Space Based ADS-B

Transforming the Way you See the Sky

February, 2015
The current ATM reality
Significant challenges for airlines

- High physical infrastructure costs
  - Duplication of signals / contingency
  - High costs in remote terrain & large areas
- Inefficient routes following surveillance
- Inefficient separation based on tracking
- Sub-optimal flight paths
- Sub-optimal speeds
- Flow restrictions / border metering
- Weather avoidance
- Service predictability / training costs
- Cost of avionics
- Safety risk in un-surveilled airspace
- ICAO flight tracking proposals
Unlocking ATM Performance
Unlocking ATM Performance

Global Space-based ADS-B Coverage

Aireon™ Ground Facility

ATM System

Aireon™
Investors, Customers and Innovators
## Aireon System Development Status

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADS-B Payload</strong></td>
<td>24 units produced, 6 delivered to Orbital, 4 installed on satellites. Harris is producing them at a rate of 4 per month.</td>
</tr>
<tr>
<td>Hosted Payload Operations Center (HPOC)</td>
<td>Completed qualification test and full system integration testing is underway</td>
</tr>
<tr>
<td>Aireon Processing &amp; Distribution Center (APD)</td>
<td>Completed qualification test and full system integration testing is underway</td>
</tr>
<tr>
<td>Service Delivery Point (SDP)</td>
<td>Design and specifications completed, in progress of installing the SDP for Nav Canada.</td>
</tr>
<tr>
<td>Satellite Build</td>
<td>6 satellites shipped from Thales, 5 are being assembled at Orbital</td>
</tr>
<tr>
<td>Launch Schedule</td>
<td>First two satellites will be launched with Dnepr in 2015 to be followed 4 months later by 10 satellites launches with the SpaceX Falcon 9.</td>
</tr>
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</table>
Aireon proving to be a robust surveillance system

- Aireon System performance testing validates ability to support both low oceanic and terrestrial separation standards
- High availability design uses system redundancy and cross-linked communications backbone – 99.9% availability to the ICAO GOLD Standard
- System will support as low as 125W ADS-B transponders (almost all commercial aircraft are equipped with 200W or higher)
- 8 second or less update rate for 95% of the targets (based on 125W transponder)
- Built to accommodate all existing and future ADS-B standards
- Capacity to handle existing traffic and future traffic growth

Aireon ADS-B surveillance will support 5NM radar like separation in areas with VHF coverage and 15NM or better oceanic separation
Concept of Operations Update

• Aireon partners / customers have formed both a Technical Working Group and an Aireon Operations Working Group (OWG)
• The Operations Working Group (OWG) has met twice in the last year and consists of senior level operational & regulatory experts from each ANSP
• The group was tasked with developing a generic template for several scenarios to:
  • Determine operational concept
  • Determine the regulatory requirements towards operational capability
  • Determine the main impact and benefit areas
  • Determine a generic safety & implementation plan
• OWG has made significant progress in developing a concept of operations for the 4 main scenarios where Aireon is expected to deliver benefits:
  • Introducing SB ADS-B where no surveillance currently exists (HF/CPDLC)
  • Introducing SB ADS-B where ADS-C is used (HF/CPDLC
  • Augmenting or replacing existing surveillance layers with SB ADS-B
  • Using SB ADS-B as a cross center / cross border contingency source
Oceanic / Remote Applicability

- Safety
- Reduced Separation
- Route Optimization
- SWIM
- Cost Avoidance

North Atlantic
Pacific Tracks
South China Sea
Bay of Bengal
EUR/SAM

Tracks / Random
Phased Implementation in the North Atlantic

- Phase 1 (2016) Conformance Monitoring of space based signal
- Phase 2 15NM longitudinal / ½ degree separation, on tracks between surveillance identified a/c
- Phase 3: 15NM Longitudinal off tracks between surveillance identified aircraft
- Phase 4: Allow surveillance identified aircraft to operate on all tracks which do not intersect
- Phase 5: 15 NM lateral separation between the tracks of surveillance-identified aircraft operating on non-intersecting tracks
- Phase 6: Application of 15 NM separation between surveillance-identified aircraft
- Evolving thereafter…
Polar / Low COM Applicability

- Safety
- Predictability
- Cost Avoidance

N-Canada
Polar Routes
Central Africa
Arctic

HF or / SATCOM Only

Tracks / Random
Polar Routes
Terrestrial Applicability

- Flow Management
- SWIM
- Contingency
- Cost Reduction / Avoidance

Terrestrial Airspace

Augment or replace Radar / Ground Based ADS-B

DCPC

Routes / Random
ENAV Surveillance Infrastructure

APP + ENR Surveillance

- 9 ENR Radar (PSR+SSR)
- 3 ENR Radar (SSR only)
- 18 APP Radar (PSR+SSR)

Total Radar

- 30 SSR
- 27 PSR

Ground ADS-B

- 20 ground stations already installed
BLUEMED: Countries involved

- Italy
- Greece
- Cyprus
- Malta
- Tunisia (associated partner)
- Albania (a.p.)
- Egypt (a.p.)
- Jordan (observer)
- Lebanon (observer)
# It’s Just ADS-B

<table>
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<tr>
<th>Surveillance Source</th>
<th>None</th>
<th>ADS-C</th>
<th>En-route Radar</th>
<th>Space Based &amp; Ground Based ADS-B</th>
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<tr>
<td><strong>Update Interval</strong></td>
<td>Verbal position report less than every 10-15 min</td>
<td>CPDLC position data every 10-15 min</td>
<td>Calculated position data &lt;12 seconds</td>
<td>GPS position data plus trend &lt;8 seconds</td>
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<tr>
<td><strong>Procedural separation only</strong></td>
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<td>Tactical Separation</td>
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<tr>
<td>HF</td>
<td>10 to 15 min / &gt;80NM</td>
<td>N/A</td>
<td>N/A</td>
<td>15 NM</td>
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<tr>
<td>CPDLC/HF</td>
<td>N/A</td>
<td>40/30 NM</td>
<td>5 NM</td>
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## Impacts and Benefits

**Impacts**
- Less restricted altitudes
- Less restricted air speeds
- Less restricted routing
- Minimize impact from operational and weather disruptions
- Reduced legacy surveillance (radar/WAM/ground ADS-B) outage disruptions
- Reduced metering delay / improved flow
- Reduced likelihood of loss of separation events
- Improved search and rescue services
- Reduction of gross navigation errors
- Reduced complexity through harmonization of operating environment
- Early detection of emergency transponder codes
- Decreased legacy surveillance system replacement or maintenance costs
- Avoided legacy surveillance system expansion investment
- Avoided signal duplication and associated telecom costs
- Decreased infrastructure and signal costs through cross border contingency
- Improved airspace integration of UAS
- More predictable airline cost planning
- Reduced training costs through harmonization of operating environment
- Avoided avionics investment
- Improved data for flight billing and airspace route design purposes
- Reduced GHG emissions and the associated avoided SCC

**Beneficiary**
- ANSP
- Airline
- Society

**Benefits**

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Significant engagement amongst leading ANSPs
Transforming the way you see the sky