International Civil Aviation Organization

Sixth Meeting of the Surveillance Implementation Coordination Group (SURICG/6)

Video Teleconference, 24 – 27 August 2021

Agenda Item 8: Update on surveillance activities and explore potential cooperation opportunity

STATUS OF SPACE BASED ADS-B

Presented by Aireon LLC (a member of ICCAIA)

SUMMARY

This paper presents the status of Space based ADS-B.

1. INTRODUCTION

1.1 Space based ADS-B has dramatically changed the surveillance landscape in some parts of the world. This paper outlines the current progress.

2. DISCUSSION

2.1 Surveillance as a service

2.1.1 Space based ADS-B as a service has now been operational for some time. The Aireon ADS-B receivers are located on each of the 66 " Iridium Next" satellites and conveys the received data to central processing where it is filtered for distribution to customers. It is distributed as Asterix Cat 21 (nominally version 2.4 or 2.1) but can be converted to any version as required.

2.1.2 The European Aviation Safety Agency (EASA) have certified Aireon as an ANSP for the provision of operational surveillance data. This means that the Aireon system, management, procedures, staff, training etc have been assessed, and continue to be assessed for this safety critical application.

2.1.3 ICAO has now updated Doc 4444 to allow reduced oceanic separation using Space based ADS-B with CPDLC. See Doc 4444 AMENDMENT NO. 9 para 8.7.4

2.1.4 Nav Canada is using Space based ADS-B with the reduced separation standards and is now going further by examining the possibility of abandoning the North Atlantic Organised track structure. NavCanada is conducting tests now. See https://www.navcanada.ca/en/news/blog/why-your-next-flight-over-the-north-atlantic-might-be-safer-faster-and-use-less-fuel.aspx. This will further increase efficiency and decrease carbon emissions.

2.1.5 Aireon has contracted with some customers for the provision of ATFM data – supporting both strategic and tactical flow applications. See https://aireon.com/products/aireonflow/. Typically the positional data is updated every 30 seconds rather than every few seconds and is tailored to suit the

customer needs. Usually a two way data flow is required so that Aireon receives flight plans and is able to use that data to tailor what data is delivered to the customer.

2.1.6 Aireon also provides a separate "Aireon Alert" service supporting Search and Rescue events.

2.1.7 Aireon stores all received data and the product "Aireon Query" allows subscribed customers to extract both historical and temporal data based on various user entered criteria to CSV files for analysis.

2.1.8 The costs of Space based ADS-B vary depending on the application/operational use and operational benefit. Situational awareness applications are generally less expensive than applications using Space based ADS-B as a sole source for separation purposes. Some ANSPs have fixed costs/year whilst others have variable costs based on the flight hours of surveillance provided. In the latter, when traffic drops, the payments to Aireon also reduce in line with the ANSP revenue loss. Other ANSPs prefer the certainty of fixed costs.

2.1.9 ANSPs are now using or evaluating Space based ADS-B including the following :

- UK NATS/ Nav Canada Oceanic – Fully operational
- Nav Canada – Fully operational 5 NM separation enroute domestic in the Edmonton Centre
- Singapore Oceanic – Fully operational
- India – Fully operational
- PNG Domestic and Oceanic – Fully operational
- ASECNA (Enroute terrestrial and oceanic in Africa) – Fully operational
- Eurocontrol (ATFM) – Fully operational
- Iceland – ISAVIA– Fully operational
- Curacao – Fully operational
- COCESNA – Fully operational
- Denmark (Naviair) – installed, completing CONOPS
- South Africa – ATNS ISAT completed, waiting regulatory approval
- Norway – Avinor (Helicopter surveillance) – expected to be operational in next 2 months
- Indonesia – Trial deployment
- Hong Kong – Trial deployment
- Dominican Republic –Trial deployment
- NavPortugal – Oceanic Area in the Azores – planned to be operational late 2022
- ENAV Italy Installed and testing the system
- Irish Aviation Authority – completing implementation

2.2 VPN Demonstration

2.2.1 To demonstrate Space based ADS-B service, Aireon has offered trial VPN deployments to a number of ANSPs. The trial uses the internet to convey ADS-B data from the USA to the customer site, whilst protected in a VPN tunnel. The trial system has allowed ANSPs to assess the coverage, to test the interface with their ATC automation and demonstrate the benefits without the costs of establishing communication links and without installing permanent hardware. This trial does not have maintenance tools nor performance measurement capabilities. Latency & availability are usually acceptable but depend on test infrastructure and the internet. The VPN demonstration is not designed for operational use.

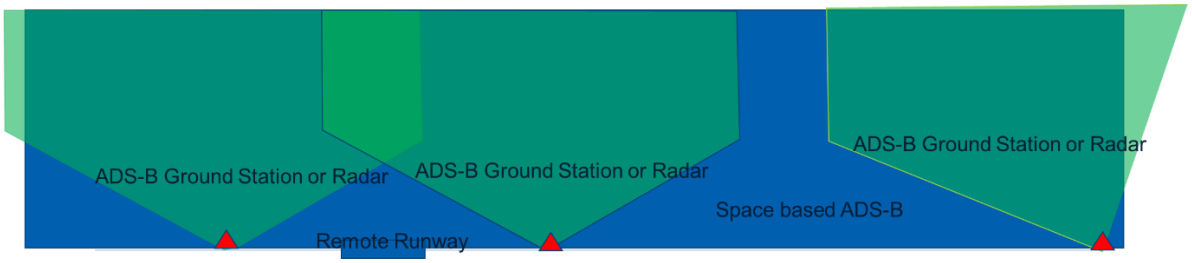
2.3 Deployment during COVID

2.3.1 The deployment of Space based ADS-B has continued during the COVID-19 pandemic. ANSP staff or local contractors have installed the hardware and acceptance tests have been conducted using video teleconference facilities.

2.4 Complete coverage

2.4.1 Space based ADS-B has the potential to "complete" the coverage picture even in States that have significant ground based radar or terrestrial ADS-B because it "sees" where those sensors don't. Space based ADS-B "fills in" coverage below and between terrestrial sensors and hence provides ideal supplementary surveillance in Airspace with radar or terrestrial ADS-B.

2.4.2 As shown in the diagram below, Space based ADS-B detects aircraft below and between terrestrial sensors :



2.5 CRV

2.5.1 PNG supported by Indonesia proposed to the ICAO CRV Operations Group that Aireon be allowed to connect to CRV with the objective of lowering the costs of Space based ADS-B. Following submittal of appropriate documentation the CRV Operations Group authorised Aireon to connect.

2.5.2 Aireon connected to CRV in 2020 and that connection is operational supporting PNG ATC operations today. Performance on CRV has been somewhat equivalent to the performance of CRV lines. A second Aireon connection to CRV – at a different city to the first connection – has been ordered from PCCW and is currently being installed. It is expected to become operational in the next two months.

2.5.3 Both these Aireon to CRV connections are able to serve multiple Aireon customers.

2.5.4 Typically an ANSP will choose a dual CRV package B. A dual package B means that both A and B channel are always active and there is no surveillance outage if one path fails. Other packages have a short, but unacceptable for a Tier 1 service, outage. Typically, no additional bandwidth is required to serve Space based ADS-B but of course this depends on the number of ADS-B equipped aircraft in the airspace.

2.5.5 A mixed environment with one CRV connection and one MPLS connection are also possible.

2.5.6 Thanks to this work, Space based ADS-B data can now be delivered to other Aireon customers in Asia Pacific via CRV, potentially without need for any additional communication link or dedicated telecommunications costs!

2.5.7 An additional benefit flows to such customers because the same CRV physical connection could be used to exchange ADS-B ground station data with other ANSPs

2.6 Example: NiuSky Pacific

2.6.1 The previous operational surveillance was one radar at Port Moresby Airport and one ADS-B ground station at Burns Peak. Approximate current operational surveillance coverage at FL200 is shown as shaded pink in Figure 1 below. The white line is the FIR boundary.

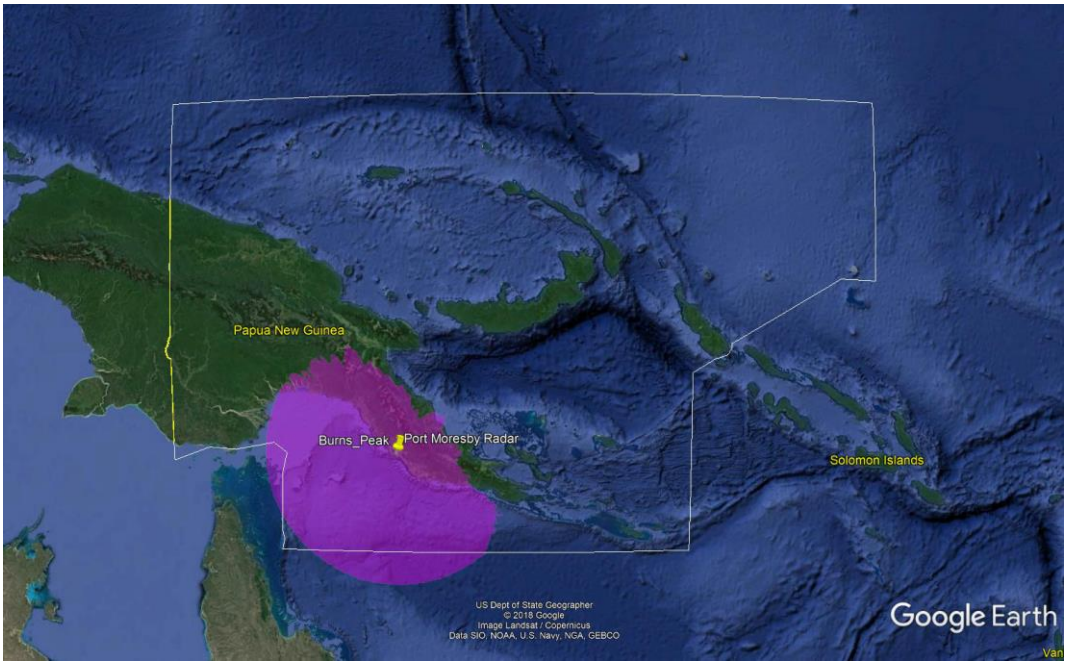


Figure 1 : Surveillance at FL200

2.6.2 In 2019, Aireon and NiuSky Pacific conducted a trial of Space based ADS-B using a VPN (internet data communication) in which Aireon delivered ADS-B data to the Port Moresby Test and Evaluation system.

2.6.3 The trial demonstrated that deployment of space based ADS-B across the FIR was justified. The benefits were assessed as :

- Reliability of data
- Confidence in application of surveillance-based separation
- Enables more efficient flight through less restrictive separation standards, flexible routing etc.
- Cost effective when balanced against previous costs with ground-based systems

2.6.4 A full service Space based ADS-B service has now been installed, accepted and commissioned. Data is flowing from Aireon and is being used operationally by ATC. Initial commissioning in 2000 was via dual MPLS communication channels. Currently the system is operation with one MPLS and one CRV channel. The operational CRV channel is delivered via satellite. The second CRV channel (MPLS) has been successfully tested and will be commissioned when the 2nd CRV connection at Aireon becomes operational.

2.6.5 Space Based ADS-B is now providing ADS-B coverage over the complete PNG FIR, and also in the 100 NM outside the FIR to support FIR boundary safety as shown by the shaded polygon in Figure 2.

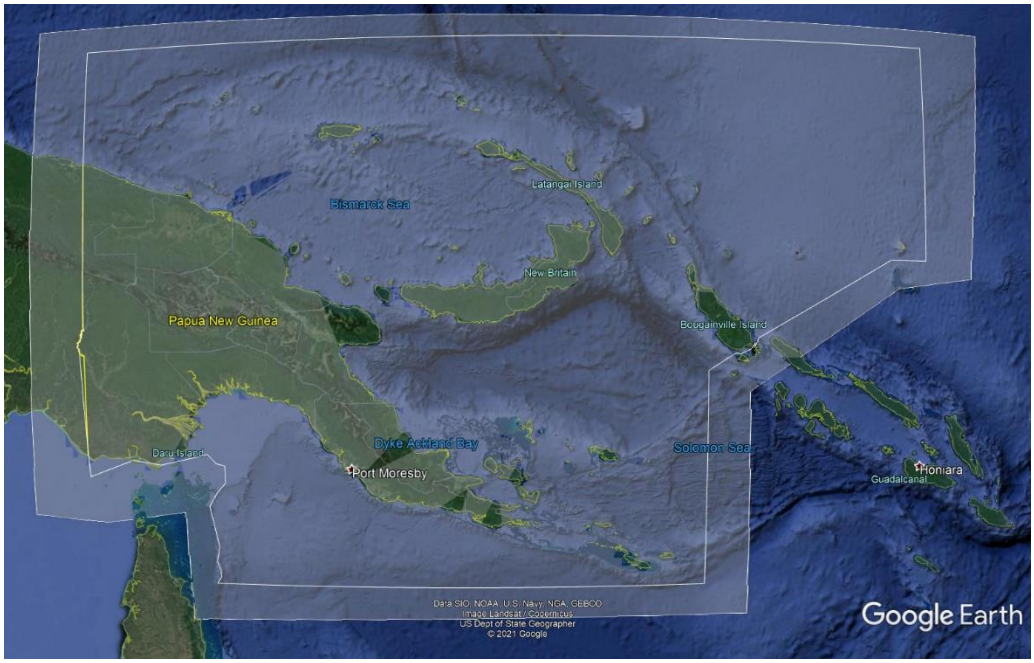


Figure 2 : Complete FIR coverage plus 100 NM

2.6.6 Space based ADS-B is now operating in tandem with the existing radar and ADS-B ground stations. This deployment has significantly improved coverage, safety and efficiency within this airspace. Air Traffic Controllers have advised that they are delighted with the system.

3. ACTION BY THE MEETING

3.1. The meeting is invited to:-

a) take note of the implementation of Space-Based ADS-B system; and

b) discuss any relevant matter as appropriate.

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