International Civil Aviation Organization

AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST SEMINAR AND THIRTEENTH MEETING OF AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) STUDY AND IMPLEMENTATION TASK FORCE (ADS-B SITF/13)

Hong Kong, China, 22 - 25 April 2014

Agenda Item 4: Review Subject/Tasks List and action items:

TASK LIST: ADS-B DATA RVSM SAFETY MONITORING

(Airservices Australia)

SUMMARY

This paper provides an update on Australian use of ADS-B for RVSM monitoring

1. INTRODUCTION

1.1 At SITF/12 ADS-B Subject Task list 9 (His No 39) requires States to report experience in using ADS-B data for performing safety monitoring including RVSM aircraft height keeping. This paper responds to that request.

2. DISCUSSION

Australian Airspace Monitoring Agency (AAMA)

2.1 The Australian Airspace Monitoring Agency (AAMA) operated by Airservices Australia on behalf of ICAO, is one of 5 Asia/Pacific Regional Monitoring Agencies. The AAMA has led the world in the development and implementation of aircraft height-keeping monitoring and determination of Altimetry System Error (ASE) using ADS-B.

2.2 The principle used is to use the ADS-B geometric altitude (GPS derived) and environment pressure data to validate the Barometric based Flight level, which is also transmitted in ADS-B messages.

2.3 In undertaking this activity, the AAMA has developed means by which to determine the geoid height reference of the aircraft. This is the height assumption of the GNSS system as Height Above Mean Sea Level (HAMSL) or Height Above Ellipsoid (HAE). The difference between HAE and HAMSL varies over the Earth's surface by +/- 200 ft and data analysed by the AAMA has determined there is significant variance across aircraft and aircraft fleets in relation to the reference used.

2.4 The AAMA has been actively utilising ADS-B data to assess ASE since 2010 using data obtained from Airservices' ADS-B network and data from a small number of ground-stations in Indonesia (Bali) but used by Australian ATC. Aircraft that were seen only in this Indonesian data were not examined in our monitoring analysis. Data from the Indonesian ground

stations were used as part of the ASE analysis for aircraft also seen in Australia, in order to assist in determining the geoid height reference. With support from ICAO, the AAMA has recently reached agreement with the DGCA of Indonesia for that State to provide ADS-B data to the AAMA for the purposes of height-keeping monitoring of all ADS-B equipped aircraft operating within the Indonesian FIRs.

2.5 In December 2012 the Monitoring Agency Asia Region (MAAR) based in Bangkok, commenced using ADS-B for height-keeping monitoring and it is understood that the China Regional Monitoring Agency is also well advanced in developing this capability. Additionally the AAMA is shortly to provide support to the North Atlantic Central Monitoring Agency to implement ADS-B height-keeping monitoring. The importance of regional cooperation and data sharing cannot be overstated, as it enables ICAO designated monitoring agencies utilising ADSB monitoring to more easily determine the geoid height reference by providing a greater geographical range and an improved estimation of the ASE.

2.6 To date, the AAMA has monitored over 2800 individual airframes representing more than 122 operators and in excess of 4 billion separate data points, each of which has an associated ASE calculation. The data resulted in excess of 200 million minutes of monitoring output.

2.7 Cooperation between MAAR, China RMA and AAMA has allowed the geoid height reference for some aircraft to be determined where individually each RMA has insufficient data, since the ADS-B based techniques require large quantities of data from a range of geographic regions.

2.8 The ability to monitor a large number of aircraft daily has enabled the AAMA and MAAR to identify aircraft whose height keeping performance is degrading over time. The operators of these aircraft were notified allowing the issue to be resolved during regular maintenance before the aircraft's performance deteriorates to unsafe levels. This degradation is thought to be due to debris accumulation in the pitot-tubes and can cause an aircraft's height keeping to reach safety limits over a time span of 1-2 years. Continuing monitoring using ADS-B hence improves safety outcomes and is cost-beneficial to the operator compared to previous techniques. Typically degradation is restricted to particular aircraft types allowing for targeted monitoring and maintenance.

2.9 Using ADS-B for height monitoring has overcome numerous technical hurdles including: determining the geoid height reference; correcting data for bias due to ionosphere-induced errors in GNSS signals, position and time of day; developing statistical methods for small-data samples; and, the ability to efficiently analyse very large data sets (approximately 120 GB of data per month).

2.10 The AAMA uses some computer-code written by the FAA and this assistance is gratefully acknowledged.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

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