INTERNATIONAL CIVIL AVIATION ORGANIZATION

Second Meeting of the Africa - Indian Ocean Aviation System Planning and Implementation Group (AASPG/2)

Livingstone, Zambia, 2 - 6 November 2026

Agenda Item 4: Implementation of air navigation goals, targets and indicators, including the priorities set in the regional air navigation plan

ARMA ADS-B HEIGHT MONITORING SYSTEM (AHMS)

(Presented by ARMA)

SUMMARY	
With the official endorsement of the ADS-B Height Monitoring methodology by ICAO, it becomes possible to utilize ADS-B data for the calculation of the Altimetry System Error (ASE) to meet ICAO requirement for aircraft operating in RVSM airspace related to periodic monitoring on height-keeping performance. The existing methods to estimate aircraft ASE include use of a portable device, Enhanced GPS Monitoring Unit (EGMU), or ground-based systems called Height Monitoring Unit (HMU). The use of ADS-B data for height-keeping performance monitoring, on top of providing enhanced and alternative means of surveillance, will provide another option for height monitoring and keeping performance as per ICAO Annex 6 Part 1 requirement. States are encouraged to provide access to archived ADS-B data to ARMA to support the height-keeping performance monitoring for RVSM approved aircraft registered within and outside the ICAO AFI region. Action by the Meeting is in paragraph 3.	
Strategic Objectives	*A. Every Flight is Safe and Secure* *C. Aviation Delivers Seamless, Accessible, and Reliable Mobility for All* *F. The Economic Development of Air Transport Assures the Delivery of Economic Prosperity and Societal Well-Being for All*
References	- ICAO Annex 6, Part 1. - ICAO Doc 9574 - ICAO Doc 9937 - Guidance Material for the continued safe monitoring of AFI RVSM Airspace.

1 INTRODUCTION

1.1. Altimetry System Error (ASE) is the difference between the altitude indicated by the altimeter display, assuming a correct altimeter barometric setting, and the pressure altitude corresponding to the undisturbed ambient pressure (i.e; local station QNH or standard QNE). In airspace where RVSM applied, the importance of accurate aircraft height-keeping performance is magnified. Aircraft use a barometric altimeter to determine height and follow common pressure levels in RVSM airspace. The errors in the aircraft altimetry sensing systems are not apparent during routine operations as the altimeter displays to the aircrew and Air Traffic Control a flight level which contains the ASE. Due to the existence of aircraft ASE, the observed flight level by

the pilot and ATC is different than the actual height of the aircraft.

1.2. The altimetry system utilizes parts that can degrade in performance over time (e.g., the pitot-static probe); can be damaged (e.g., skin flexing/deformation during operations); and can be affected by modifications made to the airframe (e.g., the application of paint or mounting of accessories in the vicinity of the static pressure port). These activities can affect in a negative way the performance of altimetry system onboard aircraft, producing a significant error in true height. Since the ASE is not detectible in routine operations; ICAO adopted two methods to measure aircraft ASE, either by the Enhanced GPS Monitoring Unit (EGMU) or by the Height Monitoring Unit (HMU). The ADS-B Height Monitoring System (AHMS) is now adopted by ICAO as another method to measure aircraft ASE, for height-keeping performance monitoring.

2. DISCUSSION

2.1. Using ADS-B for height-keeping performance monitoring in the AFI region requires that the aircraft employ ADS-B Out and operate within the coverage area of a state with ground and/or space-based receiver infrastructure. In comparison to other existing ground-based monitoring systems, such as the Height Monitoring Units (HMU) and Aircraft Geometric Height Monitoring Element (AGHME), which have a coverage area of approximately 40 NM, the defined coverage area of the monitoring system utilizing ADS-B data is much larger. The coverage area for a single ADS-B ground station could reach approximately 200NM.

2.2. ADS-B monitoring is undertaken by processing large data sets of ADS-B messages captured in the coverage area of ADS-B Network. The data is processed to enable the calculation of Altimetry System Errors (ASEs) for each ADS-B message obtained from a specific aircraft or group of aircraft. The value is then assessed to calculate ASE for each observed aircraft.

2.3. The process of collecting this data is entirely passive and does not necessitate any special arrangements with aircraft operators, as long as the aircraft comply with monitoring requirements. There is no need for direct interaction with flight crews.

This passive data collection approach ensures flexibility and minimizes disruptions to regular flight operations. It allows for frequent ASE measurements without significantly affecting processing times.

2.4. ARMA acknowledges and appreciates the support of NAARMO on the testing and trials of ADS-B Height Monitoring System (AHMS) operations within the AFI region, utilising archived ADS-B data provided by ATNS, South Africa.

2.5. ARMA requests all member States currently implementing ADS-B operations for flight monitoring or management, to share archived data for height-keeping performance analysis. The AHMS is the most cost effective and efficient process of assessing aircraft ASE. The analysis process is a post operational activity.

3 ACTION BY THE MEETING

3.1. The meeting is invited to:

a) review and discuss the contents of this working paper;
b) encourage States to share their archived ADS-B data with ARMA for RVSM height monitoring; and
c) agree on ARMA's implementation of hybrid height monitoring program.

END