International Civil Aviation Organization

TWELFTH MEETING OF THE SOUTH EAST ASIA AND BAY OF BENGAL SUB-REGIONAL ADS-B IMPLEMENTAITON WORKING GROUP (SEA/BOB ADS-B WG/12)

Guangzhou, China, 08 – 10 November 2016

中国民用航空总局
空中交通管理局
Air Traffic Management Bureau.CAAC

Agenda Item 3: **Review implementation and co-ordination activities and sub-regional implementation plans**

3.3) Updates by other States

ADS-B TO RADAR FORMAT CONVERTER – IMPLEMENTATION IN AUSTRALIA

(Presented by Australia)

SUMMARY

This paper provides information about a recently commissioned system which converts ADS-B Asterix Category 21 data to a 'radar like' Asterix Category 34/48 format.

1. Introduction

1.1 This paper describes the implementation in Australia of a new capability to convert ADS-B data into a 'radar like' format, for integration into ATM surveillance platforms which cannot process ADS-B data in Asterix Category 21 format.

1.2 This new capability is planned to be commissioned in the Melbourne terminal area on 3rd November (Southern Australia) to provide an additional ATC surveillance input, and will be used in the Perth terminal area (Western Australia) to support delivery of a 3 nautical separation service. It will also assist the decommissioning of an old 1990's era Mode A/C radar.

2. Background

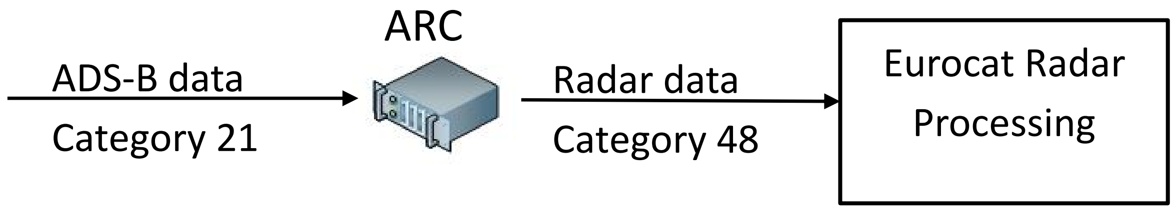
2.1 The Australian ATM system uses separate surveillance processing systems for Enroute (ACC) and Approach (APP) operations. While the enroute surveillance system (partition) can accept and process ADS-B data in Asterix Category 21 (V0.23) format, the approach (terminal area) partition can only accept radar data in Asterix Category 34/48, as well as older legacy radar formats.

2.2 Australia is in the process of replacing the current ATM system (Eurocat). The new ATM system will have capability for all partitions to process a variety of surveillance inputs (radar, ADS-B, multilateration) in a true multi-sensor track fusion processor. Until that is commissioned (circa 2020), there is still the need to include ADS-B surveillance information into the approach partitions to enhance surveillance redundancy and support radar decommissioning.

2.3 Instead of adding an ADS-B processing capability to the approach partition (a quite expensive proposal), Australia decided instead to convert ADS-B data to be 'radar like' and therefore able to be input to the existing multi radar tracking system.

3. System Design

3.1 The ADS-B to Radar Converter (ARC) has been developed by Airservices Australia surveillance and software engineers. The system subscribes to ADS-B data from specified ground stations (identified by SIC and SAC) and converts the position information into a 'radar like' bearing and distance (rho/theta) from a specified 'radar centre'. The ADS-B information received is extrapolated (using velocity data received in the ADS-B messages) to a 'time of detection', associated with an imaginary rotation of this 'radar like' system. The aircraft position information is then output as if being processed by a rotating radar, with Cat 48 track messages being integrated with Cat 34 radar service messages (north crossing and sector messages).



3.2 The ARC can process ADS-B messages from multiple ADS-B ground stations. The 'radar like' output from the ARC is limited to 256nm (range limit in the Asterix Cat 48 message structure), however, unlike a traditional radar, it is not limited to 'line of sight' from the radar centre. By using multiple ADS-B ground stations in different locations, the coverage from the ARC will be much better at lower altitudes than a traditional radar.

3.3 The ARC performs a number of processes to create its output:

3.3.1 Receiving ADS-B data from a number of ADS-B sites which can contribute coverage within the 256nm range limit of the ARC.

3.3.2 Using ICAO aircraft address, matches ADS-B reports from multiple ADS-B ground stations to avoid creation of duplicate track outputs.

3.3.3 Converting the ADS-B position into a 'slant range' position (bearing/distance) from the nominated radar centre.

3.3.4 Converting received Asterix Category 21 message elements to their corresponding Category 48 data item.

3.3.5 Including Mode A code received in DO-260B ADS-B messages in the track output.[1] Where no Mode A code is received, the 'invalid Mode A' is set in the track message, with the code set to A0000.

3.3.6 Then an ADS-B emergency is reported by an aircraft, the ARC sets the Mode A code to its respective emergency indication (A7500/7600/7700).

[1] The ADS-B Ground station can also derive Mode A code from replies to Mode S radar interrogations (DF=5 or DF=21). This capability has not been enabled at this time due to some encoding errors in the Cat 21 ground station output observed during testing – these are still under investigation.

3.3.7 Synchronizes track message output with a 'radar like' rotation, where the output includes Category 34 radar service messages to simulate the rotation. The rotation rate is configurable, but has been set to 30RPM (2 second rotation period).

3.4 Only ADS-B equipped aircraft data can be processed by the ADS-B to Radar converter. In Australia, all IFR aircraft will be ADS-B equipped, however aircraft that operate under the VFR will not (note that for VFR operations in controlled airspace, they do require an SSR transponder). This means the ARC is usually not useful for VFR aircraft, but as the majority of aircraft in controlled airspace are IFR, the ARC still provides a useful surveillance input. Traditional radar is still required to support ATC operations, but the ARC is a useful as a risk mitigation against traditional radar failure – certainly better than no surveillance at all.

3.5 Many of the ARC track messages do not include a valid Mode A code (because the aircraft do not transmit this in the DF17 messages). The Eurocat ATM system correlates radar tracks from multiple sensors using attributes such as ICAO Aircraft Address, Mode A code, position, speed, and potentially altitude. During testing of the new system, it was observed that if a valid Mode A code was not available, correlation between older Mode A/C radar tracks and the ARC tracks would not occur. Airservices has requested a small software modification of the Eurocat system to improve this correlation. In the meantime, the ARC data is not being used in areas of overlapping Mode A/C only radar coverage.

3.6 The use of a high 'rotation rate' of 30 RPM allows for improved aircraft tracking, with track updates twice as fast as a traditional radar. This will provide improved aircraft tracking during maneuvering in approach airspace – though not quite as good as true ADS-B, which provides a 1 second update rate to the ATM system.

4. Action by the Meeting

4.1 The meeting is invited to

a) note the latest implementation of ADS-B (converted to radar like) in Australia.

b) note that the solution is 'sub optimal' and only used due to the ATM system for approach services not being able to process ADS-B data in it's original form; and

c) discuss any relevant matters as appropriate.

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