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International Civil Aviation Organization

UNDP/ICAO Regional Project RLA/98/003
Transition to the CNS/ATM Systems in the CAR and SAM Regions

Fifth Meeting/workshop of Air Traffic Management (ATM) Authorities and Planners for RVSM, RNAV routes and RNP implementation in the CAR and SAM Regions (AP/ATM/5 RVSM-RNAV-RNP)

(Panama, Panama, 18 to 20 June 2003)

Agenda Item 4: **Review of the matters related to RVSM Implementation in the CAR/SAM Regions**

b) Safety and Airspace Monitoring Working Group (SAM/WG)

Minimum Monitoring Requirements

(Prepared by CARSAMMA)

(Presented by Brazil)

Summary

This working paper presents the ICAO recommendation about aircraft monitoring and proposes to update the list of Minimum Monitoring requirements for the CAR/SAM Regions.

1. Introduction

1.1 The approval process of an aircraft to fly in an airspace where the RVSM is or will be implemented is necessary to guarantee the safety of the operations and to provide information that will be used in the risk analysis.

1.2 Depending on the type of aircraft and the experience of the operator there are a minimum number of aircrafts that must be monitored to provide information about the height keeping performance of the fleet to be approved.

1.3 Since RVSM TF3 the group decided to adopt the minimum monitoring requirements established by APARMO due to its great experience in that field.

1.1. The purpose of this working paper is to propose a modification in the list of Minimum Monitoring Requirements for the aircrafts and operators based in the CAR/SAM Regions.

2. **Discussion**

2.1 In a state letter sent to States in the last February (copy in annex) ICAO has stated that in some of the initial RVSM implementation monitoring of height-keeping performance was a prerequisite for approval.

2.2 It was considered prudent to require this in the early implementation until an adequate database of aircraft height-keeping performance could be accumulated.

2.3 This requirement can now be removed, considering that nowadays States and Organizations in charge of equipment installation and approval process, already have a great experience in this field, and a big database has already been established.

2.4 In this sense, it is proposed to update the list of Minimum Monitoring Requirements for the CAR/SAM Regions as shown below:

CATEGORY		AIRCRAFT TYPE	MINIMUM OPERATOR MONITORING FOR EACH AIRCRAFT GROUP
MONITORING NOT REQUIRED PRIOR TO THE GRANT OF RVSM APPROVAL			
3	OPERATORS OF AIRCRAFT TYPES SHOWN IN THE BLOCK TO THE RIGHT	Other group or non –group aircraft other than those listed above including: A124, ASTR, B707, B731, B732, C525, C560, C650, C750, DC8, DC9, E145, FA10, FA20, F100, GLF2, GALX, H25A, H25C, IL62, LJ31, LJ35, LJ55, MD90 or new aircraft types from a manufacturer **without** a demonstrable track record of the production of MASPS compliant airframes.	60% of target number of airworthiness approved, same type, airframes of each operator to be monitored **or** individual monitoring of airworthiness approved airframes of a given operator. Monitoring to be completed as soon as possible but **not later then 3 months** after the issue of RVSM operational approval or not later then 3 months after the start of CAR/SAM RVSM operations, whichever occurs later.

3. **Conclusion and recommendation**

3.1 The group is invited to analyze the proposed change in the Minimum Monitoring Requirements list and, if agreed, update and send it to CAR/SAM States through the ICAO Regional Offices.

ICAO STATE LETTER

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28 February 2003

Subject: Approval and monitoring requirements for aircraft operations in RVSM airspace

Action required: As indicated in paragraph 9.

Sir/Madam,

1. I have the honour to draw your attention to certain aspects of the requirements associated with the approval of aircraft and operators for operations in airspace where a reduced vertical separation minimum (RVSM) of 300 m (1 000 ft) is applied above Flight Level 290, and the height monitoring programs which are instituted in RVSM airspace.

Approval of aircraft and operators for RVSM operations

2. The requirements and procedures for RVSM were developed by the Air Navigation Commission's Review of the General Concept of Separation Panel (RGCSP), which has since been renamed the Safety and Airspace Separation Panel (SASP). These requirements and procedures were derived from safety studies conducted by this panel, and are contained in the *Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive* (Doc 9574). In order to ensure that the overall safety objectives for the ATS system can be met in airspace where RVSM is implemented, all aircraft operating in the airspace are required to hold an approval, issued by the State of the Operator or State of Registry as appropriate, indicating that they meet all the technical and operational requirements for such operations. The criteria on which these approvals are based can be found in Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL) No. 6, *Guidance Material on the Approval of Aircraft and Operators for Flight in Airspace above Flight Level 290 where a 300 m (1 000 ft) Vertical Separation Minimum is Applied*; Federal Aviation Administration (FAA) Document 91-RVSM, *Interim Guidance on the Approval of Operators/Aircraft for RVSM Operations;* or similar documents issued by other States which have implemented RVSM approval procedures.

Operating procedures

3. It should be noted that RVSM approvals are valid globally. The technical performance requirements are common to all RVSM implementations. This should also apply to operating procedures insofar as this is possible. However, there may be some cases where differences are unavoidable; for example, contingency and weather deviation procedures in oceanic versus high density continental airspace. In such cases, the States concerned will need to ensure that all other State authorities responsible for issuing RVSM approvals, and all flight crews of aircraft with existing RVSM approvals which could operate in the airspace, are made aware of the differences.

Systems performance monitoring

4. Doc 9574 indicates that there is a need for system performance monitoring during both implementation planning and the post-implementation operational use of RVSM. The principles and procedures for monitoring are described in Chapter 6 of Doc 9574. In all regions where RVSM has been implemented, Regional Monitoring Agencies (RMA) have been established, by the appropriate Planning and Implementation Regional Groups (PIRGS), to undertake these functions. The objectives of the RVSM monitoring program, as described in paragraph 3.3 e) of Doc 9574, include, inter alia:

a) verification that the RVSM approval process remains effective;

b) verification that the target level of safety will be met on implementation of RVSM, and will continue to be met thereafter;

c) monitoring the effectiveness of the altimetry system modifications which have been implemented to enable aircraft to meet the required height-keeping performance criteria; and

d) evaluation of the stability of altimetry system error (ASE).

5. In some of the initial implementations of RVSM, monitoring of height-keeping performance was a prerequisite for approval. This is not a requirement in Doc 9574, JAA-TGL6 or FAA 91-RVSM; however, it was considered prudent to require this in the early implementations until an adequate database of aircraft height-keeping performance could be accumulated. If any such requirements for height monitoring prior to issuance of an approval still exist in State documentation, they can now be removed.

6. States are also reminded of the need to ensure that details of all RVSM approvals issued are notified promptly to the appropriate RMA, so that the approvals databases maintained by these bodies will be as up-to-date as possible.

7. While monitoring prior to issuance of the RVSM approval is not necessary, all RVSM approved operators are required to participate in the monitoring program. The guidance on the approval process contained in JAA TGL-6 and FAA 91-RVSM requires an operator to submit a plan for participation in the monitoring program as part of the application for approval. Compliance with this monitoring plan is a condition for maintenance of the RVSM approval.

8. When an operator is found not to be complying with the requirements of the monitoring plan, or when the height-keeping performance of a particular aircraft or an aircraft type group is found, as a result of monitoring, to be exceeding the prescribed limits, the RMA will notify, as appropriate, the aircraft operator in question and the appropriate State authorities as described in the Attachment to this letter. The RMAs are bodies which operate within the framework of the ICAO regional planning and implementation process, and play an essential role in ensuring the safety of RVSM operations. On receipt of such a notification from an RMA, the operator and the responsible State authority should take immediate action to resolve the matter. If an immediate solution to the problem cannot be found, the appropriate action may involve revoking the RVSM approval for that operator, aircraft, or aircraft type(s) if the group limits have been exceeded, until the problem is rectified.

9. The Attachment to this letter contains additional explanatory material on the monitoring process, the required height-keeping performance criteria, and the role of RMAs.

10. All States are requested to ensure that their regulations and procedures concerning the approval of aircraft and operators for operation in RVSM airspace adequately take into account the matters raised in this letter.

Accept, Sir/Madam, the assurances of my highest consideration.

for D/ANB
R.C. Costa Pereira
Secretary General

Enclosure:
Explanatory material on RVSM
height-keeping monitoring procedures
and performance criteria

ATTACHMENT to State letter AN 13/11.1-03/6

EXPLANATORY MATERIAL ON RVSM HEIGHT-KEEPING MONITORING PROCEDURES AND PERFORMANCE CRITERIA

Height-keeping performance requirements

Separate performance criteria have been specified for individual aircraft, and aircraft type groups[1]. The prescribed performance limits are:

Individual aircraft:	ASE ≤ ±245 ft TVE ≤ ±300 ft
Aircraft type groups:	mean ASE ≤ ±80 ft mean ASE + 3 standard deviations ≤ 245 ft

The monitoring process

Monitoring of aircraft height-keeping performance may be done by either a ground-based Height Monitoring Unit (HMU) or a portable GPS Height Monitoring Unit (GMU), which is carried on board the aircraft. In regions with HMUs, aircraft operators may meet the monitoring requirements without any specific action on their part, other than ensuring that the aircraft undertakes a flight within the area of coverage of an HMU within the time period within which monitoring should take place. For monitoring with the portable GMUs, operators need to arrange for a monitoring flight. RMAs will notify operators sufficiently in advance regarding the time scales when specific aircraft require monitoring.

In both methods of monitoring, the aircraft's flight level is converted to a geometric height above the geoid, using current meteorological data, and this height is compared to the aircraft's geometric height as measured by the height monitoring system. This comparison gives the Total Vertical Error (TVE). There are two components to TVE, Altimetry System Error (ASE) and Assigned Altitude Deviation (AAD). AAD can also be determined by the height monitoring system (using Mode C information in the case of a ground-based HMU). Subtracting AAD from TVE gives the ASE. RMAs are therefore able to monitor both TVE and ASE.

In assessing compliance the height-keeping performance requirements, an appropriate correction is applied by the RMA to take into account the measurement error of the monitoring system used.

When the measurements indicate that the performance of an individual aircraft is outside the permissible limits, the RMA will, as soon as practicable, notify the operator as well as the State authority responsible for issuance of the RVSM approval. When the measurements over a large number of different aircraft in the same aircraft type group indicate that the group performance requirements are not being met, the RMA will notify the aircraft manufacturer or type certificate holder of the aircraft group in question, and also notify the State authority responsible for the approval or certification of the RVSM solution for that aircraft group.

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In the case of an observed error by an individual aircraft, the action to be taken by the operator and the relevant State authority will depend on whether the occurrence was the result of a flight crew or ATC error, or an aircraft system problem. When the group performance limits are exceeded, the relevant State authority and the aircraft manufacturer or provider of the RVSM solution for the aircraft type will need to take action to identify and rectify the problem. Unless the cause can be immediately identified and remedied, the appropriate initial action would be for the RVSM approval for that aircraft type group to be withdrawn until the performance problem has been appropriately addressed.

If the permissible limits for group ASE performance are exceeded, it will have serious consequences for both the safety of operations and the approval status of all aircraft in that group. It has therefore been agreed that an RMA should notify the type certificate holder and responsible State authority when an aircraft group's mean ASE + 3 standard deviations exceeds 200 ft, so that remedial action can be initiated before the group ASE exceeds the permissible limits.

— END —