SPACE BASED ADS-B

CANADIAN DOMESTIC

&

NORTH ATLANTIC AIRSPACE

CONCEPT OF OPERATIONS

OCTOBER 2013

COORDINATION DRAFT

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Introduction

Installing and maintaining ground-based aviation infrastructure in remote areas can be challenging and costly. In some cases, such as oceanic areas, there is no viable way it can be done.

Currently, Air Traffic Services (ATS) providers depend upon ground-based infrastructure to receive Automatic Dependent Surveillance - Broadcast (ADS-B) data from aircraft. This concept of operations proposes the use of Low Earth Orbiting Satellites (LEOS) to receive ADS-B data from aircraft so as to expand the geographic area where ATS surveillance services can be provided.

Canada has completed the commissioning of ground-based ADS-B in its northern airspace over Hudson Bay and within the Gander Oceanic Control Area (OCA) over southern Greenland and the northwest portion of the Gander Oceanic Flight Information Region (FIR). The supporting safety analyses, testing and monitoring for these implementations provides the foundation for expansion of ATS surveillance services based on ADS-B.

This concept of operations has been developed in accordance with the guidance provided in ICAO's *Manual on Airspace Planning Methodology for the Determination of Separation Minima* (Doc 9689).

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Focus Areas

Supporting plans and deliverables to achieve this Concept will be organized under Focus Areas as described below.

Governance

The objective of this Focus Area is the development and promulgation of policies and decisions regarding the overall scope and conduct of the project, including the development and on-going maintenance of a detailed Concept of Operations. The initial Concept is to be completed in 2013 and will address the following points, at a minimum:

- Involvement of stakeholders;
- Description of service delivery changes attributable to ADS-B;
- Timeframes including air traffic controller (ATCO) training, procedures, inter-unit agreements and Air Traffic Management (ATM) system changes;
- Communications and surveillance requirements envisioned for the NAT oceanic airspace;
- Devolving NAT and Canadian domestic airspace classifications which are not globally applicable (MNPS, CMNPS, RNPC) and replacing with Performance Based Navigation (PBN) designations and separation applications which are appropriate for the aircraft and ground system capabilities in the airspaces concerned;
- Aligning NAT and Domestic airspace designations and services as appropriate; and
- Using Canadian Domestic airspace for "proof of concept" and procedures validation.

Progress towards reaching the goals and objectives of the project will be tracked under this Focus Area. To achieve this and to take account of any changes in direction, the Concept and supporting Action Plans will be updated as required. Under this Focus Area, deployment strategies will be reviewed to ensure alignment between data link, ADS-B and other related technical initiatives.

IATA and other Stakeholder Coordination

The objective of this Focus Area is to conduct consultation and coordination with stakeholders outside of NAV CANADA and Aireon to support and achieve the objectives of the project.

Safety Management

The objective of this Focus Area is to complete all Safety Management System (SMS) related activities, such as the Safety Management Plan (SMP), Hazard Identification and Risk Assessment (HIRA) and Safety Management Report (SMR). The expected timeframe of activities is from 2012 to 2017.

The SMP will be completed in accordance with ICAO established guidelines and procedures and must support all areas of the initiative to provide ATS surveillance services using space-based ADS-B.

Communications

The objective of this Focus Area is to assess communications performance and identify communication performance requirements to support the safe provision of ATS surveillance services using space-based ADS-B. This includes activities necessary to assess and improve communications procedures or infrastructure where needed. The communications types to be considered within this Focus Area include:

- Direct Controller Pilot Communications (DCPC) via VHF voice;
- DCPC via SATVOICE;
- DCPC via data link (i.e. Controller Pilot Data Link Communications (CPDLC));
- third party communications, where a Communication Service Provider (CSP), such as the Gander International Flight Service Station, relays communications between the flight crew and the ATCO, usually using High Frequency (HF) radio to communicate with the flight crew; and

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- data link or automated position reporting, including for the purposes of flight profile conformance monitoring.

This Focus Area will also consider any new technologies which may become available to support DCPC during the planning phases of the project. This Focus Area will provide the information on communications performance necessary to support the development appropriate ATM procedures for the use of space-based ADS-B data.

Surveillance

The objective of this Focus Area is to assess surveillance performance and identify surveillance performance requirements to support the safe provision of services using space-based ADS-B data. This includes activities necessary to assess the surveillance infrastructure related to receiving, transmitting and processing space-based ADS-B data. This Focus Area will provide the information on surveillance performance necessary to support the development appropriate ATM procedures for the use of space-based ADS-B data.

Air Traffic Management

The objective of this Focus Area is to develop and validate air traffic management procedures, system requirements and updates, training material and documentation to support the provision of ATS surveillance services using space-based ADS-B. This will include the alignment of data link messages and procedures between NAT and Canadian Domestic airspace and also, to the extent possible, the alignment of procedures, including separation provision. The goal of this alignment is to ease the eventual transition from a procedural operational environment to an Air Traffic Services (ATS) surveillance environment. The goal of this project is to provide a seamless operating environment within the Canadian Domestic and NAT airspace through the provision of services using space-based ADS-B.

Regulatory

The objective of this Focus Area is to carry out timely and on-going coordination with all regulatory bodies, ICAO groups and Standards organizations so as to ensure that all required agreements, standards, guidelines and approvals are in place when space-based ADS-B data becomes available to ANSPs. This includes activities related to ensuring frequency protection and any other subject which is in the remit of global or regional coordination and regulatory bodies. Activities relating to the approval and conduct of operational trials in the ICAO NAT Region will be tracked under this Focus Area.

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Identification of the Need for Change

Where ATS surveillance services are not provided, maintaining a safe, orderly and expeditious flow of air traffic requires the use of the largest air traffic control separation standards. To ensure that the required spacing will be maintained between aircraft, flights must often operate at less than optimum flight levels, speeds or routes, which has a direct, negative effect on operator costs and on the environment.

Where ATS surveillance services are provided, operations can be less restricted because Air Traffic Management (ATM) can be provided using tactical procedures and smaller separation minima. It should be highlighted that the possible ATS surveillance services to be provided will be dependent upon a number of factors, including the communications capability and performance in the airspace concerned.

Expanding the geographic area where ATS surveillance is available is expected to enhance safety, increase operational efficiency and predictability and reduce negative environmental impacts from aviation operations. The specific operational improvements to be supported through the use of expanded ATS surveillance coverage should be based on the user requirements in the airspace concerned, taking account of available communications capabilities.

Airspace users require more fuel-efficient flight profiles (route, altitude and speed) that will reduce operating costs and show a return on operator investment in aircraft avionics. Where fuel burn is reduced, there are commensurate environmental benefits from reduced aircraft emissions. ATS surveillance is expected to enhance the provision of fuel and cost-efficient profiles.

Minimum cost flight profiles need not be limited to fixed speeds or flight levels. Recent initiatives such as ENGAGE and Top Flight have demonstrated the economic and environmental benefits which can accrue if flights are able to vary their speed and altitude within a defined operating band. Such flexibility is more easily accommodated where ATS surveillance services are provided.

Recently, the aviation community has been discussing the possible benefits of “extended arrival metering”. Extending ATS surveillance coverage will support more fuel efficient management of arrivals into congested airports. It is believed that the earlier adjustments to flight profiles are made, the lower the resulting fuel penalties will be.

Ground based safety nets use ATS surveillance data to generate alerts for Air Traffic Controllers (ATCO) of increased risks to flight safety. Predominantly, these alerts concern potential, impending or actual violations of required spacing between aircraft or proximity alerts regarding terrain. Expanding ATS surveillance coverage will expand the airspace for which such safety nets can be implemented.

Search and Rescue (SAR) operations are more efficient and effective when aircraft locations can be accurately determined. Expanding ATS surveillance coverage will expand the airspace within which aircraft positions can be accurately determined in support of SAR operations.

This Concept focusses on the potential benefits within Canadian Domestic and NAT airspace. Additional assessments will be required to identify specific benefits which could be realized in other airspaces.

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Description of the Current Airspace and the CNS/ATM Systems

Airspace Structure - North Atlantic

The responsibility for air traffic control services within the ICAO North Atlantic (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 FL 55 except in the Bodø OCA and in the Søndrestrøm FIR where it has been established above FL 195 and in the domestic portion of the Reykjavik FIR where it has been established at and above FL 200.

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. The ICAO NAT Region comprises the following FIRs/CTAs: Bodø Oceanic, Gander Oceanic, New York Oceanic, Reykjavik, Santa Maria, Shanwick. and Søndre Strømfjord.

Traffic is controlled by oceanic area control centres at Reykjavik, Bodø, Gander, New York, Santa Maria and Prestwick and by Shannon and Brest Area Control Centres (ACC).

The traffic operating in the ICAO NAT Region is predominantly commercial. International General Aviation (IGA) Business aircraft comprise a high proportion of the higher altitude airspace operations.

For most of the NAT airspace radar surveillance and Very High Frequency (VHF) voice communications is unavailable. Therefore, procedural control is exercised. The exception is the south and east sector of the Reykjavik area, Bodø oceanic airspace with the exception of the north-west part, the NOTA, SOTA and BOTA airspaces in the eastern portion of Shanwick FIR controlled by Shannon and Brest ACCs and in the central portion of the Santa Maria OCA where radar aided services are provided. Based on current progress and plans, ground-based ADS-B installations in southern Greenland and Iceland will expand ATS surveillance, creating a “Greenland surveillance corridor” in the 2014/2015 timeframe.

RVSM airspace has been established within the confines of MNPS airspace and associated transition areas from FL290 to FL410 inclusive. In RVSM airspace, 1000 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.

Strategic lateral offsets of one or two miles right of a route or track centreline have been introduced as a means of reducing collision risk and is now standard operating procedure in the entire NAT Region.

In addition to the requirements of Annex 6, - *Operation of Aircraft*, Part I, paragraph 6.16 and Part II, paragraph 6.14, ACAS II shall be carried and operated in the ICAO NAT Region by all turbine-engine aeroplanes having a maximum certificated take-off mass exceeding 5 700 kg or authorized to carry more than 19 passengers.

Airspace Structure - Canadian Domestic

The Canadian Domestic Airspace is divided into Northern and Southern domestic airspace with further classification into Canadian Minimum Navigation Performance Specifications (CMNPS) and Required Navigation Performance Capability (RNPC) airspaces. Currently, navigation performance requirements in Canada are classified as meeting either of these unique Canadian standards; however, these designations will be replaced by Performance Based Navigation (PBN) or other internationally recognized designations. Aircraft meeting the NAT Minimum Navigation Performance Specifications (MNPS) requirements are permitted to operate within CMNPS airspace and the CMNPS requirements are the same as those specified for NAT MNPS in the *North Atlantic Regional Supplementary Procedures*

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(NAT SUPPs, Doc 7030). The RNPC designation pertains to the ability to apply certain separation minima between appropriately equipped flights; this is a pre-PBN designation.

The Canadian Domestic Airspace consists of controlled and uncontrolled airspace. In the Southern domestic airspace, controlled airspace is designated to ensure, to the extent possible, that aircraft operating between, into and out of controlled airports will remain within controlled airspace. These structures include control zones, control area extensions and controlled airspace associated with the protected airspace of specified ATS routes. Outside of these airspace structures, the base of controlled airspace is 18,000 Above Sea Level (ASL) or 7,000 feet Above Ground Level (AGL), whichever is higher.

In the Northern domestic airspace, controlled airspace is designated at and above FL230.

The Canadian Domestic Airspace is divided into seven FIRs: Edmonton, Gander Domestic, Moncton, Montréal, Toronto, Vancouver and Winnipeg. Traffic is controlled by ACCs associated with each FIR.

Radar or ADS-B surveillance services are provided throughout most of the Southern Domestic Airspace and the southern portions of the Northern Domestic Airspace. Outside of surveillance coverage or where VHF DCPC is not available, procedural control is exercised.

Strategic lateral offsets are not approved within the Canadian Domestic Airspace.

Reduced Vertical Separation Minimum (RVSM) airspace has been established within Canadian Domestic Airspace from FL290 to FL410 inclusive. In RVSM airspace, 1000 feet vertical separation is applied between approved aircraft. Under specified conditions, and subject to additional procedures to ensure safety, non-RVSM certified aircraft may be permitted to operate in RVSM airspace; such aircraft are separated from all other aircraft in RVSM airspace by a minimum of 2000 feet vertically. Monitoring is conducted to verify aircraft performance and scrutinize operational safety performance.

Transport Canada has not initiated rule-making to adopt the ICAO provisions related to the carriage and operation of ACAS II. **[further material to be developed, based on TC AIM 12.16]**

CNS/ATM

[material to be developed to describe Flight Data Processing Systems (FDPS) and required aircraft equipment]

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Customer Expectations and Benefits

ATS surveillance services enable:

- enhanced safety monitoring
- increased operational predictability and efficiency
  - operations at, or closer to, the preferred flight level
  - more route options when flight planning
  - more route options to tactically respond to weather conditions, wake vortex avoidance, etc.
  - fewer speed restrictions
- longer timelines for arrival planning

ATS surveillance directly benefits operators by providing a safer operating environment which also allows them to more closely adhere to minimum cost flight profiles. Such profiles need not be limited to fixed speeds or flight levels; recent initiatives such as Top Flight and ENGAGE have demonstrated the economic and environmental benefits which can accrue if flights are able to vary their speed and altitude within a defined operating band. Such flexibility is more easily accommodated where ATS surveillance services are provided.

Flight profiles which result in reduced fuel burns directly decrease the environmental impact from that flight, along with reducing fuel costs.

Recently, the aviation community has been discussing the possible benefits of "extended arrival metering". Extending ATS surveillance into the North Atlantic could support more fuel efficient management of arrivals into congested European airports.

The following benefits can be expected from the expansion of ATS surveillance:

- increased operational safety
- reduced fuel burns
- fewer greenhouse gas emissions
- lower operating costs
- increased ATM flexibility

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Guiding Principles and Assumptions

A number of principles will guide the activities, participants, responsibilities and deliverables, to achieve the goals and objectives of the Space-Based ADS-B project, including:

- Adherence to a "Safety First" risk management approach;
- Collaboration with airlines, industry groups such as IATA and ANSPs,
- Coordination with, and involvement of, State regulators and ICAO throughout the planning and implementation;
- Leveraging existing technology and aircraft separation standards to minimize regulatory and equipage changes;
- Validation of capabilities through incremental changes to existing systems and procedures;
- Developing and maintaining a Concept of Operations document;
- Establishing incremental change aligned procedures;
- Communicating the plan and process and providing updates on achievements;
- Demonstrating readiness via operational trials;
- Monitoring performance with empirical evidence, analysis and metrics; and
- Reporting on risk management, efficiency and environmental enhancements.

A number of assumptions underlie the assessments being developed to quantify the potential benefits of space-based ADS-B and the operational scenarios being considered:

- Traffic patterns (i.e. city pairings) will remain the same;
- Increases in air traffic demand will be in accordance with current forecasts;
- The application of 5 minutes longitudinal separation between ADS-C equipped aircraft and, in the NAT airspace, ½ degree spacing between tracks, will have already been implemented;
- In the NAT airspace, aircraft equipage will be in accordance with the NAT Region Data Link Mandate;
    - 90% of aircraft will be equipped with FANS 1/A ADS-C and CPDLC by 2018;
- **[To be developed: relevant estimates for FANS 1/A equipage in Canadian Domestic airspace]**
- **[To be developed: estimate of when, in the NAT airspace, 85% of aircraft will be equipped with ADS-B]**
- **[To be developed: relevant estimates for ADS-B equipage in Canadian Domestic airspace]**
- Controller decision support tools will include a Flight Data Processing System (FDPS) in which the current approved flight profiles are maintained up to date for all aircraft in the airspace;
    - The FDPS will provide automated conflict monitoring and alerting;
- Continuous surveillance, based on a mixture of ADS-B and radar, will be possible throughout the Gander and Shanwick Oceanic Control Areas (OCA), the southern portion of the Reykjavik OCA and the northern portion of the Santa Maria OCA and all of Canadian Domestic airspace;

  Note: Only an aircraft equipped with ADS-B would be subject to continuous ATS surveillance through these airspaces.

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- CPDLC is available as a means of communication and related procedures will be in accordance with the *Global Operational Data Link Document* (GOLD);
- Controller initiated SATVOICE will only be via the NCVS, which automates part of the "dialling" process;
- In the North Atlantic airspace, all flights will operate on Oceanic Clearances; these clearances provide for conflict free profiles within certain parameters, which will not initially be changed;
- Between FL285 and FL420, priority will be given to flights equipped with ADS-B
- The NAT Organized Track Structure will be maintained during the initial implemenation;

  Note: In the future, the peak traffic pattern across the North Atlantic airspace will likely continue to resemble a collection of laterally separated organized tracks. However, rather than being determined and published 8 hours ahead of time, this structure will be the natural result of de-conflicted clearances provided in response to requested routings and post-departure estimates for the oceanic entry points. Operators will no longer be expected to select from a pre-determined set of organized tracks based upon the minimum-time track for that flow; the requested trans-Atlantic route will be the operator preference for that particular flight.

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Current System

Communications

VHF coverage **[Chart to be developed]**

CPDLC service area **[Chart to be developed]**

ATCO-initiated SATVOICE **[Chart to be developed]**

Surveillance

Radar coverage **[Chart to be developed]**

ADS-B coverage **[Chart to be developed]**

Air Traffic Management - Gander OCA

- North Atlantic Organized Track System used to manage heavy east/west flows, balancing operational efficiency against capacity and cost-effective ATM
- Conflict free profiles
- MNPS lateral separation

  60 NM track to track separation OR 1 degree gentle slope (as close as 50.5 NM)
- Longitudinal separation

  60, 30, 20 or 15 minutes

  10 minutes using MNT

  5 to 9 minutes using MNT with speed differential
- RLongSM

  5 minutes between appropriately equipped aircraft
- Non-MNPS lateral separation

  120 NM track to track within, above or below NAT MNPS airspace, or 2 degrees gentle slope

  90 NM track to track outside NAT MNPS or 1 ½ degrees gentle slope

Air Traffic Management - Canadian Domestic Airspace

- Within ATS surveillance, VHF DCPC

  Enroute: 5 NM

  Terminal: 3 NM
- Within ATS surveillance, no DCPC

  Non-surveillance minima
- Outside ATS surveillance, within CMNPS airspace

  60 NM track to track or 1 degree gentle slope

  15 minutes meet time

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10 minutes or 60 NM tail to tail

No overlap of airspace to be protected (ATP) for each flight, based on navigation method or signal coverage

15 minutes longitudinal

20 or 15 minutes crossing track

10 minutes longitudinal using MNT

5 to 9 minutes longitudinal using MNT and speed differential

50 NM longitudinal, RNP/10 or RNP/4 aircraft, if DCPC

RNP/10 and RNP/4, 50 NM laterally

- Outside ATS surveillance, within RNPC airspace

  30 NM tail to tail

  No overlap of ATP

  RNPC ATP, off airways, 10 NM either side of track

  Longitudinal, same or crossing track, 10 minutes with DCPC

  Longitudinal, same or crossing track, 30 NM (RNAV or surveillance from a common point)

  10 minutes longitudinal using MNT

  5 to 9 minutes longitudinal using MNT and speed differential

- Outside ATS surveillance, CMNPS and RNPC airspace

  Any non-surveillance minimum

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Operational Concept for space-based ADS-B supported ATS surveillance services

Communications

Communications between flight crews and ATCOs will be achieved via VHF or CPDLC. Third party communications via SATVOICE and HF communications will be available. ATCOs will have the ability to contact flights directly using SATCOM voice.

Flights will contact ATCOs directly, via VHF, CPDLC. Flights may contact the ATSU using a third party communications service via SATVOICE or HF.

Outside of VHF coverage, it is expected that most profile change requests will be made via CPDLC, using the existing standard CPDLC message elements.

Where CPDLC services are available, including within areas of VHF coverage, flights will have the option to use either CPDLC or VHF to make requests and ATCOs will have the option of using either CPDLC or VHF to request information or issue instructions. Preferably, communications will be initiated and completed using CPDLC in such cases.

ATCOs will respond to CPDLC messages via CPDLC. Outside of VHF coverage, it is expected that most clearances or instructions will be issued via CPDLC, using the existing standard CPDLC message elements; ATCOs will have the option of directly contacting a flight using SATVOICE, using the existing capabilities of National Voice Communication System (NVCS). ATCOs will have the option of initiating contact with a flight using third party communications service.

Horizontal Separation Minimum

The candidate separation minimum using space-based ADS-B is 15 NM. Appropriate ATM procedures will be developed, taking account of available communications capability, to ensure an acceptable level of safety is maintained during any application of this minimum.

Validation of operational applications using space-based ADS-B data will be carried out in Canadian Domestic airspace. This will leverage the ability to carry out trials which mimic different levels of communications and surveillance performance in an environment where VHF DCPC and ground-based surveillance is available. Performance comparisons will be possible between various modes of surveillance as soon as the first space-based ADS-B data becomes available, in 2015; this will permit validation of operational applications based on the actual space-based ADS-B performance in the “test” environment prior to any trial application in the NAT environment.

Consideration will be given to introducing the application of this minimum in a phased approach, possibly on a timeline resembling:

- Mid-Late 2016: implementation of conformance monitoring using available space-based ADS-B data;
- Late 2017: application of 15 NM longitudinal separation between surveillance-identified aircraft operating on the NAT OTS;
- Early 2018: application of 15 NM longitudinal separation between surveillance-identified aircraft, whether or not operating on the NAT OTS;
- Mid 2018: allowing surveillance identified aircraft to operate on tracks which do not intersect with and are separated by ½ degree laterally from the outer-most RLatSM track;
- Late 2018: use of ATS surveillance to maintain 15 NM lateral separation between the tracks of surveillance-identified aircraft operating on non-intersecting tracks;
- Early 2019: application of 15 NM separation between surveillance-identified aircraft

The 15 NM minimum is to be applied centre to center between surveillance targets or from the centre of a surveillance target to the edge of the airspace to be protected for a non-surveilled flight.

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Air Traffic Management

Segregation of airspace is not being considered at this time.

Automated conformance monitoring will be conducted for all flig ht profiles under ADS-B coverage in the vertical and horizontal planes. Inter-facility coordination will also be monitored and alerts provided when manual coordination is required or the observed flight profile differs from the coordinated flight profile.

Improvements to meteorological data, including frequency of updates, may be considered.

Canadian Domestic Airspace

- operators will be encouraged to file minimum cost routes, not necessarily on airways or published tracks
- existing non-surveillance minima will be reviewed to determine which, if any, should be discontinued
- outside of VHF coverage, consideration will be given to defining conflict free "look ahead" times

North Atlantic

- develop a transition strategy for the devolution of the current NAT OTS approach, taking account of customer efficiency and flow management requirements

  Note: In the future, the peak traffic pattern across the North Atlantic airspace will likely continue to resemble a collection of laterally separated organized tracks. However, rather than being determined and published 8 hours ahead of time, this structure will be the natural result of de-conflicted clearances provided in response to requested routings and post-departure estimates for the oceanic entry points. Operators will no longer be expected to select from a pre-determined set of organized tracks based upon the minimum-time track for that flow; the requested trans-Atlantic route will be the operator preference for that particular flight.
- evolution to reduced conflict free window
- evolution away from Mach assignment except to maintain required longitudinal spacing
- ADS-B safety related monitoring will be in addition to safety-related monitoring using ADS-C event contracts

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Pre-Trial Activities

The current operating environment over the North Atlantic, utilizing ADS-C and CPDLC provides a suitable environment in which to gather data concerning existing communications and surveillance performance. Data collection has been implemented for the Gander OCA to validate the current system as being sufficiently robust and to identify potential improvements to existing communications capabilities in support of reducing separation standards.

The addition of same altitude ADS-B surveillance over southern Greenland provides another opportunity to gather data in support of applying a surveillance minimum over the North Atlantic or other surveillance areas without the use of DCPC voice. Same altitude separation of 10 NM was introduced in the Greenland ADS-B environment in March 2013. This mode of operation resembles the expected space-based ADS-B environment with the exception that VHF communications is available. It is important to note however, that all clearances and controller/pilot exchanges (with the exception of the initial contact) are to be completed using CPDLC where possible. The methodology for data collection was being reviewed at the time of this update (October 2013).

Considerations for upcoming ADS-B Southern Greenland & Continuation of data gathering for ADS-C/CPDLC outside of surveillance areas

1. It is necessary to establish ADS-B data collection methodology for climbs and same altitude. Currently this information resides in different log files so may have to be identified manually during the early stages until a more suitable method can be achieved. This is currently being assessed by NAV CANADA.

2. NAV CANADA will continue the assessment of CPDLC communications performance for specified messages, identified as being critical for ATC intervention, to identify possible areas of concern and provide solutions where necessary to improve the measured performance as much as we possibly can.

3. It is necessary to establish test protocols for contacting aircraft through SATVOICE to verify/validate suitable alternatives for ATC intervention capabilities in support of a Safety Case for Separation Reductions.

4. Discussions on-going as to whether NAV CANADA will conduct a trial under which flights use SATVOICE as the primary data link communications media rather than selecting the lowest cost medium (VHF, HF, SATVOICE) as is done currently.

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Acronyms

ACAS	(ICAO) Airborne Collision Avoidance System
ACC	Area Control Centre
ADS-B	Automatic Dependent Surveillance - Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
ANS	Air Navigation Services
ANSP	Air Navigation Services Provider
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
ATS	Air Traffic Services
CMNPS	Canadian Minimum Navigation Performance Specifications
CPDLC	Controller Pilot Data Link Communications
CRM	Collision Risk Model
CSP	Communication Service Provider
CTA	Control Area
DCPC	Direct Controller Pilot Communication
Doc 4444	(ICAO) Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM)
FIR	Flight Information Region
FL (number)	Flight Level
GNSS	Global Navigation Satellite System
HF	High Frequency
HIRA	(NAV CANADA) Hazard Identification and Risk Assessment
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IGA	International General Aviation
LEOS	Low Earth Orbiting Satellites
MNPS	Minimum Navigation Performance Specifications
MTCD	Medium Term Conflict Detection
NAT	(ICAO) North Atlantic (Region)
NM	Nautical Miles
NVCS	(NAV CANADA) National Voice Communication System
OCA	Oceanic Control Area
PBN	Performance Based Navigation
RCP	Required Communication Performance
RNPC	Required Navigation Performance Capability

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RVSM	Reduced Vertical Separation Minima
SAR	Search And Rescue
SATCOM	Satellite Communications
SATVOICE	Satellite Voice Communications
SMP	(NAV CANADA) Safety Management Plan
SMR	(NAV CANADA) Safety Management Report
SMS	Safety Management System
TCAS	Traffic Collision Avoidance System
VHF	Very High Frequency

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