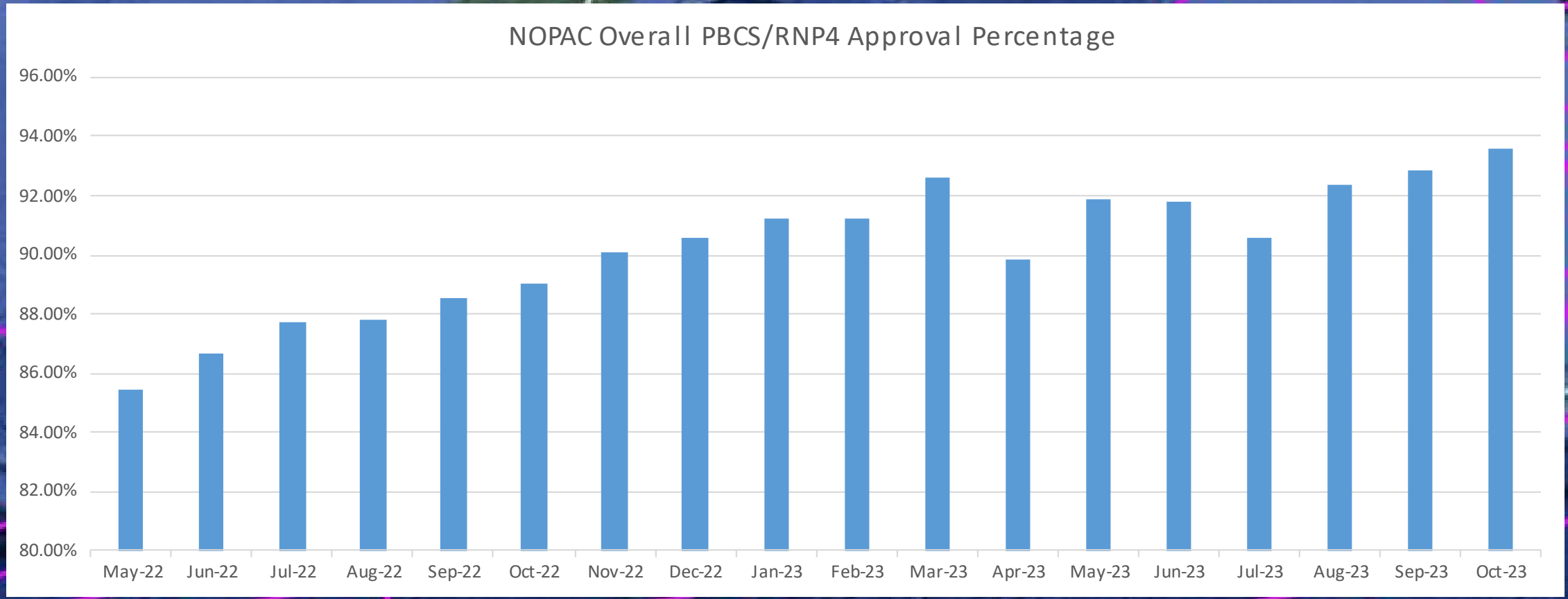
- **In 2018 when the collaborative decision was made to implement 25 NM spaced NOPAC Routes over 90% of the NOPAC Fleet was using FANS 1/A.**
  - But only 33% of the aircraft had the PBCS RCP240, RSP180 and PBN RNP4 approvals necessary to apply the 23 NM lateral minimum.
- **It was determined that at least 90% of the NOPAC aircraft must have the PBCS and RNP4 approvals prior to implementing the 25 NM laterally spaced routes.**

NOPAC REDESIGN PROJECT

- **After some COVID-19 delays, for 5 years, JCAB, IATA and the FAA worked with the operators to increase the number of aircraft with PBCS and RNP4 approvals.**
  - Explained the benefits of the NOPAC Redesign Project
  - Conducted monthly data collections to identify operators without the necessary PBCS and RNP4 approvals.
  - IATA contacted their members to encourage them to obtain the necessary approvals.
  - Emails were sent to operators without the necessary approvals where a contact could be found.

NOPAC REDESIGN PROJECT

NOPAC PBCS/RNP4 Approved Flights %



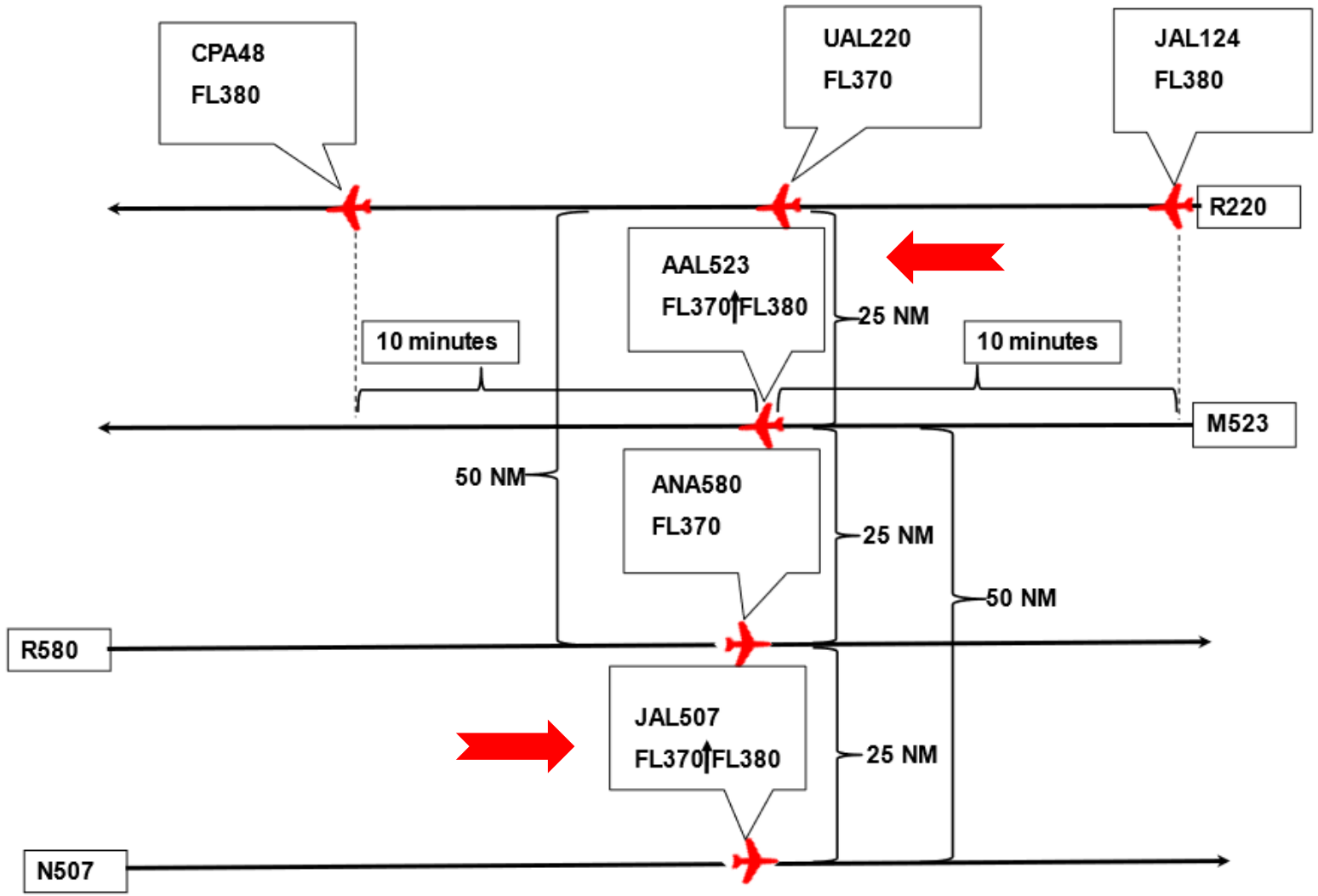
NOPAC REDESIGN PROJECT

- **Phase 2 of the NOPAC Redesign will begin on January 25, 2024.**
  - New Route M523 will be published between the 2 northern most routes R220 and R580
  - R220, M523 and R580 will be laterally separated by at least 25 NM.
  - R580 changes to an eastbound route.
  - Aircraft on R220, M523 and R580 operating at FL340 through FL400 must have PBCS and RNP4 approvals.
  - M523 is closed to traffic at or below FL330 or at or above FL410.
  - Aircraft without PBCS and RNP4 approvals may:
    - Fly R220 or R580 at FL330 and below or FL410 and above.
    - Fly on A590 or south

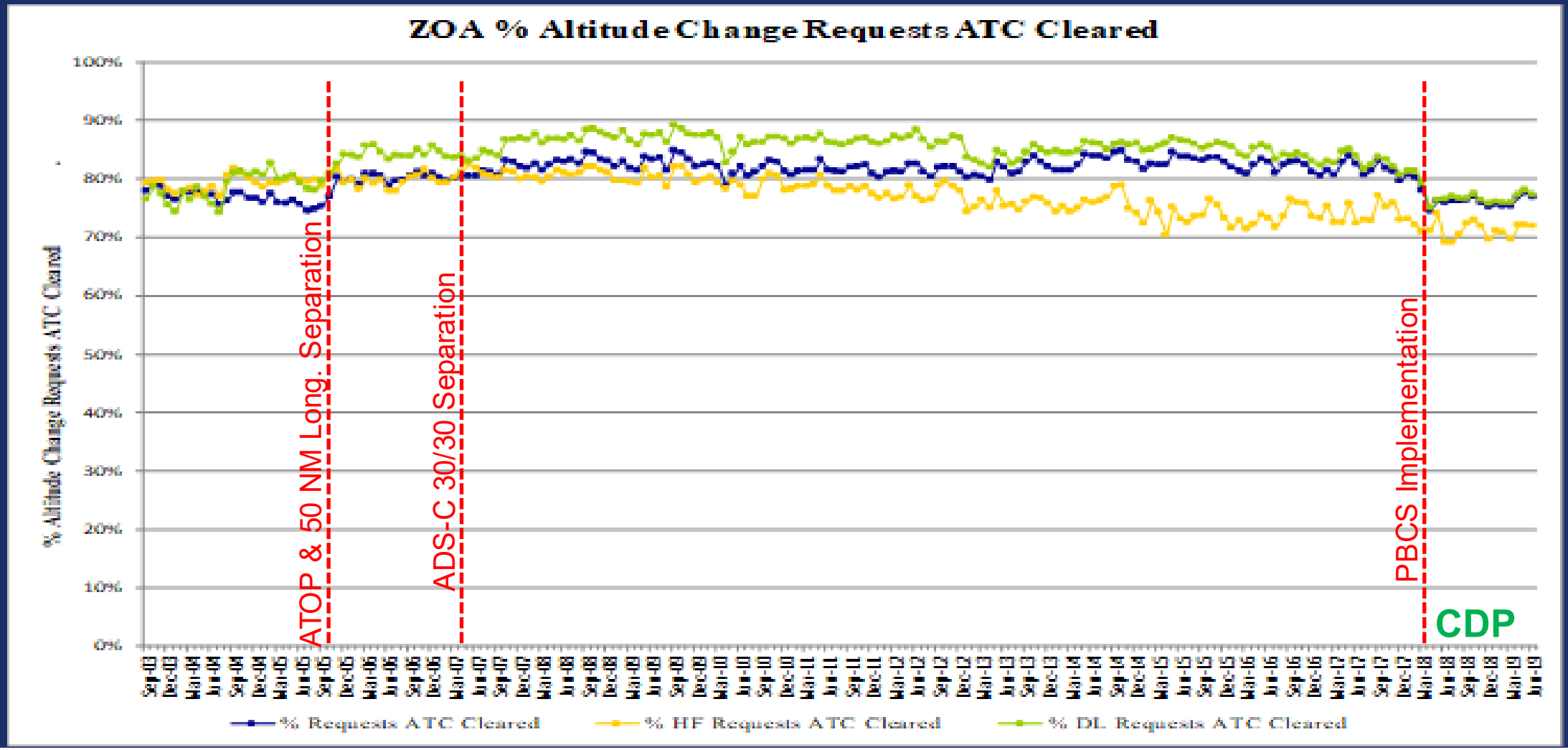
NOPAC REDESIGN PBCS OUTAGES

- **Application of the 23 NM lateral minimum requires PBCS RCP240 and RSP180 connectivity.**
- **The data link network that supports RCP240 and RSP180 is prone to periodic outages.**
- **Depending on what part of the data link network fails, determines how many aircraft are affected.**
  - Historical data shows some outages may affect 8 or less aircraft.
  - Other less common outages affect a large percentage of the traffic on the NOPAC Routes
- **The NOPAC Redesign Routes are at least 25 NM (vs 23 NM) apart to help controllers manage large scale data link network outages.**

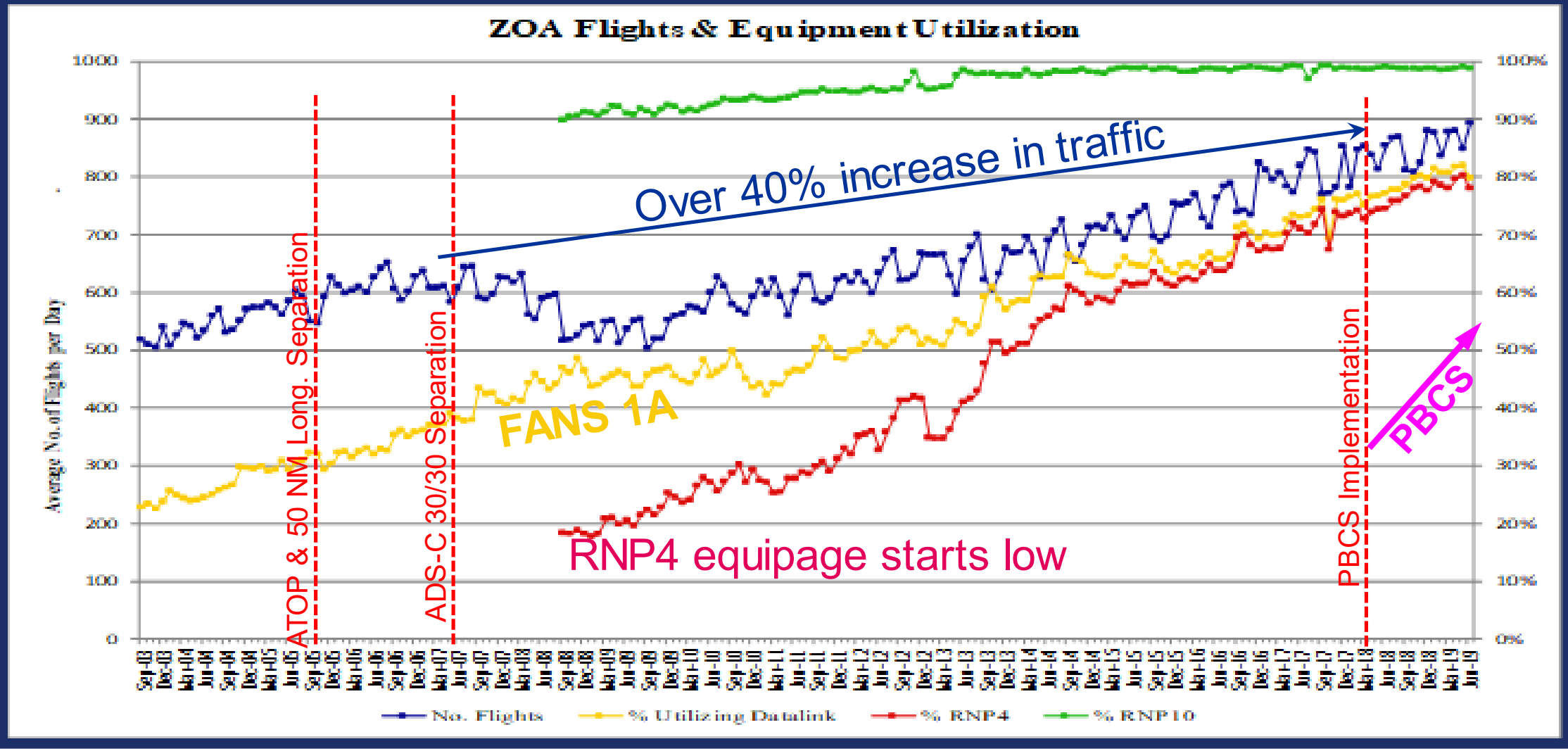
NOPAC REDESIGN PBCS OUTAGES



Effect of reduced Oceanic Separation Minima



Aircraft PBN/PBCS Oceanic Separation Minima



LESSONS LEARNED FROM PB REDUCED SEPARATION IMPLEMENTATIONS

- **Create a Concept of Operations (CONOPS) that defines how and where the new separation minimum will be applied.**
- **The CONOPS will help drive:**
  - Airspace Safety Assessment,
  - ATC Automation Changes,
  - Adjacent ANSP LOA changes
  - Controller procedures.

LESSONS LEARNED: SAFETY ASSESSMENTS

- **Prior to implementing a new separation minimum in an airspace volume, States must complete a local safety assessment to ensure the airspace will maintain the Target Level of Safety.**
- **The ICAO SASP safety assessment undertaken for global purposes does not always contain all the information required to address specific local implementation requirements.**
- **ICAO Implementation Guidance Material.**
  - Usually listed in PANS-ATM Doc 4444 with the Separation Paragraph
- **If unable to obtain the Implementation Guidance Material listed in PANS-ATM:**
  - Contact ICAO, or
  - Contact an ICAO SASP Panel member
- **Mitigate any unacceptable risks.**

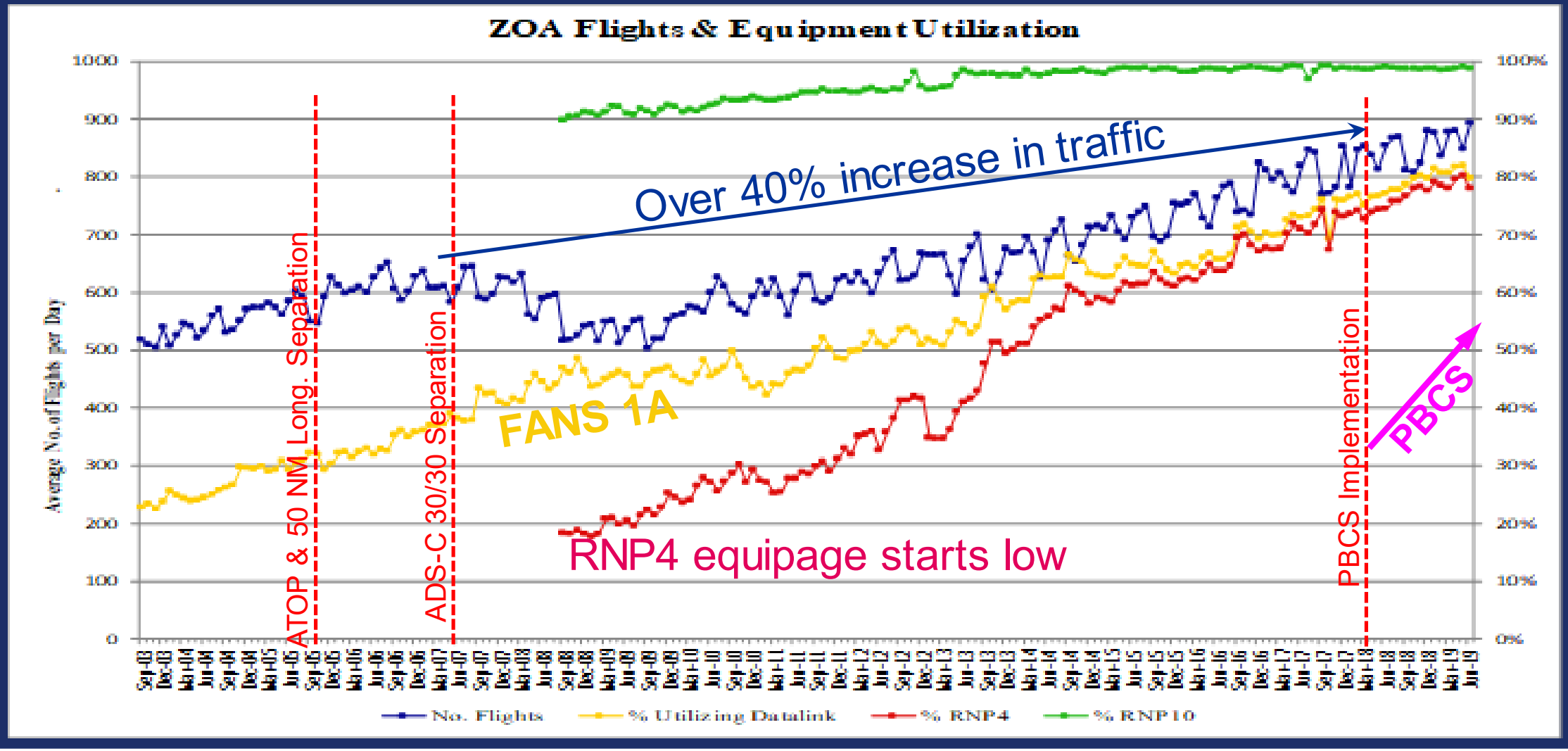
LESSONS LEARNED: COLLABORTATION

- **Collaboration with adjacent ANSPs**
- **Will the adjacent ANSP be implementing the reduced separation minima also?**
  - No: Implement procedures for handling aircraft separated by the new minima entering the adjacent ANSP airspace; do controllers have to establish another form of separation.
  - Yes: Collaborate on the Implementation Process.
    - Consider Implementing the minimum on the same date.
    - Ensure the adjacent ANSP is using the same procedures
    - Update Letters of Agreement as appropriate

LESSONS LEARNED: COLLABORTATION

- **Amount of required collaboration with airspace operators will vary based on the scope of the project.**
- **NOPAC Redesign: Major Collaboration Required**
  - Detail the benefits and requirements of the project.
  - Obtain IATA/Airspace Operators support for the project
  - Work with the operators to have them obtain the necessary aircraft approvals to support the project.
- **Application of reduced minima to Targets of Opportunity**
  - Little collaboration needed; Meeting Papers and AIP Publication
  - Detailing the benefits of a reduced separation minima will help operators obtain the necessary approvals to apply the minima

Aircraft PBN/PBCS Oceanic Separation Minima



LESSONS LEARNED: AUTOMATION CHANGES

- **When implementing a new Performance-Based Separation Minima, ATC System automation changes are usually required.**
- **CONOPS Requirements, how will the minima be applied**
- **Conflict Probe Updates**
  - Separation Minima enabled for aircraft that meet the requirements
  - Safety Assessment additional requirements
  - Airspace requirements
  - Automatic vs Controller enabling application of the minima

LESSONS LEARNED: ICAO IMPLEMENTATION GUIDANCE MATERIALS

- **ICAO Implementation Guidance Material.**
- **Doc or Circular are usually listed in PANS-ATM Doc 4444 with the Separation Paragraph**
- **Example PANS-ATM 5.4.2.9** *Note.— Guidance material for implementation and application of the separation minima in this section is contained in the* Performance-based Communication and Surveillance (PBCS) Manual *(Doc 9869), the* Global Operational Data Link (GOLD) Manual *(Doc 10037), the* Satellite Voice Operations Manual *(SVOM) (Doc 10038) and the* Manual on the Implementation of Performance-based Longitudinal Separation Minima *(Doc 10120), and the* Manual on Monitoring the Application of Performance-Based Horizontal Separation Minima *(Doc 10063).*
- **ICAO Implementation Guidance Material is an invaluable reference when implementing a new separation minima.**
- **Material contains Collision Risk Modelling and Airspace assumptions and other implementation considerations.**

LESSONS LEARNED: CONTROLLER TRAINING

- **The Scope of the change will drive controller training.**
- **Smaller changes may only require an instructive briefing**
- **Larger changes may require instructional training and DYSIM problems.**
- **The FAA puts together a Team of SMEs to develop the controller training for each change.**

Contact Information

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