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WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 1: Strategic issues that address the challenge of integration, interoperability and harmonization of systems in support of the concept of "One Sky" for international civil aviation

1.1: Global Air Navigation Plan (GANP) – framework for global planning

d) Surveillance roadmap

SPACE-BASED ADS-B SURVEILLANCE AND THE IMPACT ON AIR TRAFFIC MANAGEMENT

(Presented by the International Coordinating Council of Aerospace Industries Associations)

SUMMARY

This paper presents an overview of a global space-based ADS-B surveillance service by using Iridium's next generation satellite communications network, to be provided by the Aireon public private partnership.

Action: The Conference is invited to:

a) note the content of the paper; and
b) agree on the recommendations presented in paragraph 5.1.

1. INTRODUCTION

1.1 The purpose of this document is to introduce the planned deployment of a global space-based ADS-B surveillance service by Aireon LLC by using the Iridium next generation satellite communications network (Iridium NEXT). The paper will provide an overview of the system, an update on the current status, an overview of the impact to oceanic and remote air traffic operations and the schedule for the roll out. The paper will then discuss the need to engage the entire aviation stakeholder community during the formation and roll out of this service including the need to include space-based ADS-B surveillance in the implementation of the aviation system block upgrades (ASBUs) and future air transport infrastructure upgrades on regional and global levels.

2. BACKGROUND

2.1 Aireon is a joint venture to finance, develop, deploy and operate the world's only global solution for tracking and monitoring the world's aircraft using space-based ADS-B, as part of Iridium's fully funded next-generation global satellite communications constellation ("**Iridium NEXT**").

2.2 Aireon is a planned space based ADS-B surveillance solution that will be set up as a joint venture between Iridium and NAV CANADA with support from the U.S. Federal Aviation Administration (FAA) and several other partners:

a) **Iridium** will host the ADS-B receivers on its next-generation Iridium NEXT constellation. By hosting the ADS-B payload on commercial satellites, the venture would leverage the $3B investment by Iridium in deploying Iridium NEXT, sharing the infrastructure costs of the satellite network with a growing global commercial enterprise, reducing long-term costs;

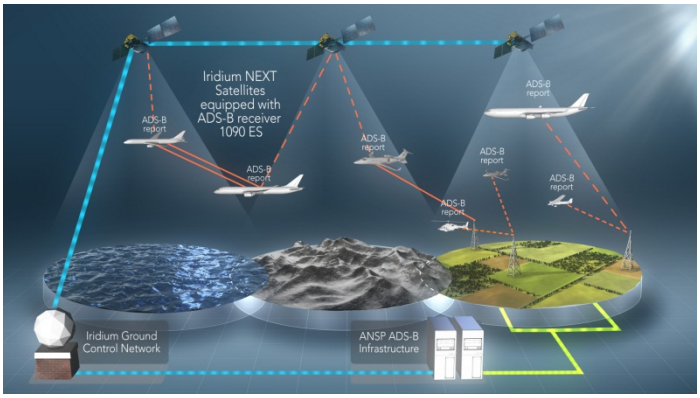
b) **NAV CANADA** intends to be Aireon's first customer and an investor in Aireon. The venture will be operated under a public-private partnership between industry and the world's major ANSPs;

c) **Harris Corporation** is supplying 81 ADS-B payloads for the venture; and

d) **ITT Exelis** is providing systems engineering support.

2.3 The Iridium architecture is unique in that all of the satellites are cross-linked, communicating with their neighboring satellites, allowing signals to be relayed from any point on the globe to a central ground location in Tempe, AZ in near real-time, with back-up locations in Alaska and Norway. The real time nature of relaying ADS-B surveillance data through Iridium network is critical to achieving radar-like surveillance and reduced oceanic separation minima down to 15 NM for aircraft equipped with appropriate communication and navigation avionics – enabling the full potential of benefits from such operations. No other existing or planned LEO-constellation has an equivalent capability. The Iridium architecture with built in redundancy and backup would provide a seamless experience to the Air Traffic Controllers when utilizing the Aireon surveillance capability.

2.4 The Iridium NEXT LEO constellation is the world's largest with 66 operational satellites, plus six on orbit and nine ground spares, providing a level of redundancy and system availability that is unprecedented. The Iridium satellite design has significant built-in redundancy and high reliability. The planned ADS-B payload receivers will have even higher reliability requirements and the design will include the ability to make on-orbit software updates to adapt to future changes in ADS-B formats, if required. No other LEO constellation has a comparable global coverage, system availability, redundancy or flexibility.



3. DISCUSSION

3.1 Space-based ADS-B surveillance can transform operations provided by Air Navigation Service Providers (ANSPs) responsible for oceanic, remote and polar airspace, enabling extraordinary operating and environmental benefits for the world's airlines:

a) **Significant Fuel Savings** in oceanic airspace where procedural separation assurance is practiced by being allowed to climb to more optimal altitudes and use more efficient routes.

b) **Return on ADS-B Investment** with no additional aircraft equipage, beyond what is already mandated,. Iridium hosted ADS-B payload approach provides a solution that would simply receive ADS-B signals from aircraft equipped with 1090 MHz ES ADS-B OUT avionics, mandated by the FAA on all aircraft in NAS by 2020.

c) Reduced Emissions through fuel consumption optimization, a key benefit in the emerging cap and trade world.

d) Enhanced Safety by eliminating service gaps ("blind spots") over regions with limited infrastructure or coverage.

e) **Global Harmonization** by connecting regions with different next-generation ATM operating procedures and systems.

3.2 Space-based ADS-B can be a critical enabler for ANSPs responsible for oceanic and remote airspace by providing radar-like surveillance where no surveillance currently exists.

a) **Leading air traffic modernization** by extending next generation air traffic surveillance capabilities to all the ANSPs of the world.

b) **Greater Return on ANSP ADS-B Investment** by accelerating ADS-B equipage and extending benefits to oceanic/remote airspace.

c) **Enhanced Safety** from near real-time visibility of aircraft using ADS-B surveillance available everywhere on the planet.

d) **Cost Effective Service Model and Infrastructure Savings –** Industry deploys global infrastructure; ANSP purchases a data service.

3.3 Aireon has plans to work with NAV CANADA and other ANSPs to develop all specific requirements and changes in ATC procedures to utilize the reduced separation minima enabled by Aireon. Aireon will work with ICAO to promote adoption of Aireon surveillance and procure ICAO approvals for new separation standards and procedures. Aireon is also currently analyzing specific requirements for the communications and navigation functions which are required to achieve reduced separation minima down to 15 NM, with acceptable safety cases. Here are some preliminary conclusions:

- A direct controller-pilot communications is needed. This can be met by use of controller-pilot data link communication (CPDLC) with RCP 240 performance.

- A navigation performance of RNP10 is deemed sufficient with planned 15 second update rate to achieve at least 30 NM separations. RNP4 with 15 second update rate would achieve reduced separation minima down to 15 NM.

The Aireon service is being developed to meet requirements that are considered adequate for ATC operations with reduced separation minima down to 15 NM by the ANSPs.

1. Availability: >= 0.999 which is measured as the Up Time/Total Time. The Aireon design when coupled with Iridium constellation mitigates any cone of silence related issues from aircraft antenna to deliver this availability performance.

2. Capacity: 1000 targets within service volume

3. Latency: <= 5 seconds from the reception at the space-based ADS-B receiver of the last bit of an aircraft's ADS-B Message until delivery of first bit of the corresponding ADS-B Report at the ANSP Service Delivery Point (SDP). Iridium NEXT being a LEO constellation can actually reduce this latency to less than a second.

4. Update Rate: <= 15.0 seconds (95%) at the ANSP SDP for each target in the coverage volume

5. Integrity: The probability that the service introduces hazardously misleading information into an ADS-B Report < 10^{-5} per hour.

Iridium NEXT satellite-based ADS-B system is scheduled to begin launching in 2015 and will be completed in 2017. This schedule coincides with the timing of broad-based implementation of ADS-B systems by airlines worldwide and for meeting various ADS-B surveillance requirements.

4. CONCLUSION

4.1 The Aireon global space-based ADS-B surveillance system is being developed under a joint venture between Aireon and NAV CANADA and will be operational in 2017. This transformational new global surveillance system will offer far reaching capabilities and benefits to the global aviation community. The global aviation community would benefit by early interaction and participation in the development and deployment of this capability.

5. ACTION BY THE CONFERENCE

5.1 The Conference is invited to recommend to ICAO to:

a) support the adoption of global space-based ADS-B surveillance capability into future air transport infrastructure upgrades on regional and global levels and its incorporation into the implementation of the Aviation System Block Upgrades (ASBUs); and

b) facilitate needed interactions and discussions between interested stakeholders throughout the world with relevant ANSPs and their industry partners to take full advantage of this revolutionary capability when it becomes operational in 2018.

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