APPENDIX B — CONCEPT OF OPERATIONS (CONOPS) ON PROVISION OF SPACE BASED ADS-B SERVICES IN THE NORTH ATLANTIC REGION

(paragraph 2.15 refers)

Concept of Operations (CONOPS) Provision of Space Based ADS-B services in the North Atlantic Region

Issue 3 – September 2018

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Publication History

Issue	Month/Year	Change Requests and summary
Issue 1	October 2016	Submitted to IMG/49 for approval November 2016.
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1 EXECUTIVE SUMMARY

This document provides the North Atlantic Region Concept of Operations (CONOPS) for the introduction of Air Traffic Services (ATS) surveillance services using Space-Based Automatic Dependent Surveillance - Broadcast (SB ADS-B). This service will enhance air traffic controllers' ability to provide operators with more planning and tactical options in oceanic airspace including greater flexibility for severe weather avoidance, request and receive new oceanic routes, optimized speed, and request and receive flight level changes.

Expanded ATS surveillance coverage in the North Atlantic (NAT) airspace will enable more efficient use of airspace, increase fuel savings, and enhanced safety, as compared to the services and separation standards that can be provided in the current non-surveillance environment. The Air Traffic Control (ATC), Flight Information and Alerting services provided in the NAT region will be enhanced by the real time availability of aircraft position. SB ADS-B surveillance will facilitate the application of Advanced Surveillance-Enhanced Procedural Separations (ASEPS) between suitably equipped flights, resulting in a significant increase in airspace capacity, particularly in areas where there is a high volume of traffic which will allow more flights to operate within their optimum flight profiles. New airspace capability will assist reduced fuel burn with the associated environmental benefit of decreased greenhouse gas (GHG) emissions.

2 PURPOSE AND SCOPE

The purpose of this CONOPS is to support the detailed technical planning necessary for NAT ANSPs / States providing an Air Traffic Control Service intending to implement SB ADS-B based operations. This document will also support stakeholder consultations and regulatory engagement.

This CONOPS should be considered in conjunction with the NAT 2025 Concept of Operations. The ability to apply ATS surveillance separation and perform trajectory based monitoring in real time will support achievement of the NAT2025 CONOPS.

2.1 Introduction to SB ADS-B

ADS-B is an ATS surveillance system. ADS-B is automatic as no flight crew or ATCO action is required for the information to be transmitted. It is dependent surveillance as the surveillance-type information depends on information from the aircraft's navigation system.

ADS-B OUT systems broadcast aircraft parameters such as identification (24 bit address and flight identification as per the flight plan), position (latitude, longitude and pressure altitude), 3-D velocity and position integrity, via a broadcast-mode data link. Aircraft identification information is broadcast every 5 seconds while aircraft position and velocity data is typically broadcast twice per second.

APPENDIX C contains a table of required and optional AMC 20-24, US and European elements for ADS-B Out systems used in the NAT.

The space-based ADS-B surveillance system will consist of a constellation of Low Earth Orbiting Satellites (LEOS) hosting ADS-B receivers. A satellite will receive ADS-B data including position, velocity and altitude from aircraft, which is then routed through other satellites and down-linked to a satellite operations ground station from where it is on-forwarded to Air Navigation Service Providers (ANSPs) and/or aircraft operators.

2.2 Aircraft Equipage

ADS-B mandates, which are effective on the 1st of January 2020 in the United States and 7th of June 2020 in European airspaces, state that no person may operate an aircraft in Class A airspace unless the aircraft has ADS-B out and Mode S enhanced. This is expected to increase the percentage of aircraft equipped with ADS-B transponders compatible with the low earth orbit ADS-B system (i.e. DO-260, DO-260A and DO-260B). Flight plans should reflect CPDLC (RCP240) and RNP-4 or RNP-2. Proposed change to ICAO Doc 4444 (PANS ATM) are:

8.7.4 Separation minima using ATS Surveillance systems where VHF voice communications are not available

8.7.4.1 Where direct controller-pilot VHF voice communication is not available, separation minima described in 8.7.4.2, 8.7.4.3 and 8.7.4.4 may be applied utilizing position information derived from an ATS Surveillance system, provided the following requirements are met:

a) a navigational performance of RNP 4 or the applicable RNP 2 shall be prescribed; and

b) the communication system shall satisfy RCP 240.

2.3 Change rationale and philosophy

The North Atlantic Systems Planning Group (NAT SPG) is the ICAO Planning and Implementation Regional Group responsible for coordinating the provision of ATS in the ICAO NAT Region. Significant operational changes in the NAT Region normally require consensus agreement by the NAT SPG Member States (Canada, Denmark, France, Iceland, Ireland, Norway, Portugal, United Kingdom and the United States) along with the airspace user organizations (IATA, IBAC and IFALPA) who participate in the working structures of the NAT SPG.

The NAT SPG has developed a service development strategy and roadmap to maximize airspace safety and optimization. Specifically, this strategy seeks to safely deploy reduced separation minima, delivering airspace user operational efficiencies, improved operational flexibility and increased service resilience and predictability. These improvements are planned to leverage current aircraft and air/ground communication capabilities together with the planned deployment of low earth orbit ATS surveillance.

This CONOPS builds upon the successful introduction of FANS 1/A (and equivalent) Controller-Pilot Data Link Communications (CPDLC) and Automatic Dependent Surveillance - Contract (ADS-C) into the NAT airspace and the progressive reductions in separation minima these have enabled. The change philosophy is to build on these successes to maximize benefits to airspace users using current aircraft capabilities through a progressive evolution of the ATM system. This approach is designed to achieve a safe and deliverable rate and scale of change for all stakeholders. This CONOPS supports the service vision for the North Atlantic.

3 CURRENT OPERATIONAL ENVIRONMENT

3.1 NAT Airspace Structure

The responsibility for air traffic control services within the International Civil Aviation Organisation (ICAO) NAT Region is shared among nine states: Canada, Denmark, France, Iceland, Ireland, Norway, Portugal, the United Kingdom and the United States.

The ICAO NAT Region mainly consists of Class A airspace; in which Instrument Flight Rules (IFR) apply at all times. Class A airspace has been established at and above Flight Level (FL) 055 except in the Bodø OCA and in the Nuuk Flight Information Region (FIR) where it has been established above FL195 and in the domestic portion of the Reykjavik FIR where it has been established at and above FL200.

The ICAO NAT Region airspace is divided into seven FIRs or Control Areas (CTA) for the implementation of Communications Navigation Surveillance/Air Traffic Management (CNS/ATM) systems, as depicted in Figure 1 below. The ICAO NAT Region comprises the following FIRs/CTAs: Bodø Oceanic, Gander Oceanic, New York Oceanic East, Nuuk FIR, Reykjavik CTA, Santa Maria and Shanwick Oceanic.

Air traffic control services are provided by oceanic area control centres at Reykjavik, Bodø, Gander, New York, Santa Maria and Prestwick and by Shannon and Brest Area Control Centres (ACC).

Shanwick OACC at Prestwick provides air traffic control services in the Shanwick OCA and is supported by the High Frequency (HF) radio station at Ballygirreen in the Republic of Ireland.

Gander OACC at Gander provides air traffic control services in the Gander OCA with a collocated HF radio station.

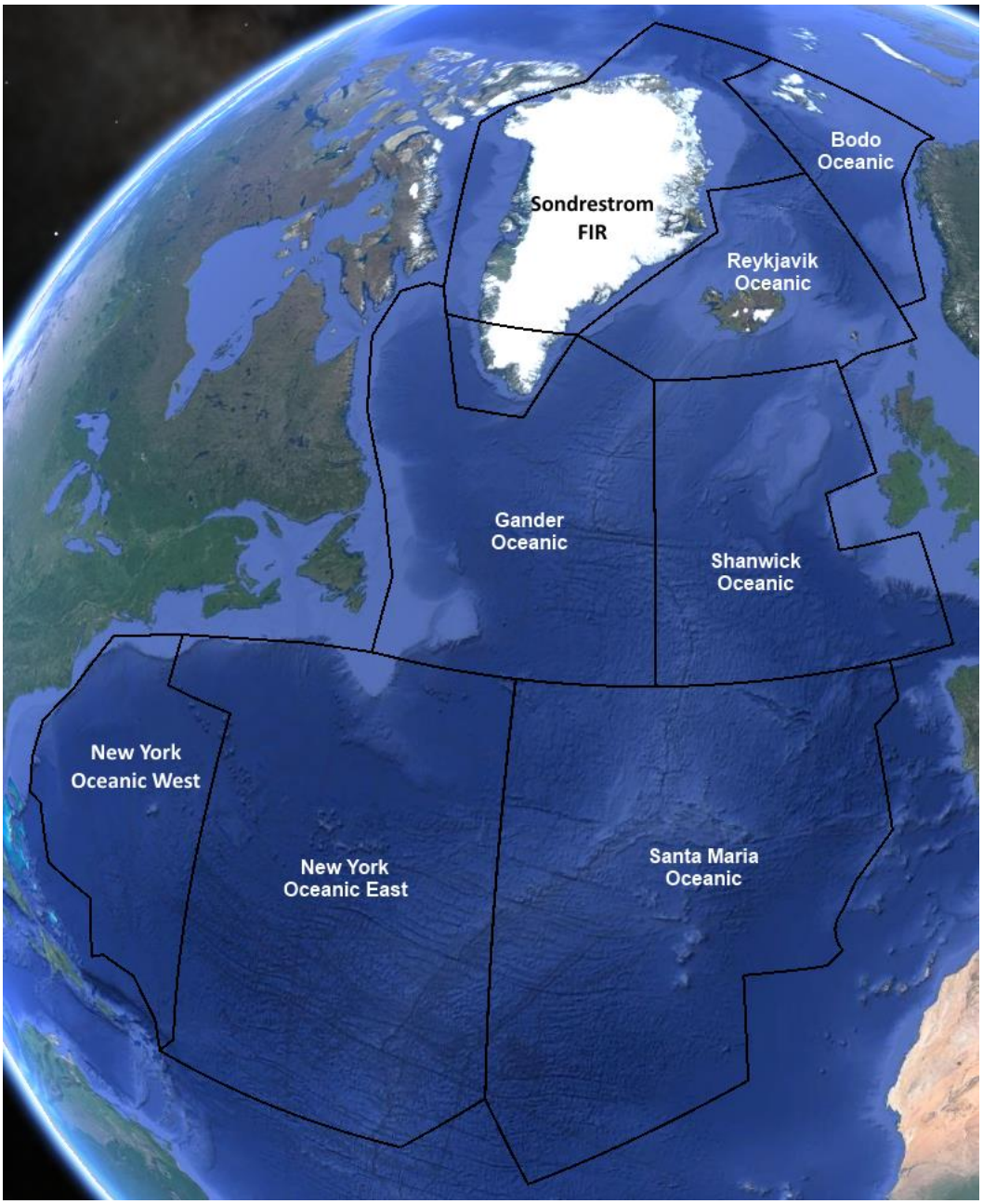

Figure 1 - North Atlantic Oceanic FIRs

ATS surveillance and Very High Frequency (VHF) voice communications are not available in most of the NAT airspace, therefore procedural control is exercised. The exceptions are the southern part of the Reykjavik area, Bodø oceanic airspace (except the north-west part), the Northern Oceanic Transition Area (NOTA), Southern Oceanic Transition Area (SOTA) and Brest Oceanic Transition Area (BOTA) airspaces in the eastern portion of the Shanwick FIR controlled by Shannon and Brest ACCs, the central portion of the Santa Maria OCA and the Gander Oceanic Transition Area (GOTA), where surveillance separation is provided using a combination of radar and ADS-B.

Figure 2 illustrates where VHF communications / ATS Surveillance based services are applied within the North Atlantic Region.

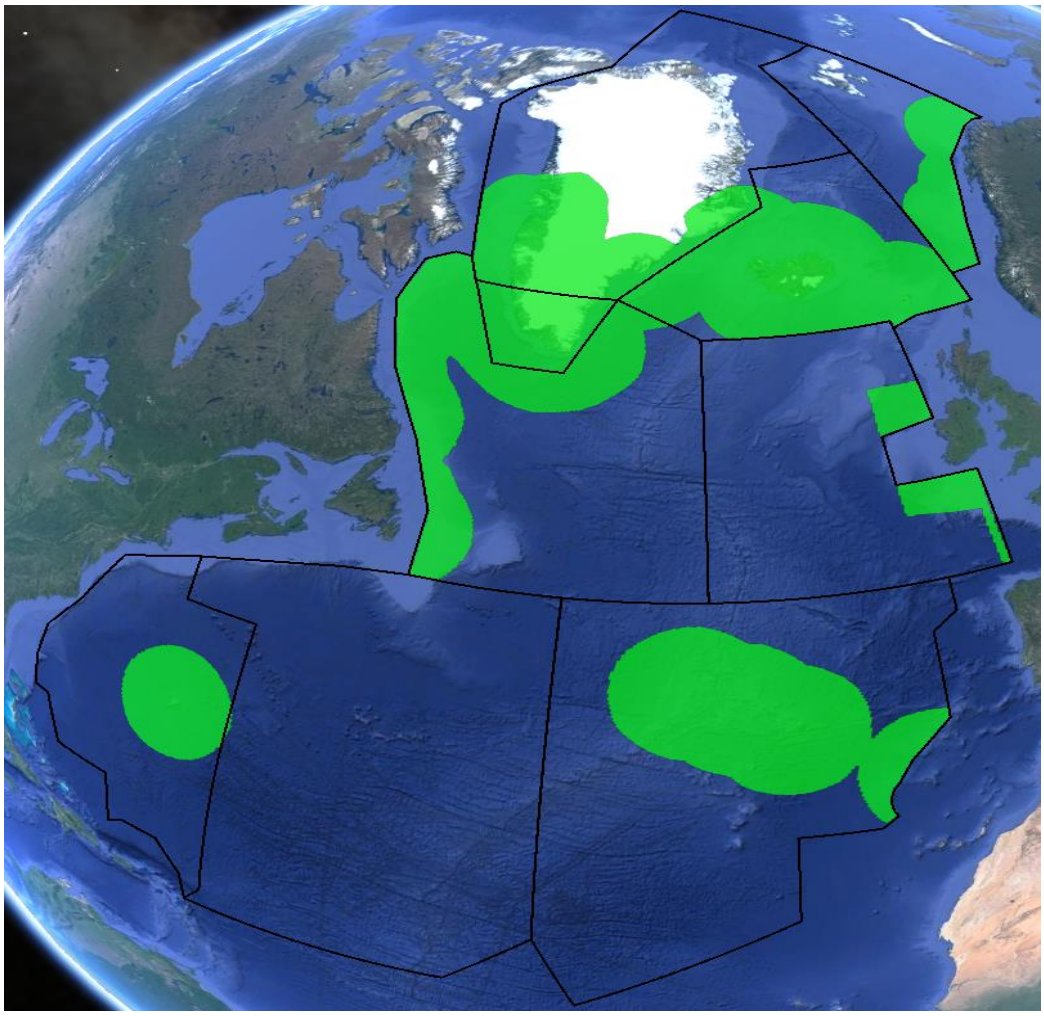

Figure 2 – ATS Surveillance Based Services in NAT Region

NAT High Level Airspace (NAT HLA) with an associated Minimum Navigation Performance Specifications (MNPS) requirement has been established between FL285 and FL420 within the Oceanic Control Areas of Santa Maria, Shanwick, Reykjavik, Gander Oceanic, Bodø and New York Oceanic East, excluding the area south of 38°30" North latitude. Only NAT HLA MNPS approved aircraft are permitted to operate within the NAT HLA airspace. Monitoring is conducted to verify aircraft performance and scrutinize operational safety performance.

From 1 January 2015 the means of compliance for demonstrating performance to MNPS was amended to include PBN Specification RNAV10 (RNP10) or Required Navigation Performance RNP4 navigation specifications as detailed in ICAO's Performance based Navigation (PBN) Manual (Doc 9613). Aircraft which were already MNPS approved by the State of Registry or the State of the Operator based on standard deviation of lateral track error of 11.7 Kilometres (km) (6.3 Nautical Miles (NM)) before 1 January 2015 are permitted to operate in NAT HLA airspace until 1 January 2020.

Reduced Vertical Separation Minima (RVSM) airspace is established within the ICAO NAT Region from FL290 to FL410 inclusive. In RVSM airspace, 1,000 feet vertical separation is applied between approved aircraft. Only RVSM approved aircraft are allowed to operate within NAT RVSM airspace. Monitoring is conducted to verify aircraft performance and scrutinize operational safety performance.

The application of strategic lateral offset procedures (SLOP), which allows flights to apply offsets of up to two miles right of a route or track centreline, is permitted in the ICAO NAT Region.

Proposed change to ICAO Doc 4444 (PANS ATM) SLOP provisions developed by the SASAP are:

"16.5 STRATEGIC LATERAL OFFSET PROCEDURES (SLOP)

Note 1.— SLOP are approved procedures that allow aircraft to fly on a parallel track to the right of the centre line relative to the direction of flight to mitigate the lateral overlap probability due to increased navigation accuracy and wake turbulence encounters. Unless specified in the separation standard, an aircraft's use of these procedures does not affect the application of prescribed separation standards.

Note 2.— Annex 2, 3.6.2.1.1, requires authorization for the application of strategic lateral offsets from the appropriate ATS authority responsible for the airspace concerned.

16.5.1 Implementation of strategic lateral offset procedures shall be coordinated among the States involved.

Note.— Information concerning the implementation of strategic lateral offset procedures is contained in the Implementation of Strategic Lateral Offset Procedures (Circular 331).

16.5.2 Strategic lateral offsets shall be authorized only in en-route airspace as follows:

a) except as provided in c) below, where the lateral separation minima or spacing between route centre lines is 28 km (15 NM) or more, offsets to the right of the centre line relative to the direction of flight in tenths of a nautical mile up to a maximum of 3.7 km (2 NM); and

b) where the lateral separation minima or spacing between route centre lines is 11.1 km (6 NM) or more and less than 28 km (15 NM), offsets to the right of the centre line relative to the direction of flight in tenths of a nautical mile up to a maximum of 0.9 km (0.5 NM); and

c) where a lateral separation minima or spacing between route centre lines of 19 km (10 NM) or more is applied while one aircraft climbs/descends through the level of another aircraft, offsets to the right of the centre line relative to the direction of flight in tenths of a nautical mile up to a maximum of 3.7 km (2 NM) may be permitted.

Note.— refer to 5.4.1.2.1.6 for Lateral separation of aircraft on parallel or non-intersecting tracks or ATS routes."

Planning for CPDLC and ADS-C implementation started in the ICAO NAT Region at the end of 1990. The NAT Data Link Mandate (NAT DLM) Phase 2A commenced on February 5, 2015 and applies from FL350 to FL390 within the NAT Organised Track System (OTS). Phase 2B started on December 7, 2017 and applies from FL350 to FL390 throughout the ICAO NAT Region. Phase 2C is planned to start on January 30, 2020 and will apply from FL290 and above throughout the ICAO NAT Region. The NAT DLM requires aircraft to be capable of FANS 1/A (or equivalent) ADS-C and CPDLC operations in order to operate in the airspace.

3.2 CNS / ATM Systems

Each Air Navigation Services Provider (ANSP) providing air traffic control services within the ICAO NAT Region employ Flight Data Processing Systems (ATM Systems) which provide decision support tools tailored to the NAT operational environment. These assist ATCOs in planning flight profiles, formulating air traffic control clearances, exchanging data link messages with flights, monitoring flight progress, detecting and resolving potential and actual conflicts and exchanging flight data with adjacent ANSPs using ATS Inter-Facility Datalink Communications (AIDC.)

3.3 NAT Procedural Position Reporting

At present NAT flights are normally required to flight plan and report at positions separated by 10 degrees of longitude. Position reports are sent either via voice, normally through HF radio, or by ADS-C reports. ADS-C Periodic and Event reports are used for conformance monitoring and updating of the flight profile held in the

Flight Data Processing System (FDPS). The current maximum interval between ADS-C Periodic reports is 14 minutes.

3.4 NAT Separation Minima

The Application of Separation Minima – North Atlantic Region (NAT Doc008) which is published on behalf of the North Atlantic Systems Planning Group (NAT SPG.) It details the separation methods and minima that are, or planning to be, applied to aircraft transiting the ICAO North Atlantic (NAT) Region.

It contains definitions, general rules pertaining to the application of separation minima, separation minima in the vertical, lateral, and horizontal planes applicable to aircraft operating in the ICAO NAT Region. It is specifically designed for, and provides guidance to, operational air traffic control personnel. It serves as a written and pictorial interpretation of separation rules and their application, its overall objective being a common application of separation minima throughout the ICAO North Atlantic Region.

Appendix A of The Application of Separation Minima (NAT Doc008) contains a table of separation minima that are being applied, or plan to be applied by the various ANSPs serving the ICAO North Atlantic Region, which is regularly reviewed and updated by State Representatives within the NAT SPG working group structure.

This table also contains ICAO references and communication, navigation & surveillance requirements associated with each minimum.

Other ICAO documents, such as the Procedures for Air Navigation Services-Air Traffic Management (Doc 4444) and the NAT Regional Supplementary Procedures (Doc 7030) should be read in conjunction with NAT Doc008 and this CONOPS.

The separation environment in the NAT , into which SB ADS-B services in the ICAO North Atlantic Region is being introduced, is a mixture of procedural separation types, including performance based separations as contained with PANS-ATM Chapter 5 and NAT Regional Supplementary Procedures (Doc7030) Chapter 6.2.

The application of surveillance separation in accordance with PANS-ATM (Doc4444) Chapter 8 is restricted to those areas where ATS surveillance and VHF coverage are available as shown in Figure 2.

As of March 2018, all performance based separations were being applied between flights that have the appropriate RCP and RSP designators within their flight plan in accordance with the NAT Region Performance Based Communications Surveillance (PBCS) plan.

Lateral Separation:

Lateral separation is consistently applied so that the distance between those segments of the intended routes for which the aircraft are to be laterally separated is never less than an established distance to account for navigational inaccuracies plus a specified buffer.

Longitudinal Separation:

Longitudinal separation is applied so that the spacing between the estimated positions of the aircraft is never less than a prescribed minimum. Longitudinal separation between aircraft following the same or diverging tracks may be maintained by application of speed control, including Mach Number Technique.

Longitudinal separation is applied between flights that are on the same track, reciprocal tracks or crossing tracks as defined in PANS-ATM Chapter 5.4.2.

Longitudinal separation is measured either as a time or a distance.

Vertical Separation:

Vertical separation is applied in terms of flight levels.

3.5 Flight Planning and Coordination

Flight planning within ICAO NAT Region airspace will be in accordance with the processes detailed in the applicable State aeronautical information publications.

Communication and coordination of flight data between ANSPs and appropriate agencies will be via automated ATM system messages using ATS Inter-Facility Datalink Communications (AIDC), supplemented as required using voice.

4 PROPOSED OPERATIONAL ENVIRONMENT

4.1 Pre-Implementation Assumptions

The following assumptions are made about the operational practices and technical capabilities which will exist at the time SB ADS-B is introduced into the ICAO North Atlantic Region.

a. SB ADS-B will have been confirmed as an ATS surveillance system.

b. The SB ADS-B system will have been confirmed as being capable of receiving ADS-B signals from equipped aircraft which meet, or exceed those specified in European Aviation Safety Agency (EASA) Acceptable Means of Compliance (AMC) 20-24 (or equivalent), United States' FAA Advisory Circular (AC) 20-165() (or equivalent) or EASA Certification Specification for Airborne Communications, Navigation and Surveillance (AC – ACNS).

Note: The United States would restrict use of SB ADS-B for separation only to aircraft using ADS-B Version 2. Aircraft approved under provisions of AMC 20-24 would, therefore, not be eligible for ASEPS in United States controlled oceanic airspace.

c. Each ANSP that plans to implement SB ADS-B will have obtained the necessary regulatory approvals from their respective State regulators to implement SB ADS-B.

d. The NAT SPG will have endorsed the implementation plan and supporting task list.

e. The capability to appropriately process and display all available aircraft position data will have been implemented ahead of application of surveillance-enhanced separations.

f. Geographic waypoints for aircraft routes will consist of named waypoints or waypoints defined using whole degrees of longitude and whole and half degrees of latitude.

g. NAT OTS tracks can be spaced by whole or ½ degree of latitude.

h. Random routes will be issued using whole or ½ degrees of latitude.

i. Flights may be planned and cleared to enter the ICAO North Atlantic Region from domestic European and Canadian and American FIRs with longitudinal and lateral spacing appropriate to aircraft criteria.

j. Flight Data Processing System conformance monitoring functionality will process SB ADS-B data.

k. An ADS-B non-compliance list is in place which has been coordinated between NAT providers, and is used to ensure that ADS-B data from non-compliant aircraft is not displayed to ATCOs.

l. The NAT DLM will apply from FL350 to FL390 inclusive (NAT DLM Phase 2B).

4.2 Operating Assumptions

The following assumptions are made about the operating practices that will be implemented as part of the application of surveillance-enhanced procedural separations within the ICAO North Atlantic Region.

a. Adjacent domestic ANSPs will undertake any necessary enhancements to assure sufficient service quality to for aircraft operating across the oceanic/domestic interface.

b. The requirement to obtain an oceanic clearance prior to entering the OCA will remain in place for all aircraft.

c. Conformance monitoring via ADS-C or other means will remain in place; i.e. confirm assigned route, waypoint change event, vertical and lateral deviation contracts will be set up between aircraft equipped with FANS 1/A or equivalent. ADS-C periodic contracts may not be established with ADS-B aircraft.

Proposed SASP changes to ICAO Doc 4444 (PANS ATM), specifically 8.7.4.1.d.ii, are as follows:

"8.7.4.1 Where direct controller-pilot VHF voice communication is not available, separation minima described in 8.7.4.2, 8.7.4.3 and 8.7.4.4 may be applied utilizing position information derived from an ATS Surveillance system, provided the following requirements are met:

a) a navigational performance of RNP 4 or the applicable RNP 2 shall be prescribed; and

b) the communication system shall satisfy RCP 240; and

c) an alternate means of communication shall be available to allow the controller to intervene and resolve a conflict within a total time of 9 minutes should the normal means of communication fail; and

d) lateral conformance monitoring shall be ensured by the use of:

i) lateral deviation warning using ATS surveillance system data with a warning threshold set at 3 NM. Higher warning thresholds may be set provided the lateral separation minima in 8.7.4.2 a), 8.7.4.2 b) and 8.7.4.3 are increased by the same amount; and

ii) The ATS ground system shall prioritize and enable immediate recognition by the controller of the lateral deviations in i) above.

Note. — Collision risk modeling for the separation minima in 8.7.4.2 a), b) and c), 8.7.4.3, and 8.7.4.4 assumed that the controller could send an intervention message within 45 seconds of the lateral deviation being detected."

d. The NAT OTS will remain in use, although its geographic "footprint" may be reduced.

e. ADS-B and non-ADS-B flights will operate in the same airspace; i.e. mixed-mode operations.

f. An ADS-B flight is an aircraft that is equipped with and using an appropriately approved ADS-B system and which can be expected to be surveillance identified while operating in the ICAO North Atlantic Region.

g. Reduced separations will only be applied between surveillance-identified aircraft operating within and transiting between ICAO North Atlantic Region ANSPs which are applying ASEPS.

h. Reduced separation minima will be applied in accordance with material developed by the ICAO SASP on a trial basis pending its incorporation into the PANS ATM.

i. The required communications performance (RCP) will be RCP240.

j. The required navigation performance for the airspace (RNP) may be RNP2 or RNP4.

k. Downlinked ADS-B position performance level will be NIC $\geq$ 4 and NACP $\geq$ 5 (NUCP $\geq$ 4).

4.3 Changes Introduced by this CONOPS

4.3.1 ADS-B Position Updates

ADS-B messages contain aircraft position information and also Aircraft Position Quality Indicators (QI). ADS-B position information is normally provided by the Global Navigation Satellite System (GNSS). The SB ADS-B system will be compatible with the DO-260, DO-260A and DO-260B transponders.

Normally, aircraft identification information is broadcast every 5 seconds and aircraft position and velocity information is typically broadcast twice per second.

SASP separations are predicated on aircraft position information updates every 15 seconds.

4.3.2 Flight Conformance Monitoring

ATS surveillance information will more frequently be checked for conformance. This will be achieved through automated ground based route and level adherence monitoring and alerting against the flight's cleared profile as held in the Flight Data Processing System, which will result in controllers being alerted more quickly to any de deviation.

ADS-C event reports, in the form of Waypoint Change Event (which include NEXT and NEXT+1) and Lateral / Vertical Deviation Event, will continue to be checked for conformance through automated adherence monitoring and altering.

Any predicted or actual deviations from the cleared profile held in the flight data processing system will result in alerts being presented to controllers for immediate action.

4.3.3 Enhanced Profile Monitoring

This CONOPS will introduce the ability for ICAO North Atlantic Region ANSPs to introduce system automation that will extract additional filed flight plan information such as step climbs and speed changes.

In addition to pilot requests, operator (flight plan) requests will be regularly checked by the flight data processing systems against the cleared profile, and will present those requests to the controller if it becomes possible to accommodate them prior to oceanic entry and during the oceanic portion of the flight.

4.3.4 Speed Control

Reduced separation standards and increased position update information provided by SB ADS-B supports the ability to permit variable, rather than fixed, Mach numbers. This will allow aircraft to operate in ECON mode. Fixed Mach numbers will be assigned when required.

4.3.5 Human Factors

ATCOs:
There are no fundamental changes to the roles and responsibilities of the ATCO, as they remain responsible for the management of the airspace, maintaining separation and providing information to flight crews.

With the introduction of various separation values based on a number of communication and surveillance criteria, a full Human Factors review of new and existing HMI will take place to ensure that the ATCO is provided with not only with the correct information, but in the correct manner.

Flight Crew:
There are no fundamental changes to basic methods of operation, however, because aircraft will be in closer proximity both laterally and longitudinally, emphasis will need to be placed on:

a. Pilot awareness of the physical proximity of other aircraft both visually and on ACAS.
b. The necessity for pilots to contact ATC as soon as possible in contingency situations with requests for revised clearance. (The intent is to provide as much time as possible for ATC to assess and act upon the request).
c. The necessity for pilots to be prepared to execute ASEPS contingency procedures quickly and correctly, due to the reduced distance in which to maneuver the aircraft.

Note: Flight Crew contingency procedures are under review for ASEPS operations.

4.3.6 Interfaces with Domestic Airspace

It is likely that, subject to specific coordination with each adjacent domestic ANSP concerned, aircraft will be permitted to transition between domestic and oceanic airspace with less spacing than is required in the current operational environment.

4.3.7 **Interfaces with Oceanic Airspace**

ADS-B flights may transition between OCAs using surveillance- enhanced separation. The procedures for the transfer of control and surveillance identification between Oceanic areas must be detailed in their inter-unit Letter of Agreement.

4.4 **Phased Introduction of ASEPS**

Introduction of ASEPS may be done through a phased implementation, and will be detailed within each ANSP implementation plan. The following phases of application are envisaged.

4.4.1 *Phase 1 - ATS Surveillance-Enhanced Longitudinal Separation*

ADS-B aircraft pairs operating in the same direction, on non-converging same tracks, on the same identical track or on diverging tracks, may be separated using 17 NM (ASEPS-Note1), or 14 NM surveillance-enhanced longitudinal separation, depending on the relative angle between tracks, provided that no part of the track(s) is outside the area of application (unless otherwise agreed by the adjacent ANSP(s) concerned).

Aircraft on reciprocal tracks may be cleared to climb or descend to the, or through the, level(s) occupied by another aircraft provided that ADS-B reports show that the aircraft have passed each other and are at least 5 NM (ASEPS Note1).

4.4.2 *Phase 2 – ATS Surveillance-Enhanced Lateral Separation*

Same or opposite direction ADS-B aircraft may be laterally separated by requiring them to operate on non-intersecting tracks that are never less than 19 NM apart (ASEPS Note1) or 15 NM surveillance- enhanced longitudinal separation, depending on established occupancy or number of aircraft deviations.

Outside the NAT OTS, this will permit more efficient routes to be utilized in areas where operators would prefer to operate in a more north-south alignment.

Note: NAT OTS tracks will be spaced by at least 25 NM. If either aircraft in a pair is not an ADS-B aircraft, the pair will be planned and separated using the appropriate lateral separation minimum, based upon the qualification of both aircraft.

ASEPS-Note 1:

Proposed SASP change to ICAO Doc 4444 (PANs ATM):

8.7.4.2 Unless otherwise prescribed in accordance with 8.7.4.3 and 8.7.4.4, the separation minima, in accordance with the requirements detailed in 8.7.4.1 above, shall be:

a) 35.2 km (19 NM) lateral spacing between parallel or non-intersecting tracks.

b) 35.2 km (19 NM) lateral separation of aircraft operating on intersecting tracks applied in accordance with section 5.4.1.2.1.7 a) and b).

c) 29.7 km (17 NM) longitudinal separation of aircraft operating on same tracks or crossing tracks applied in accordance with section 5.4.2.9.5 provided that the relative angle between the tracks is less than 90 degrees.

d) Opposite-direction aircraft on reciprocal tracks may be cleared to climb or descend to or through the levels occupied by another aircraft provided that surveillance position reports have been received from both aircraft demonstrating the aircraft have passed each other by 10 km (5 NM).

8.7.4.3 The separation minimum in 8.7.4.2 a) may, if so prescribed by the appropriate ATS authority, be reduced, but not below 27.8 km (15 NM), provided:

iii) the number of aircraft deviating 13 km (7 NM) or more off the cleared track shall be less than 3 x 10-5 per flight hour; and

iv) the number of aircraft deviating 20.4 km (11 NM) or more off the cleared track shall be less than 1.9 x 10-5 per flight hour;

or

ii) the density of traffic in the airspace as measured by occupancy is less than 0.6

*Note: ICAO "AIR TRAFFIC SERVICES PLANNING MANUAL Doc **9426** for occupancy calculation.*

8.7.4.4 The separation minimum in 8.7.4.2 c) may be reduced, but not below, 26.0 km (14 NM), provided the relative angle between the tracks is less than 45 degrees.

8.7.4.5 Vectoring by means of CPDLC shall not be used in application of the separation minima in section 8.7.4.

Note 1. — Guidance material for the implementation of the navigation capability supporting the separation minima in 8.7.4.2, 8.7.4.3 and 8.7.4.4 is contained in the Performance-based Navigation (PBN) Manual (Doc 9613).

Note 2. — Guidance material for implementation of communication and surveillance capability supporting the separation minima in 8.7.4.2, 8.7.4.3 and 8.7.4.4 is contained in the Performance-based Communication and Surveillance (PBCS) Manual (Doc 9869) and the Global Operational Data Link (GOLD) Manual (Doc 10037).

Note 3. — Detailed information on the analysis used to determine these separation minima, implementation considerations and monitoring procedures is contained in the Guidelines for Separation Minima Using ATS Surveillance Systems Where VHF Voice Communications are not Available (Manual xxx).

Note 4. — Application of the separation minima in 8.7.4.2, 8.7.4.3 and 8.7.4.4 includes elements of both procedural and surveillance control; refer to Annex 1 paras 4.5.1 e) and f) for applicable air traffic controller rating requirements.

5 CONTINGENCIES

5.1 Degraded Mode Operations - Unplanned

Procedures are covered within NAT implementation Plan that support SB ADS-B.

5.2 Degraded Mode Operations - Planned

The SB ADS-B service includes a capability of providing dynamic information about where and when certain areas may be without SB ADS-B coverage due to degraded performance or satellite failure.

ANSP agreements will ensure those affected by any planned outage will be given sufficient notice so that ATC apply the appropriate separations.

5.3 Flight Crew Contingency Procedures

Note: Flight Crew contingency procedures are under review for ASEPS operations, and any revisions will be made to PANS ATM (Doc 4444.)

APPENDIX A Glossary

ABI Advance Boundary Information

ACC Area Control Centre

ACI Area of Common Interest

ACP Acceptance

ADS-B Automatic Dependent Surveillance - Broadcast

ADS-B Out system the overall set of avionics that generate, transport, process, and transmit ADS-B data.

ADS-C Automatic Dependent Surveillance - Contract

AIDC Air Traffic Services Inter-Facility Data Link Communications

AMC Acceptable Means of Compliance

ANSP Air Navigation Services Provider

ASEPS Advanced Surveillance-Enhanced Procedural Separation

ATC Air Traffic Control

ATCO Air Traffic Controller

ATM Air Traffic Management

ATS Air Traffic Services

ATS surveillance generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft

ATS Surveillance enhanced separation: the use of ATS surveillance to provide high integrity and frequent position updates to support the application of reduced separation minima

BET Boundary Error Trapping

BOTA Brest Oceanic Transition Area

CDN Coordination

CDO Clearance Delivery Operator

CNS/ATM Communication, Navigation and Surveillance / Air Traffic Management

CONOPS Concept of Operations

CPDLC Controller-Pilot Data Link Communications

CPL Current Flight Plan

CTA Control Area

Data Link communication technology where 'Data Link' equipped aircraft communicate with 'Data Link' capable ground units to exchange digital information (bi-directional exchange).

DCPC Direct Controller Pilot Communications

EASA European Aviation Safety Agency

FANS 1/A CPDLC and/or ADS-C avionics certified in accordance with the requirements specified in RTCA DO-258/EUROCAE ED-100 or equivalent

FDPS Flight Data Processing System

FIR Flight Information Region

FL Flight Level

FPL Flight Plan

GAATS+ Gander Automated Air Traffic System Plus

GHG Greenhouse Gas (emissions)

GNSS Global Navigation Satellite System

GOTA Gander Oceanic Transition Area

HF High Frequency

HMI Human/Machine Interface

ICAO International Civil Aviation Organisation

IFR Instrument Flight Rules

km Kilometre

MNPS Minimum Navigation Performance Specifications

MNT Mach Number Technique

NAC Navigation Accuracy Category

NAT North Atlantic

NAT DLM North Atlantic Data Link Mandate

NAT HLA North Atlantic High Level Airspace

NAT SPG North Atlantic Systems Planning Group

NIC Navigation Integrity Category

NM Nautical Miles

NOTA Northern Oceanic Transition Area

NUC Navigation Uncertainty Category

OACC Oceanic Area Control Centre

OCA Oceanic Control Area

OCL Oceanic Clearance

OCM Oceanic Clearance Message

OTS Organised Track System

PBCS Performance Based Communications & Surveillance

PBN Performance-Based Navigation

QI Quality Indicators

RACON GAATS+ Gander functionality that uses the received Surveillance data (Radar /ADS-B) to conformance check flights against the profile held in the GAATS+ Flight Data Processor.

RBT Route Based Trajectory

RCL Request for Clearance

RLatSM Reduced Lateral Separation Minimum of 25 nautical miles

RLongSM Reduced Longitudinal Separation Minimum (of 5 minutes between ADS-C equipped aircraft)

RNAV Area Navigation

RNP Required Navigation Performance

RVSM Reduced Vertical Separation Minima

SAR Search and Rescue

SB ADS-B Space-Based Automatic Dependant Surveillance - Broadcast

SESAR Single European Sky Air Traffic Management (ATM) Research

SLOP Strategic Lateral Offset Procedures

SOTA Southern Oceanic Transition Area

SWIM System Wide Information Management

VHF Very High Frequency

APPENDIX B References

(1) Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B) ED-102A January 2012

(2) Working Copy of the 5th Edition of the NAT Regional Supplementary Procedures (SUPPs) (Doc 7030), Amendment No. 8, dated 01 November 2013.

(3) Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance CS-ACNS Initial Issue 17 December 20131

(4) NAV CANADA Space Based ADS-B Concept of Operations Version 3 - October 2014

(5) ICAO's Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689).

(6) COMMISSION IMPLEMENTING REGULATION (EU) No 1207/2011 of 22 November 2011 laying down requirements for the performance and the interoperability of surveillance for the single European sky (Text with EEA relevance) http://easa.europa.eu/system/files/dfu/2013-031-R-Annex%20I%20to%20ED%20Decision%202013-031-R.pdf

(7) NAT 2025 Concept of Operations for the North Atlantic. Issue 1 Feb 2013

(8) North Atlantic Systems Planning Group 12_NATSPG49 Final REPORT.docx June 2013

(9) EUROCONTROL STANDARD DOCUMENT FOR SURVEILLANCE DATA EXCHANGE, Part 12: Category 021 ADS-B Reports, SUR.ET1.ST05.2000-STD-12-01, version 2.1, May 2011 https://www.eurocontrol.int/sites/default/files/content/documents/nm/asterix/part2-cat021-asterix-ads-b-messages-part-12.pdf

(10) SESAR Concept of Operations Step 1 Project title Concept of Operation Project N° B4.2 Project Manager DFS Deliverable Name Concept of Operations Step1 Deliverable ID D65-011 Edition 01.00.00
http://www.sesarju.eu/sites/default/files/documents/highlight/SESAR_Conops_Document_Step_1.pdf

(11) ICAO Performance Based Navigation (PBN) Manual (Doc 9613).

APPENDIX C AMC 20-24, US and European ADS-B Requirements

Parameters	U.S.	E.U.	AMC 20-24 (1)
Length and width of the aircraft	R	R	O
Latitude and longitude	R	R	R
Barometric pressure altitude	R	R	R
Velocity	R	R	O
TCAS II or ACAS is installed & operating in a mode that can generate resolution advisories	R	R	O
If a resolution advisory is in effect when an operable TCAS II or ACAS is installed	R	R	O
Mode 3/A transponder code	R	R	O
Aircraft Identification (the aircraft's call sign)	R	R	R
An emergency, radio, communication failure, or unlawful interference indication	R	R	R (allows generic EMG) (2)
"IDENT" indication (SPI)	R	R	O
Assigned ICAO 24-bit address	R	R	R
Emitter category	R	R	O
ADS–B In capability	R	O	O
Geometric altitude	R	R	O
Navigation Accuracy Category for Position (NAC_P)	R ≥8	R (≥7)	R
Navigation Accuracy Category for Velocity (NAC_V)	R ≥1	R (≥1)	O
Navigation Integrity Category (NIC)	R ≥7	R (≥6)	R (or NUC in DO260)
System Design Assurance (SDA)	R ≥2	R ≥2	O
Source Integrity Level (SIL) (3)	R =3	R =3	R
Version number	R =2	R =2 (4)	R
Geometric Vertical Accuracy (GVA)	O	R	O
Vertical rate	O	R	O
GNSS antenna offset	O	R	O
Selected altitude	O	R	O
Barometric pressure setting	O	R	O

R = required information. O = optional

(1) This column describes the European Aviation Safety Agency (EASA) Acceptable Means of Compliance (AMC) 20-24 standard. It is planned to be the minimum standard for NAT ASEPS operations. However, the United States would restrict use of SB ADS-B for separation only to aircraft using ADS-B Version 2 (i.e., meeting United States and European Union mandate requirements). (Even though AMC 20-24 lists "Velocity" as optional, there are no known aircraft implementations without it).

(2) AMC 20-24, 8.8.2: For ATC transponder-based ADS-B transmit systems, the discrete emergency code declaration capability should be integrated into the transponder functionality and should be controlled from the transponder control panel. Permissible deviation for initial implementations: For initial implementations, instead of the required transmission of the discrete emergency codes 7500, 7600 and 7700 when selected by the flight crew, the transmission of only the generic emergency indicator can satisfy this requirement. Such deviation from the above target requirement needs to be listed in the Aircraft Flight Manual.

(3) Note that SIL has a different meaning in ADS-B Version 2 than in ADS-B Version 1; SIL did not exist in ADS-B Version 0. For ANSPs that don't require Version 1 or Version 2, an "R" in this row means "required if available in the transmitted ADS-B Version."

(4) The E.U. mandate requires Version 2 ADS-B avionics. However, specific (early) local deployments in Europe accept the legacy ADS-B standards, ADS-B Version 0 and 1.

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