International Civil Aviation Organization

Middle East Regional Monitoring Agency Board

Twenty-first Meeting (MIDRMA Board/21)
(Cairo, Egypt, 14 – 15 January 2026)

Agenda Item 5: RVSM Monitoring and Related Technical Issues

ESTABLISHMENT OF A STANDARD CRITERION FOR VALID HEIGHT MONITORING USING THE ADS-B HEIGHT MONITORING SYSTEM (AHMS)

(Presented by the MIDRMA)

SUMMARY

This paper presents the continued progress achieved by the Middle East Regional Monitoring Agency (MIDRMA) in the regional implementation of the ADS-B Height Monitoring System (AHMS) across the ICAO Middle East Region. It highlights the successful cooperation with the Civil Aviation Authorities (CAAs) of Bahrain, Oman, and Kuwait, and the positive technical outcomes achieved during the AHMS testing and validation phases.

Building on this progress, the paper addresses the absence of a globally defined ICAO standard specifying the minimum number of valid AHMS monitoring results required for an aircraft to be formally recognized as successfully height-monitored for RVSM purposes. In response, the MIDRMA proposes the establishment of a standard regional criterion defining the minimum number of valid AHMS results necessary to ensure statistical reliability and long-term confidence in aircraft height-keeping performance.

The proposed criterion is based on MIDRMA technical studies and operational experience and aims to promote consistency, transparency, and harmonization in RVSM height-monitoring practices across the Middle East Region.

Action by the meeting is at paragraph 3.

REFERENCES

- MIDRMA Board/20
- ICAO Docs 9574 and 9937
- MIDANPIRG/21 Report

1. INTRODUCTION

1.1 The implementation of the ADS-B Height Monitoring System (AHMS) represents a significant advancement in the evolution of Reduced Vertical Separation Minimum (RVSM) height-monitoring methodologies. AHMS provides a continuous, data-driven capability to assess aircraft height-keeping performance through ADS-B information, complementing and, where appropriate, reducing reliance on traditional monitoring techniques such as Enhanced GPS Monitoring Units (EGMU), Height Monitoring Units (HMU), and Aircraft Geometric Height Measurement Elements (AGHME).

1.2 In line with the decisions of the ICAO Middle East Air Navigation Planning and Implementation Regional Group (MIDANPIRG) and the MIDRMA Board, the Middle East Regional Monitoring Agency (MIDRMA) has made substantial progress in the regional implementation and technical validation of AHMS. This progress has been achieved through close cooperation with several Civil Aviation Authorities (CAAs) in the region and has demonstrated the system's capability to generate reliable and repeatable height-monitoring results across a wide range of aircraft types and operational environments.

1.3 The results obtained during the AHMS validation and testing phases have confirmed that the system is capable of supporting large-scale, routine RVSM monitoring activities. AHMS enables the accumulation of multiple independent monitoring results for individual aircraft through normal flight operations, thereby enhancing the statistical confidence in the assessment of long-term aircraft height-keeping performance.

1.4 Notwithstanding these technical achievements, there is currently no globally defined ICAO requirement specifying the minimum number of valid AHMS monitoring results necessary for an aircraft to be formally recognized as successfully height-monitored for RVSM purposes. In the absence of such guidance, Regional Monitoring Agencies (RMAs) are required to establish their own operational criteria to ensure consistency, reliability, and transparency in the application of AHMS.

1.5 To address this gap and promote harmonized implementation within the ICAO Middle East Region, the MIDRMA proposes the establishment of a standard regional criterion defining the minimum number of valid AHMS monitoring results required to confirm an aircraft's RVSM height-keeping performance. This proposed criterion is based on MIDRMA technical studies, operational experience, and statistical analysis and is intended to ensure an appropriate balance between data sufficiency, monitoring reliability, and operational practicality.

2. DISCUSSION

Regional AHMS Implementation and Technical Maturity

2.1 The MIDRMA expresses its appreciation to the Civil Aviation Authorities that supported the AHMS validation and testing activities, which enabled the Agency to assess the system's performance under a wide range of operational conditions. The outcomes of these activities demonstrated that AHMS is capable of producing accurate, stable, and repeatable height-monitoring results suitable for large-scale RVSM monitoring.

2.2 The ability of AHMS to collect monitoring results through routine flight operations, without requiring special flight planning or dedicated airborne equipment, makes it a highly efficient and cost-effective solution for long-term RVSM compliance monitoring across the Middle East Region.

Need for a Harmonized Validation Criterion

2.3 Despite the demonstrated technical maturity of AHMS, ICAO guidance material does not currently define a standardized requirement specifying the minimum number of valid AHMS monitoring results necessary to confirm that an aircraft has been successfully height-monitored for RVSM purposes. As a result, Regional Monitoring Agencies may apply differing thresholds, potentially leading to inconsistencies in monitoring practices and interpretations.

2.4 To ensure uniformity, transparency, and technical consistency within the ICAO Middle East Region, it is essential to establish a single, clearly defined regional criterion that can be applied consistently by the MIDRMA and understood by States and operators alike.

MIDRMA Technical Studies and Statistical Basis

2.5 The MIDRMA conducted detailed technical studies and statistical analyses based on validated AHMS datasets collected during the system implementation and testing phases. These analyses examined the stability of Altimetry System Error (ASE) values across multiple independent flight samples and assessed the level of statistical confidence achieved as the number of valid monitoring results increased.

2.6 The results demonstrated that a minimum of **five (5) valid AHMS monitoring results** per aircraft provides an optimal balance between statistical reliability and operational practicality. This threshold ensures sufficient independent samples to confirm the long-term stability of an aircraft's height-keeping performance while allowing results to be accumulated naturally through normal flight operations.

Technical Requirements for Valid AHMS Monitoring Results

2.7 To qualify as a valid AHMS monitoring result, each flight segment must satisfy established quality and integrity criteria, including:

a. Sufficient ADS-B data density to enable accurate comparison between geometric and barometric altitude.
b. Compliance with data quality thresholds related to completeness, time synchronization, and flight segment stability; and
c. Altimetry System Error (ASE) and Total Vertical Error (TVE) values within the acceptable limits defined for RVSM operations.

2.8 When five (5) such valid monitoring results are obtained, preferably within a defined operational time window and across varied traffic conditions or routes, the aircraft may be considered successfully height-monitored using AHMS.

Operational Benefits of the Proposed Criterion

2.9 The establishment of a standard regional criterion for valid AHMS height monitoring will:

a. Ensure a consistent and transparent approach to RVSM height-monitoring assessments across all MIDRMA Member States.
b. Provide clarity and predictability for aircraft operators and Civil Aviation Authorities.
c. Enhance confidence in AHMS-based monitoring outcomes; and
d. Support the long-term sustainability of RVSM monitoring activities by reducing reliance on ad-hoc or aircraft-specific monitoring arrangements.

2.10 In view of the technical maturity achieved by the ADS-B Height Monitoring System (AHMS) and the results of MIDRMA's validation activities, it is considered necessary to formalize a standard regional criterion defining when an aircraft may be recognized as successfully height-monitored using AHMS. Establishing a minimum threshold of valid monitoring results provides a transparent and consistent basis for assessing aircraft height-keeping performance and ensures adequate statistical confidence in AHMS-derived outcomes. The proposed criterion also supports harmonized application of AHMS across the ICAO Middle East Region and facilitates the continued expansion of AHMS monitoring coverage through effective cooperation between the MIDRMA and its Member States.

DRAFT CONCLUSION 21/XX: ESTABLISHMENT OF A STANDARD CRITERION FOR VALID HEIGHT MONITORING USING AHMS

That,

a) each aircraft shall be considered officially height-monitored using AHMS when a minimum of five (5) valid successful AHMS monitoring results have been obtained within a 90-day period, meeting all required ASE and TVE validation thresholds; and

b) MIDRMA Member States are encouraged to ensure that the responsible airworthiness inspectors adequately brief and inform the concerned aircraft operators of this standard criterion and its application for RVSM height-monitoring recognition using AHMS.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the progress achieved by the MIDRMA in the implementation and testing of the ADS-B Height Monitoring System (AHMS); and

b) review and agree on the establishment of a standard regional criterion for valid RVSM height monitoring using AHMS, as set out in the draft conclusion in para 2.6 above.

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