Western and Central African Office

Twenty-first Meeting on the improvement of Air Traffic Services over the South Atlantic (SAT/21),

Lisbon, Portugal, 6-7 June 2016.

Agenda Item 4:
Space-Based ADS-B via Low Earth Orbiting Satellites– Concept and benefits for use in oceanic and remote air traffic management environments

(Presented by Aireon)

SUMMARY

This paper presents a description of the concepts for use of space-based ADS-B in the provision of Air Traffic Services in oceanic and remote locations. The paper relates to the planned use of the system which is currently under development in the ICAO North Atlantic Region.

Action by the meeting: see paragraph 3

1. Introduction

Air Traffic Management (ATM) improvements with regard to capacity and flexibility in oceanic Air Traffic Service (ATS) provision is hampered by the absence of ATS surveillance coverage. Because of recent developments in the deployment of Automatic Dependent Surveillance-Broadcast (ADS-B) receivers in space it will in the near-term be possible to apply separation standards based on ATS surveillance in oceanic areas.

Aireon is a company which is formed as a joint venture between Iridium Communications and the Air Navigation Services Providers (ANSP) of Canada (NAV CANADA), Ireland (Irish Aviation Authority), Denmark (Naviair) and Italy (ENAV). Aireon is deploying ADS-B receivers in a Low Earth Orbit (LEO) (760 kilometers) over the earth´s surface, hosted on the Iridium NEXT satellite constellation. The ADS-B receivers on the Iridium NEXT constellation will be able to deliver constant global coverage for all aircraft equipped with ADS-B 1090 MHz transponders.

NAV CANADA and NATS (United Kingdom's primary ANSP) have developed an ATM concept for introducing new separation standards into the North Atlantic (NAT) based on space-based ADS-B. The ICAO Separation and Airspace Safety Panel (SASP) are developing new separation standards based on space-based ADS-B data. These new separations will be published in the *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM; Doc 4444).

2. Discussion

2.1 Low Earth Orbit Satellites and ADS-B

ADS-B coverage will be global through the use of the 66 Iridium NEXT satellites equipped with receivers capable of receiving signals from 1090 MHz Mode S extended squitter transponders. Iridium NEXT will include six in-orbit spares and further spares available to be launched, if required. Iridium NEXT will provide global coverage, offering the possibility of monitoring ADS-B equipped aircraft anywhere in the world, augmenting the current ground-based ATS surveillance infrastructure. This will reduce the necessity to make potentially very costly investments to extend ATS surveillance coverage to oceanic, polar and other remote areas. It can also avoid costs that would be required to replace ground-based ATS surveillance systems, as they reach their end of service. The ability to provide ATS surveillance services would be an effective means for

harmonizing ATS and supporting cost-effective improvements for safety and efficiency. This satellite space-based surveillance would be on a separate network from that supporting current FANS 1/A and equivalent Controller Pilot Data Link Communications (CPDLC) capabilities.

2.2 With the deployment of the Aireon service, real-time position updates will be available every 8 seconds or better for each equipped aircraft. This update rate would significantly improve situational awareness for air traffic controllers and provide for more timely conflict detection and resolution. The ability for air traffic controllers to provide advice and clearances during contingency and emergency situations would greatly improve. ADS-B information will be available to better detect, report and investigate aviation occurrences, improving Safety Management System (SMS) processes.

2.3 The current separation minima applied to aircraft operating in oceanic airspace limits flexibility for aircraft to operate on their preferred flight profiles. Aircraft requesting to cross the current main traffic flows, or operate opposite to them, frequently suffer significant vertical or routing penalties, which increase costs, fuel consumption and greenhouse gas emissions. Even with recent improvements, it is still the case that many requests cannot be accommodated; neither is it possible to allow a significant number of aircraft to operate on variable speed nor vertical profiles to maximize fuel savings. The ENGAGE trials have demonstrated that significant fuel savings can be achieved when such flexibility can be accommodated.

2.3 Continuous ATS surveillance in oceanic areas would allow for a more seamless transition to domestic areas. It is also possible that this new capability could support Air Traffic Flow Management (ATFM) sequencing much earlier in the flight, thereby allowing for increased efficiency and predictability. The availability of timely and reliable aircraft position information supports the evolving System Wide Information Management (SWIM) concept, allowing for information and effective collaborative decision making.

2.4 A high-level assessment was made of the potential benefits from implementing space-based ADS-B in oceanic areas; for comparison purposes, the Gander and Shanwick Oceanic Control Areas (OCA) were included as one of the areas. This assessment estimated fuel savings accruing from up to three climbs per flight being accommodated. Such an operational improvement was viewed as achievable and also conservative. This assessment estimated total fuel savings in 2018 of approximately 439 million dollars (Canadian) and a concomitant savings of more than one million tons of CO_2 emissions.

2.5 Space-based ADS-B is a game changer, providing the opportunity for global ATS surveillance coverage. The technology and the potential improvements fit with the planned evolution of the global air navigation system as foreseen in ICAO's updated *Global Air Navigation Plan* (GANP), NextGEN and SESAR initiatives. The possible ATM improvements could result in significant fuel saving leading to associated reductions in greenhouse gas emissions. Space-based ADS-B will provide for a cost effective alternative to replacing or expanding ground-based ATS surveillance infrastructure. Expanded ATS surveillance coverage will support improved ATFM and better integration between oceanic and domestic traffic flows.

2.6 Recent aviation tragedies such as the loss of AF 447 in the South Atlantic and MH 370 has highlighted a weakness in the aviation system pertaining to tracking aircraft in remote regions. The ICAO High Level Safety Conference endorsed the Global Aviation Distress Safety System (GADSS) during its meeting in Montreal in 2015, and new global standards for aircraft tracking are being developed by ICAO. By 2018 aircraft operators will be required to account for the positions of aircraft in their fleet at intervals not exceeding every 15 minutes. By 2020 this requirement will be expanded to include a one-minute update interval for aircraft in distress situations.

2.7 The expected performance of space-based ADS-B meets these performance requirements by providing near real-time position updates for ADS-B equipped aircraft, whether or not they are in distress. Along with providing ANSPs with ATS surveillance data, Aireon will also deploy the Aireon Aircraft Locating and Emergency Response Tracking (ALERT) by 2018. Aireon ALERT is a free public service, hosted by the Irish Aviation Authority in Ballygirren, Ireland. Aireon ALERT

will provide search and rescue entities and aviation stakeholders' access to position data of missing aircraft.

3. Action by the meeting

The meeting is invited to:

a) Note the information presented