Satellite Based ADS-B

NAV CANADA

March 2014
Outline

- Aireon Global ADS-B via LEO satellites
- Why the initial focus on the North Atlantic?
- Benefits Assessment
- Work Underway and Moving Forward

Frequency Spectrum
Goal

To reduce aircraft separation minima through ADS-B (out) via global Low Earth Orbiting (LEO) satellites
Aireon ADS-B via Low Earth Orbiting (LEO) Satellites
Focus on North Atlantic Oceanic Airspace

- Organized Track Structure NAT OTS
- Eastbound Tracks take advantage of tail winds
- Westbound Tracks avoid head winds
- Procedural Airspace = large distances
- Changes to flight levels, routes, speed by exception
Gander/Shanwick Airspace Today

- **1,000** flights per day (1,300 peak summer day)
- **350,000** commercial flights per year
- **+23,000** military & GA flights per year
- **90%** of the flights are already ADS-B equipped
- **78%** of flights are Data Link (FANS 1/A) equipped
- **80%** are capable and use Controller Pilot Data Link Communications (CPDLC)
Benefits Assessment
Aireon ADS-B System Benefits

Safety

- ADS-B provides near real time aircraft surveillance
- Improves situational awareness, conflict detection and reaction/resolution
- Aircraft would have more flexibility in emergency situations
- Provides surveillance source separate from the communications (CPDLC) network sources
- More complete and accurate reporting of aviation occurrences, allowing better management of safety risk and better support of the Safety Management System
Aireon ADS-B System Benefits

Environmental/Efficiency

- More efficient “domestic-like” flight trajectories in oceanic airspace
- More predictable airline cost planning
- Aircraft able to Climb/Descend and vary speed to chase wind push and avoid headwinds
- Improve opposite direction and crossing traffic profiles
- Significant worldwide reductions in greenhouse gas (GHG) emissions
Aireon ADS-B System Benefits

Predictability/Reliability

- Access to ADS-B data could support traffic flow management-sequencing, merging and balancing for major cities in eastern North America and Western Europe
- Supports information sharing and collaborative process
- SWIM requires flight planning systems, dispatch, and airline gate-to-gate management to become more sophisticated and efficient. Surveillance via Low Earth Orbit satellite ADS-B will accommodate this.
Aireon ADS-B System Benefits

Supporting ICAO ASBU implementation

- B1-SWIM: Performance Improvement through the application of System-Wide Information Management (SWIM)
- B0-FRTO: Improved Operations through Enhanced En-Route Trajectories
- B1-FRTO: Improved Operations through Optimized ATS Routing
- B0-NOPS: Improved Flow Performance through Planning based on a Network-Wide view
- B1-NOPS: Enhanced Flow Performance through Network Operational Planning
- B0-ASUR: Initial Capability for Ground Surveillance
- B0-SNET: Increased Effectiveness of Ground-based Safety Nets
- B1-TBO: Improved Traffic Synchronization and Initial Trajectory-Based Operation
- B1-RPAS: Initial Integration of Remotely Piloted Aircraft (RPA) Systems into non-segregated airspace
Overview of Traffic on Tracks and No Tracks
Initial Oceanic Assessment

- High level assessment of 8 oceanic areas
- Based on 1,000’ climb fuel savings
- Up to 3 climbs per flight
- Vetted with IATA airline member familiar with oceanic operations
- Considered conservative and achievable
### Oceanic Assessment Benefits

**Estimated $439 million in 2018**

<table>
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<tr>
<th>Major Oceanic FIRs</th>
<th>Commercial IFR Flights (000s)</th>
<th>Total Fuel Climb Savings (000s)</th>
<th>GHGs (000s Tonnes CO₂ Equivalent)</th>
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<tr>
<td>Shanwick / Gander</td>
<td>390</td>
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<td>Other Oceanic FIRs</td>
<td>514</td>
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<td><strong>904</strong></td>
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Work Underway and Moving Forward
Payload being developed by Harris Corporation
- Harris selected to build 81 space-qualified ADS-B receivers in June 2012
- 50+ years designing and manufacturing space hardware and major FAA contractor
- Design phase complete; production starting

Hosted Payload Operations Center to be supported by Iridium
- Developed by an Iridium/Boeing team in Virginia and Arizona

Systems engineering and ground data processing system by Exelis
- Exelis has significant expertise and existing infrastructure supporting the FAA ADS-B terrestrial system deployment
- Successful Preliminary Design Review completed in Sep 2013

On-track to meet first launch in early 2015
Initial Operations Capability late 2017
Harris ADS-B Payload Development On Target

- Harris ADS-B Payload Critical Design Review successfully completed in May 2013
- Payload completed the Test Readiness and Production Readiness reviews in October 2013
- Payload Qualification Unit completed space qualification testing in March 2014
- Payload Qualification Unit will be shipped to Thales Alenia Space in France for further integration and testing with the satellite
- Production of Payload Units has begun
Hosted Payload

Inverted Hosted Payload
Coverage

- No coverage gaps with 250 Watt transponders
- Interference from FRUIT (other ground based and airborne transmitters) has been minimized
- Software solution has mitigated the cone of silence (area directly above the aircraft antenna)
NAT SPG

NAT EFG
NAT IMG
NAT SOG

NAT ATMG
NAT CSNG
NAT SARSIG

ICAO Regional Groups
NAM/CAR ANI/WG/1
EANPG 55
NACC WG/4
SAM IG/13
MID ASBU Workshop
APAC ATM SG
APANPIRG
TRASAS/4

Transport Canada Industry Canada

Other/Related NAT Surveillance Corridor ADS-B 4G

CPWG

ITU Regional

CPM 15-2

SG-5

ITU WP 4C
ITU WP 5B

ICAO

Assembly
BUDSS
ACP WG-F
ATMOPSP
SASP
OPLINKP

12th Air Navigation Conference
Regulatory Roadmap

Focus on 4 Areas:

1. ICAO North Atlantic (NAT)
2. ICAO Global Assemblies and Panels
3. International Telecommunication Union (ITU)
4. Other Stakeholders – Transport Canada, CPWG (Cross Polar Working Group), ADS-B 4G, etc.
1. ICAO North Atlantic (NAT)

- NAT SPG contributory groups (NAT IMG, NAT SOG & NAT EFG) have received initial CONOPS briefings

- NAT Economic and Financial Group (EFG) also received Benefits Analysis

- NAT EFG is further exploring overall NAT benefits

- Next contributory group meetings in May and June
  - Will focus on support and work to be done.
  - Will present high level safety plan (to NAT Safety Oversight Group – NAT SOG)
2. ICAO Global Assemblies & Panels

- Presentations made to ICAO regional groups on the initiative
- Separation and Airspace Safety Panel (SASP) provided input on how to approach collision risk modelling
- CONOPS will be presented to new ICAO Air Traffic Management Operations Panel (ATMOPSP) in April
- ICAO Position for the International Telecommunication Union (ITU) World Radiocommunication Conference 2015 (WRC-15) currently DOES NOT include protection for 1090 MHz for aircraft to satellite
- Updated ICAO Position may include information about space-based ADS-B frequency allocation requirements
3. International Telecommunication Union (ITU)

Goal is that the ITU will approve allocation of 1090MHz for Aircraft to Satellite ADS-B signal at the World Radio Conference (WRC) in November 2015

Industry Canada submitted a proposal that CITEL (a Regional ITU Group) recommend this subject be included in ITU Regional Director’s Report so it can be added to WRC-15 agenda

Supporting Proposed Draft New Report (PDNR) has been developed by ITU Working Parties and may be included in updated ICAO Position

Briefing planned at Asia-Pacific Telecommunity (APT) Preparatory meeting for WRC-15

Working with as many ITU Regions as possible on the frequency allocation/WRC-15 agenda issue
4. Other Stakeholders

Transport Canada
- Regular coordination meetings on ICAO working papers
- Good cooperation on numerous initiatives, particularly frequency spectrum issue

Cross Polar Working Group
- Presentation made on the Space Based ADS-B initiative with positive feedback from participants

ADS-B 4G meeting in Ottawa February 2014
- Presentation on concept positively received
Actions Going Forward

- Continue to collaborate with ANSPs, IATA/industry and ICAO/regulator to demonstrate and validate incremental improvements.
- Leverage existing technology and continue to improve service, e.g., RLongSM and RLatSM.
- Operational trials involving airlines/ANSPs will be used to demonstrate capabilities and support the safety case.
In Advance of Satellite Based ADS-B

- RLongSM implemented in Gander and Shanwick OCAs March 21, 2011
- Prepping for RLatSM - Phase 1 2015, Phases 2 and 3 TBD
- Publishing Gander Oceanic Transition Area (GOTA) April 2014 and expanding use of ground-based ADS-B in Oceanic airspace
- Ground based ADS-B corridor Scotland to Greenland 2014-2015
- Mid-Late 2016: implementation of conformance monitoring using available space-based ADS-B data
Application in the NAT: Principles

- Initially, no change to the Organized Track System (OTS) or Oceanic Clearances
- Initial application on core tracks in same direction only
- Use a phased approach
  - similar to Data Link
- Apply priority handling (best equipped best served)
Operational Validation

- data collection on ADS-B and communications
- collaboration with stakeholders on final implementation CONOPS
- GAATS+ deployment in Prestwick
Initial Application in the NAT

- Late 2017: application of 15 NM longitudinal separation (with RLatSM) between surveillance-identified aircraft operating on the NAT OTS.
- Early 2018: 15 NM longitudinal separation expanded to aircraft operating off the NAT OTS.
Future Procedure Changes in the NAT

• Mid 2018: allowing surveillance identified aircraft to operate on all tracks which do not intersect (still RLatSM).

• 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
In summary

• Global ADS-B Surveillance is a “Game Changer” for aviation
• Fits with NEXT GEN / SESAR
• Significant fuel & GHG savings
• Avoids ADS-B ground based replacement or some initial installation costs
• Benefits to domestic traffic can be realized in remote areas or through improved air traffic flow management to and from oceanic airspace
• Public will benefit from safer + more expeditious flights in remote, polar and oceanic airspace worldwide
• Opportunity to boost aviation innovation & the environment globally
Questions?