



*International Civil Aviation Organization*

**The Twenty-First Meeting of the Regional Airspace Safety Monitoring  
Advisory Group (RASMAG/21)**

Bangkok, Thailand, 14-17 June 2016

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**Agenda Item 2: Review Outcomes of Related Meetings**

11<sup>th</sup> Regional Monitoring Agencies Coordination Group (RMACG/11) meeting

(Presented by RASMAG Chair)

**SUMMARY**

This paper provides information of the 11<sup>th</sup> Regional Monitoring Agencies Coordination Group (RMACG/11) meeting held in Montreal in May 2016.

## 1. INTRODUCTION

1.1 The Eleventh Meeting of the Regional Monitoring Agencies Coordination Group (RMACG/11) was held from 16-20 May 2016 at Montreal, Canada. Twenty participants representing ten Regional Monitoring Agencies attended the meeting.

## 2. DISCUSSION

2.1 During RMACG/11 the participants reviewed and discussed forty-six papers covering a wide range of topics relevant to the work of the global RMAs. In particular the meeting was informed that the EUR RMA and RMA EURASIA had drafted a new EUR Document<sup>34</sup>, which contains guidance material related to the continued monitoring of RVSM airspace in Europe. The document is intended to provide material of benefit to State representatives who are charged with coordinating actions and data exchange with their State's accredited RMA. In particular the document introduces the concept of the bulletin of non-approved aircraft to support States to identify such aircraft which may be operating within their airspace, the latter being something that RASMAG has discussed at previous meetings.

2.2 The RMACG/11 endorsed the document as a useful resource and discussed the suitability of using EUR DOC. 34 as a template for other regions to publish similar documents. As a result of these discussions, the Chair of RASMAG agreed to draft a version of the document for applicability within the Asia/Pac region and provide that to RASMAG for consideration. The first draft of the document is provided at Attachment 1.

2.3 The RMACG/11 also reviewed the June 2015 RVSM Minimum Monitoring Requirements (MMR) Chart, as agreed during the tenth meeting of the RMA Coordination Group (RMACG/10), and as reviewed by the FAA and Eurocontrol. The meeting discussed various aspects of the chart in some detail and endorsed an updated MMR for distribution by RMAs. A copy of the new MMR is provided at Attachment 2.

2.4 Other significant actions/activities addressed by the meeting included:

- a) Reports of identified non-approved airframes operating with RVSM approval status and endorsement of a template based on a form developed by MAAR for Asia/Pac RMAs to report to States non-approved airframes;
- b) Reviewed a number of analyses of comparative altimetry system error data from RMAs and agreed to continue ongoing comparative analyses to better inform group performance;
- c) Review of a number of papers that presented height-keeping performance data using ADS-B;
- d) Reviewed data related to observed changes in the altimetry system error of A320 aircraft and the detailed work undertaken by involved RMAs to resolve the issues with State authorities and operators;
- e) Noted and reviewed the planned presentation to SASP/28 of a paper proposing a methodology to account for the erroneous use of RVSM designators in the vertical collision risk assessment; and
- f) Discussed the planned Altimetry System Error Workshop to be held in September 2016 at the FAA Technical Center in Atlantic City and considered whether a similar activity could be planned for Asia/Pac in 2017.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited note the information provided in regards to the successful RMACG/11 meeting and:

- a. Review the initial draft document at Attachment 1 and agree to the development of new RVSM monitoring guidance material for Asia/Pac based on the EUR 034 document;
- b. Review and endorse the new MMR Chart provided at Attachment 2 for applicability in Asia/Pac; and
- c. Discuss the viability of holding in 2017 in Asia/Pacific region an ASE Workshop along the lines of previous and planned workshops held in Europe and the United States.

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**Doc XX**

## **GUIDANCE MATERIAL FOR THE CONTINUED SAFETY MONITORING OF THE ASIA-PACIFIC RVSM AIRSPACE**

**Version 1.0**

June 2016

*Prepared by the ICAO European and North Atlantic Office  
on behalf of the European Air Navigation Planning Group (EANPG)*

## FOREWORD

Xxx is published by the Asia and Pacific Office of ICAO, on behalf of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG).

The Guidance material will be updated from time to time by the Regional Airspace Safety Monitoring Advisory Group (RASMAG) and amendments will be issued accordingly.

AMENDMENT HISTORY		
Version No.	Date	Originating

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## LIST OF DEFINITIONS

*The following definitions are provided in order to clarify certain specialised terms used in this document:*

<b><u>Accredited States</u></b>	Those States within an RVSM region which are collectively responsible for coordination, through a single Regional Monitoring Agency, for the implementation of APANPIRG RVSM safety policy, decisions, exchange of RVSM approvals, large height deviations, long term height-keeping monitoring data and other RVSM related information.
<b><u>Accredited RMA</u></b>	An RMA, established by APANPIRG, to which a State is accredited for the coordination of RVSM related issues.
<b><u>Altimetry System Error (ASE)</u></b>	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.
<b><u>Assigned Altitude Deviation (AAD)</u></b>	The difference between the transponder Mode C altitude and the assigned altitude/flight level.
<b><u>Automatic Altitude Control System</u></b>	Any system which is designed to automatically control the aircraft to a referenced pressure altitude.
<b><u>General Air Traffic (GAT)</u></b>	Flights conducted in accordance with the rules and provisions of ICAO.
<b><u>Collision Risk</u></b>	The expected number of mid-air aircraft accidents in a prescribed volume of airspace for a specific number of flight hours due to loss of planned separation.  <u>(Note - one collision is considered to produce two accidents.)</u>
<b><u>Height-Keeping Capability</u></b>	Aircraft height-keeping performance which can be expected under nominal environmental operating conditions with proper aircraft operating practices and maintenance.
<b><u>Height-Keeping Performance</u></b>	The observed performance of an aircraft with respect to adherence to cleared flight level.
<b><u>Hexadecimal Number Format</u></b>	A representation of a 4 bit binary number (0-15 in decimal) by use of numbers 0 to 9 and letters A to F
<b><u>Large Height Deviation</u></b>	A deviation of 300 ft. (90 m) or more in magnitude from a cleared Flight Level.
<b><u>Operational Air Traffic (OAT)</u></b>	Flights which do not comply with the provisions stated for GAT and which rules and procedures have been specified by appropriate authorities.



**Reduced Vertical Separation Minimum (RVSM)**

A vertical separation minimum of 300 m (1 000 ft) which is applied between FL 290 and FL 410 inclusive, on the basis of regional air navigation agreements and in accordance with conditions specified therein.

**RVSM Approval**

The approval that is issued by the appropriate authority of the State in which the Operator is based or the State in which the aircraft is registered

**State Aircraft**

Aircraft used in Military, Customs, and Police services shall be deemed to be State Aircraft (Reference - ICAO Convention on International Civil Aviation, Article 3 (b)).

**Static Source Error**

The difference between the pressure sensed by the static system at the static port and the undisturbed ambient pressure.

**Static Source Error Correction (SSEC)**

A correction which may be applied to compensate for the static source error associated with an aircraft.

**Target Level of Safety (TLS)**

A generic term representing the level of risk which is considered acceptable in particular circumstances.

**Vertical Separation**

Vertical separation is the spacing provided between aircraft in the vertical plane to avoid collision.

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## LIST OF ABBREVIATIONS

*The acronyms listed hereunder have been chosen from those which are specifically related to activities of the EANPG and/or are most frequently found in this report in order to assist in its reading.*

AAD	Assigned Altitude Deviation
ADS	Automatic Dependent Surveillance
AHMS	ADS-B Height Monitoring System
AMC	Acceptable Means of Compliance
AOC	Air Operator's Certificate
ASE	Altimetry System Error
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
CFL	Cleared Flight Level
CRM	Collision Risk Model
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
FIR	Flight Information Region
FL	Flight Level
GAT	General Air Traffic
GMU	GPS Monitoring Unit
GPS	Global Positioning System
HMU	Height Monitoring Unit
ICAO	International Civil Aviation Organisation
IGA	International General Aviation
LHD	Large Height Deviation
LTHM	Long Term Height Monitoring requirements
MASPS	Minimum Aircraft System Performance Specification
MEL	Minimum Equipment List
NSA	National Supervisory Authorities
OAT	Operational Air Traffic
PANS	Procedures for Air Navigation Services
RMA	Regional Monitoring Agency
RPG	Regional Planning Group
RVSM	Reduced Vertical Separation Minimum of 300 m (1000 ft) between FL 290 and FL 410 inclusive
SSE	Static Source Error
SSEC	Static Source Error Correction
SSR	Secondary Surveillance Radar
STC	Supplementary Type Certificate

TC	Type Certificate
TCAS	Traffic Collision and Avoidance System
TLS	Target Level of Safety
TVE	Total Vertical Error
VSM	Vertical Separation Minimum

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## **1. INTRODUCTION**

### **1.1 Background**

1.1.1 The implementation of a Reduced Vertical Separation Minimum between FL 290 and FL 410 in the Asia and Pacific Air Navigation Region provided the benefits of additional en-route capacity and improved fuel efficiency for aircraft operators. Such a major transformation of the separation minimum required extensive safety analysis of the inherent increase in the risk of mid-air collision, which resulted in the definition of more stringent aircraft altitude keeping performance requirements. A monitoring programme was also initiated to ensure that both the technical and operational safety issues of the new separation standard were appropriately identified and addressed prior to implementation.

1.1.2 The new aircraft performance requirements were incorporated into a number of global standards and Acceptable Means of Compliance (AMC). These are generically termed Minimum Aircraft System Performance Specifications (MASPS). The MASPS include the minimum build standard and equipment configuration of an aircraft, the accuracy of the altimetry system over the full operational flight envelope and the continued airworthiness procedures necessary to ensure that the performance is maintained. Operators which demonstrated both technical compliance and the application of appropriate operational procedures obtained an approval to operate within RVSM airspace with 1,000 ft. vertical separation.

1.1.3 The pre-implementation safety programme required monitoring of aircraft technical height keeping performance, verification of aircraft/operator RVSM approval status and the undertaking of a collision risk assessment to ensure that an internationally agreed Target Level of Safety (TLS) was satisfied.

1.1.4 Analysis of the data provided by the pre-implementation monitoring programme indicated that although the risk level was acceptable, some of the initial assumptions regarding approval requirements and the accuracy of aircraft height keeping performance were not correct. Specifically, it was assumed that only approved aircraft would operate within the airspace and that aircraft altimetry system performance would remain stable over time.

1.1.5 In 2002, ICAO took the decision that in all regions in which RVSM had been implemented, it would be necessary for the Regional Planning Groups (RPG) to initiate programmes for the continuous monitoring of aircraft height keeping performance to ensure that risk levels remained below the TLS. In addition these programmes would include monitoring the compliance of operator/aircraft approval requirements.

1.1.6 In the Asia and Pacific Region five regional monitoring agencies (RMAs) have been established by the Regional Airspace Safety Monitoring Advisory Group (RASMAG) and endorsed by APANPIRG. The RMAs conduct airspace monitoring and safety oversight activities on behalf of States accredited to their respective regions. This responsibility includes monitoring operators/aircraft with regards to height keeping performance and approval status, and long term fleet monitoring requirements. The responsibility of the RMA is limited to monitoring operator compliance with the various technical and operational requirements and reporting any non-compliance or safety issue to the State exercising operational authority over that operator. It remains the responsibility of individual States to ensure that any appropriate remedial action is taken.

1.1.7 Common Terms of Reference for both RMAs are approved by RASMAG and are reproduced in Appendix A of this document.

## **1.2 Scope and Purpose of the Document**

1.2.1 The scope of this document is limited to those activities specifically associated with the post implementation safety monitoring responsibilities conducted by an RMA on behalf of, and supported by, accredited States. It is not intended in this document to provide a comprehensive description of operational procedures and practices which are defined elsewhere, although reference is made to these when appropriate.

1.2.2 The purpose of this document is to describe the post-implementation safety monitoring activities for RVSM airspace, the respective roles and responsibilities of RMAs and States and the importance of a collaborative approach to ensure the continued safe operation of RVSM in the Asia/Pacific Air Navigation Region.

1.2.3 The document describes the regional framework established by RASMAG and interaction between stakeholders which is required to support the safe operation of RVSM and demonstrate compliance with regulatory requirements.

1.2.4 The specific purpose of this guidance material is therefore to:

- a) Encapsulate the regulatory requirements contained in Annex 6 and 11 to the Convention on International Civil Aviation and to describe a practical safety monitoring framework in order to meet the particular demands of the Asia/Pacific RVSM airspace;
- b) describe the principle roles and interfaces of the APANPIRG, accredited member State and the RMA to provide an effective framework for all safety monitoring and oversight activities;
- c) describe the data exchange and coordination requirements between the RMA and State National Supervisory Authorities as well as recommended working practices; and
- d) provide recommendations for appropriate action in the event of operator non-compliance with RVSM approval or performance requirements.

1.2.5 To facilitate comprehension this document often refers to the operations and role of the 5 RMAs in the definite singular article (The RMA); however it must be emphasised that there are 5 active RMAs in the region although some modes of operation differ.

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## 2. RVSM REGULATORY REQUIREMENTS AND MONITORING ACTIVITIES

### 2.1 Overview of Requirements

2.1.1 There are a number of documents which relate to requirements, guidance and best practices for the safe continuous operation of RVSM. Some of these documents are in effect regulatory requirements which govern all contracting States to the Convention on International Civil Aviation (unless States have notified ICAO of any differences). These are the Annexes to the Convention on International Civil Aviation and are defined as International Standards and Recommended Practices (SARPs). Other documents relate to procedures, the application of which is governed by the Annexes. Finally there is guidance material including the Acceptable Means of Compliance related to aircraft MASPS, the application of RVSM and the operating procedures for an RMA.

2.1.2 The major documents which impact the application of RVSM and the responsibilities related to technical aircraft performance, safety oversight and compliance monitoring are described below in Table 1.

Document	Description	Type
ICAO Annex 11	High level requirements for the establishment of regional monitoring agencies in all regions in which RVSM has been implemented	SARPs
ICAO Annex 6 (Part 1 and 2)	The operation of Aircraft	SARPs
ICAO Annex 8	Airworthiness of Aircraft	SARPs
ICAO Doc. 4444	Procedures for Air Navigation Services – Air Traffic Management	Procedures (governed by ICAO Annexes)
ICAO Doc. 7030	Regional Supplementary Procedures	Regional Procedures (governed by ICAO Annexes)
ICAO Doc. 9574	Implementation of a Reduced Vertical Separation Minimum	ICAO Guidance material
ICAO Doc. 9937	Operating procedures for Regional Monitoring Agencies	ICAO Guidance material
EASA AMC CS-ACNS, Annex I	AMC for the approval of aircraft to operate in RVSM airspace. <sup>1</sup>	EU Guidance material

**Table 1: Documents Related to Regulatory Requirements and Safety Oversight Activities within RVSM Airspace**

2.1.3 Of the documents listed above in Table 1, ICAO Annex 6 and ICAO Doc. 7030 contain the most relevant information related the material contained in this document. The following sections expand on the specific RVSM requirements contained in these two documents.

<sup>1</sup> This material replaces JAA TGL No. 6 in Europe. The US equivalent is FAA Advisory Circular 91-85

## 2.2 ICAO Annex 6

2.2.1 Annex 6 to the Convention on International Civil Aviation defines requirements for the operation of aircraft. Part 1 relates to commercial operators and part 2 to operators of IGA aircraft.

2.2.2 Prior to granting an RVSM approval a State is required to confirm that the aeroplane satisfies minimum equipment and height keeping performance requirements. The State must also be satisfied that the operator has instituted appropriate continued airworthiness and flight crew procedures and practices. Following the granting of an approval the State is responsible for ensuring that the aircraft continues to meet height keeping performance requirements, that all operators participate in regional or global monitoring programmes and that only approved aircraft operate within the airspace.

2.2.3 A summary of the responsibilities of individual State Authorities defined in ICAO Annex 6 are reproduced below in Table 2.

Annex 6 pt1 Reference	Annex 6 pt2 Reference	Requirement
7.2.4.a	2.5.2.4.a	Aeroplane equipment requirements
7.2.4.b		Aeroplane shall be approved by State of Operator
	2.5.2.4.b	Aeroplane shall be approved by State of Registry
7.2.4.c	2.5.2.4.c	Aeroplane vertical navigation performance requirements
7.2.5	2.5.2.5	Pre-approval aeroplane/operator requirements
7.2.6		State (of Operator) responsibility to ensure provisions for receiving reports from accredited RMA and implementing measures to correct the performance of aircraft not compliant with height keeping requirements
	2.5.2.6	State (of Registry) responsibility to ensure provisions for receiving reports from accredited RMA and implementing measures to correct the performance of aircraft not compliant with height keeping requirements
7.2.7		State of Operator that has issued an RVSM approval to an operator shall ensure that the operator complies with biennial fleet monitoring targets.
	2.5.2.7	State of Registry that has issued an RVSM approval to an operator shall ensure that the operator complies with biennial fleet monitoring targets.
7.2.8	2.5.2.8	All States that are responsible for airspace where RVSM has been implemented, or which have issued RVSM approvals shall establish provisions and procedures to ensure that appropriate action will be taken with operators of non-

		approved aircraft.
<b>Note to 7.2.8 and 2.5.2.8. These provisions and procedures need to address both the situation where the aircraft is operating without approval in the airspace of the State and the situation where an operator for which the State has regulatory oversight responsibility is found to be operating without the required approval in the airspace of another State</b>		
7.2.9	2.5.2.9	The aeroplane shall be sufficiently provided with navigation equipment to ensure that, in the event of the failure of one item of equipment at any stage of the flight, the remaining equipment will enable the aeroplane to navigate in accordance with 7.2.4 (2.5.2.4)

**Table 2: Summary of Requirements for the Approval and Operation of Aircraft in RVSM Airspace**

2.2.4 States should ensure that appropriate processes and procedures are in place to take appropriate action with operators who fail to comply with the regulatory requirements, or operate aircraft which no longer comply with the conditions under which an RVSM approval was issued. Such action may include withdrawal of an RVSM approval on a temporary or permanent basis.

### 2.3 ICAO Doc. 7030

2.3.1 Regional requirements are contained in ICAO Regional Supplementary Procedures, ICAO Doc. 7030. The principle requirements related to RVSM are reproduced below in Table 2.

Doc 7030 Reference	Requirement
2.1.5.2	Operators of RVSM-approved aircraft shall also include the letter W in Item Q of the RPL, regardless of the requested flight level. If a change of aircraft operated in accordance with an RPL results in a modification of the RVSM approval status as stated in Item Q, a modification message (CHG) shall be submitted by the operator.
2.1.5.3	Operators of formation flights of State aircraft shall not insert the letter W in Item 10 of the ICAO flight plan form, regardless of the RVSM approval status of the aircraft concerned. Operators of formation flights of State aircraft intending to operate within RVSM airspace as general air traffic (GAT) shall include STS/NONRVSM in Item 18 of the ICAO flight plan form.
2.1.6.1	Operators of non-RVSM-approved aircraft shall flight plan to operate outside the RVSM airspace.
6.2.4.1	Within the RVSM airspace, the vertical separation minimum shall be: <ul style="list-style-type: none"> <li>a) 300 m (1 000 ft) between RVSM-approved aircraft;</li> <li>b) 600 m (2 000 ft) between: <ul style="list-style-type: none"> <li>1) non-RVSM-approved State aircraft and any other aircraft operating within RVSM airspace;</li> <li>2) all formation flights of State aircraft and any other aircraft operating within RVSM airspace; and</li> <li>3) non-RVSM-approved aircraft and any other aircraft operating within the airspace</li> </ul> </li> </ul>



	designated as transition airspace.
6.10.1.1	Only RVSM-approved aircraft and non-RVSM-approved State aircraft shall be issued an ATC clearance into RVSM airspace.
6.10.1.2	ATC clearance into RVSM airspace shall not be issued to formation flights of civil aircraft.

**Table 3: Summary of Regional Supplementary Procedures related to RVSM**

2.3.2 A summary of the responsibilities of States defined in Annex 8 «Aircraft airworthiness» are presented in the table 4.

Annex 8, part II, Reference	Requirement
3.2.3	The State establishes that continuing aircraft airworthiness determined through the periodical inspection at appropriate time interval having regard to lapse of time and type of service or, alternatively, by means of a system of inspection that will produce at least an equivalent result.
3.5	Any failure to maintain an aircraft in an airworthy condition as defined by the appropriate airworthiness requirements render the aircraft ineligible for operation
4.2.3	The State, where aircraft was registered, issues airworthiness certificate or updates ones certificate in accordance with the paragraph 3.2 (including paragraph 3.2.3 see above)  The State, where aircraft was registered, establishes requirements, that the aircraft is suitable for the flights operating, in compliance with the technical maintenance requirement in accordance with Annex 6.

**Table 4: Summary of Requirements for the Aircraft RVSM airworthiness**

2.3.3 States should be aware that the requirements described above are applicable to all aircraft, including commercial, general aviation, military and other State designated aircraft, intending to operate under GAT rules with a 1,000 ft. vertical separation minimum in RVSM airspace. Non-approved State designated aircraft may request a clearance in RVSM airspace with a 2,000 ft. vertical separation minimum; however operators must declare non-RVSM on flight plans.

## 2.4 Regional Monitoring Agencies

2.4.1 A Regional Monitoring Agency is established by an ICAO Regional Planning Group to oversee the safety of operations in RVSM airspace. There are no formal regulatory requirements defining the responsibilities of an RMA. **Instead the RMA operates under Terms of Reference (ToR) agreed with the RPG.** The RMA is responsible to RASMAG for implementation of monitoring functions to the required quality standard.

2.4.2 RMAs are expected to operate in accordance with the precepts of ICAO Doc. 9574 “Manual on Implementation of a 1,000 ft. Vertical Separation Minimum between FL 290 and FL 410 Inclusive”. Guidance on the operation and procedures of an RMA are included in ICAO Doc. 9937 “Operating Procedures and Practices for Regional Monitoring Agencies in Relation to the use of a 1,000 ft. Vertical Separation Minimum between FL 290 and FL 410 Inclusive”.

2.4.3 On behalf of the accredited States the RMA fulfills the functions included in the **ToRs**. The principle activities of an RMA are to verify aircraft/operator RVSM approval status, conduct aircraft height keeping performance monitoring, verify the operator’s compliance with the long-term monitoring requirements and provide annual airspace safety assessments. The RMA monitors aircraft/operator compliance within the precepts of ICAO Annex 6, reporting non-compliance and any associated safety issues to the States which retain the responsibility for ensuring that appropriate remedial action is taken. To perform this function it is essential that the States provide practical support to the RMA, particularly with regards to coordinating RVSM approval data exchanges and providing operational incident reports for inclusion in the annual safety assessments.

2.4.4 RMAs prepare RVSM annual safety reports which are presented to RASMAG. Completed reports usually include:

- a) A quantitative assessment of the risk of mid-air collision attributable to the implementation of RVSM. This assessment includes both, technical risk attributable to aircraft technical height keeping performance, and total risk due to all causes including technical and human/operational errors
- b) A review of the major contributing factors which result in Large Height Deviations, with the purpose of reducing the number of risk bearing incidents.
- c) Any other safety related issues associated with the implementation or continued use of RVSM;
- d) Recommended measures to decrease risk with particular emphasis on improving aircraft height-keeping performance;
- e) Recommended measures to improve the safe operation of RVSM airspace; and
- f) Implement all applicable decisions and recommendations agreed by APANPIRG. Report non-compliance with APANPIRG decisions by individual States, operators and service providers.

## **2.5 Monitoring Compliance with Requirements**

2.5.1 This section provides an overview of the activities which the RMA and accredited States are required to conduct to provide an effective safety oversight and compliance monitoring infrastructure for Asia/Pacific RVSM airspace. It describes the high level functions of the monitoring programme and how these relate to the various responsibilities which are defined in the ICAO Annexes and global and regional procedures documents. Specific procedural detail for each of these functions is provided in the subsequent sections.

2.5.2 The major functional objectives of the monitoring programme are to, conduct technical aircraft height keeping performance monitoring, verify the approval status of aircraft and operators flying in RVSM airspace and conduct airspace safety assessments. For each of these functions to be conducted effectively it is important that the Regional Monitoring Agency and accredited States operate in close cooperation, with each organisation fulfilling its obligations as determined by APANPIRG.

### 2.5.3 RVSM Approvals

2.5.3.1 Under the provisions of Annex 6 and the regional supplementary procedures all operators and aircraft intending to operate in RVSM airspace with a 1,000 ft. vertical separation are required to be approved by the State exercising operational authority over that aircraft and/or operator. Operators indicate that they hold a valid approval by filing a ‘W’ in item 10 of the ICAO flight plan. States are required to take appropriate action in the event that a non-approved operator/aircraft is found to be operating within RVSM airspace.

2.5.3.2 The practical task of monitoring aircraft/operator approval status is devolved to the RMA. For the RMA to perform this function effectively it is important that a complete inventory of aircraft approved to operate in Asia/Pacific RVSM airspace is maintained. The RMA maintains a central database of RVSM approved aircraft populated with records provided by individual States and other RMAs.

2.5.3.3 The RMA cross checks the central records of RVSM approvals against flight plans. A request for approval status of any unreported aircraft for which a ‘W’ has been inserted into the flight plan is sent to the appropriate State for confirmation of approval status. If the State confirms the approval then the record is added to the responsible RMAs database and no further action is required. In the event that the aircraft is not approved the State is required to take appropriate action, which may be to exclude the operator from operating in RVSM airspace until a valid approval has been issued.

2.5.3.4 To ensure an effective service and to minimise workload for both the RMA and individual authorities, States should ensure that the list of RVSM approvals for which it is responsible is kept up to date and communicated regularly to the RMA. States should also ensure that they have introduced procedures for receiving reports of possible non-approved aircraft from the RMA and conducting follow up investigations to verify the true status of the aircraft reported. In addition to transmitting new approvals to the RMA it is equally important that the RMA is informed when approvals are withdrawn or when aircraft are de- or re-registered. It has been demonstrated that the most effective mechanism is for each State to maintain a single centralised database of RVSM approvals which should be communicated to the RMA on a regular basis.

### 2.5.4 Aircraft Technical Height Monitoring Programme

2.5.4.1 Under the provisions of Annex 11 each RVSM region is required to maintain a technical height keeping performance monitoring programme. The specific requirements of the monitoring programme are defined in Annex 6 and RVSM guidance material and include; verification of individual aircraft altimetry system performance, verification of generic aircraft MASPS, operator compliance with fleet monitoring targets and finally to provide technical performance data for annual airspace safety assessments.

2.5.4.2 The RMA conducts technical height keeping performance monitoring which involves comparing measured aircraft geometric height data against actual geometric pressure altitude derived from meteorological data, provided by accredited meteorological international organisations. The monitoring systems in use include wide area ground based multilateration systems, individual on-board GPS measurement systems and ADS-B monitoring systems.

2.5.4.3 The RMA is responsible for submitting reports of individual aircraft which do not comply with performance requirements to the appropriate State authorities for remedial action. The RMA also submits reports of operators which do not meet biennial fleet monitoring targets, upon receipt of which States are also required to take appropriate action. In the event that the RMA determines that a specific aircraft type does not comply with the RVSM MASPS then this information is forwarded to the appropriate authority which issued the original aircraft airworthiness approval. The original airworthiness authority will then resolve any non-compliance with the aircraft manufacturer.

2.5.4.4 Data from the technical aircraft height keeping performance monitoring programme also contributes to the annual safety assessment, providing core data which is extrapolated for all RVSM airspace to provide a technical collision risk assessment which must satisfy a Target Level of Safety of  $2.5 \times 10^{-9}$  collisions per flight hour.

#### 2.5.5 Operational Risk Events

2.5.5.1 The RMA is required to produce an annual RVSM safety assessment including a total collision risk assessment. The assessment consists of two elements which are the technical risk (as described above) and the risk due to operational issues such as aircraft altitude deviations and other risk bearing incidents such as incorrect coordination, communication errors and TCAS events.

2.5.5.2 The operational risk assessment relies on States to provide reports of operational incidents and/or surveillance data reinforced with specific event information when requested by the RMA.

#### 2.5.6 RMA/State Interfaces

2.5.6.1 For the RVSM safety oversight and monitoring compliance programme to remain effective it is essential that the interfaces between the RMA and each accredited State are adequately defined and maintained. Each State should ensure that appropriate contact information is provided to the RMA. It is considered to be most effective for each State to provide a single contact point for communicating with the RMA for all RVSM matters. This contact is required to transmit all RVSM approval information to the RMA, receive and process; reports of non-approved aircraft; reports of technically non-compliant aircraft; reports of operators which are not compliant with fleet monitoring targets, and to submit operational event reports for inclusion in the annual RVSM safety assessment.

2.5.6.2 States should ensure that staff required to interface with the RMA are adequately trained and instructed in the various responsibilities required. In the event that individuals change work roles or leave the organisation it is essential that a complete handover to a replacement is completed so that there is no detrimental effect on the overall quality of service. In the event that it is not feasible to maintain single points of contact then it is necessary to ensure that the RMA is notified of all contacts and their respective responsibilities.

2.5.6.3 The operational framework including the accepted procedures to accomplish the monitoring programme objectives are discussed in more detail in the following sections.

### **3. RVSM APPROVAL PROCESSES**

#### **3.1 Overview**

3.1.1 This section provides guidance and recommendations for the issuance and management of aircraft RVSM approvals by a State, and the coordination of that data with the RMA to which the State is accredited. It also describes the policies of the RMA with regard to compliance with approval requirements and how the information is shared with other RVSM regions.

3.1.2 A brief description of the constituent parts of the RVSM approval is provided below. In the following sections focus is given to the issues which particularly relate to maintenance of the approval, the conditions under which an approval may be considered to be valid and compliance monitoring in the post implementation environment.

3.1.3 There are a minimum of 3 constituent parts of an RVSM approval which are:

- Airworthiness Approval (MASPS): Confirmation that the build of an aircraft satisfies minimum equipment and height keeping performance requirements and that an appropriate maintenance programme has been developed by the manufacturer to maintain performance;
- Continued Airworthiness: Confirmation that the operator of an aircraft has instituted an appropriate continued airworthiness programme which should be based on the procedures developed by the manufacturer; and
- Operational Approval: Confirmation that the operator of an aircraft has instituted appropriate flight crew procedures for operations in RVSM airspace.

3.1.4 Detailed guidance material describing the recognised processes for the approval of the build of an aircraft is contained in ICAO Doc. 9574, FAA AC 91-85 and EASA AMC CS-ACNS, Annex I to ED Decision 2013/031/R. Additional material applicable to this document is provided in the next section.

3.1.5 The airworthiness approval is valid for all individual airframes produced to the same build standard and is normally issued by a single airworthiness authority. It is not considered necessary for subsequent approval authorities to re-confirm the airworthiness approval unless the aircraft has been modified or constructed to a Supplementary Type Certificate (STC) or equivalent build standard not covered by the original approval.

3.1.6 Unlike the Airworthiness Approval, the Continued Airworthiness and Operational Approval need to be issued by each individual approval authority, which must verify that the operator has instituted appropriate continued airworthiness procedures and that flight crews have been trained in RVSM operational procedures. The operational approval indicating valid areas of operation should be stated on the operator's AOC or in the pilot's flight manual. Once the approval authority is satisfied that all requirements have been met the State is required to notify the RMA that the aircraft in question meets all criteria for operations in RVSM airspace and is approved.

3.1.7 The airworthiness approval normally remains valid for the operational lifetime of an airframe, provided that the aircraft has been maintained in accordance with the manufacturers continued airworthiness procedures and that the aircraft is not subject to any modification which may require re-evaluation of the build standard. The continued airworthiness and operational approvals are operator specific and may not be transferred upon re-registration. Under certain circumstances it may be necessary to withdraw or re-issue an operational approval if the conditions under which the original approval was issued are no longer valid.

3.1.8 By issuing an approval to operate in RVSM airspace, a State is declaring that all contributing approval requirements are met including airworthiness approval, continued airworthiness approval and operational approval.

3.1.9 In the event that, following a report issued by the RMA, an aircraft is found to be operating in RVSM airspace without approval, the State should make immediate contact with the operator concerned and where necessary issue instructions to cease flights in RVSM airspace. A review should be held into the circumstances under which the operator was operating without approval and appropriate action taken.

## **3.2 RVSM airworthiness approval**

3.2.1 The aircraft airworthiness approval is normally granted by a single airworthiness authority and applies to a particular build standard which is defined by a specific Type Certificate (TC), Supplementary TC (STC), Service Bulletin (SB) or TC amendment. To obtain the approval, the

manufacturer is required to submit an RVSM approval data package which is then evaluated in detail by the airworthiness authority prior to issuing the approval.

3.2.2 As a minimum the RVSM approval data package consists of the following:

- a) The applicable build standard to which the data package applies;
- b) A definition of the applicable flight envelopes;
- c) Data showing compliance with the RVSM performance criteria;
- d) The procedure to be used to ensure that all aircraft submitted for airworthiness approval comply with RVSM criteria. These procedures include the references of applicable Service Bulletins and the applicable approved aircraft flight manual amendment or supplement;
- e) The maintenance instructions that ensure continued airworthiness for RVSM approval.

3.2.3 RVSM performance data should include both measured and analytical data indicating the Static Source Error characteristics of the aircraft build standard and the corrections which must be applied to demonstrate the required performance.

3.2.4 Once a State (normally the State of manufacture or in the case of the EU, EASA) has issued an RVSM airworthiness approval for a specific build standard, it is not normally necessary for States issuing operational approvals for aircraft constructed to that same build standard to repeat the process. However, States issuing approvals to operators should verify that the build standard of an aircraft put forward for approval is the same as that referenced on the original RVSM airworthiness approval. This is particularly important when an aircraft is modified or built to an STC issued at a later date to that of the original airworthiness approval.

3.2.5 Particular attention should be given to aircraft built for special purpose roles, such as military applications, photographic or civilian survey missions. Procurement authorities are recommended to explicitly indicate whether an aircraft derivative is required to operate in an RVSM environment, with reduced separation minima, on the appropriate procurement specification and that such an individual RVSM solution is required to be demonstrated by submission of an RVSM approval data package.

3.2.6 In the event that an aircraft undergoes any structural or equipment modifications post airworthiness approval issue, then the original airworthiness approval may no longer be valid. States responsible for approving the modification must issue a new airworthiness approval based on a data package produced specifically for the modification. Revised aircraft performance data will need to be submitted to verify RVSM criteria compliance.

3.2.7 An aircraft which is constructed to a build standard with a generic RVSM airworthiness approval, and which exhibits common RVSM performance characteristics, is termed an RVSM Group certified aircraft. Any aircraft which is built or modified to a unique build standard with its own individual RVSM airworthiness approval, is termed an RVSM Non-Group aircraft. States must ensure that a full RVSM performance and analysis process is conducted on all individual Non-Group aircraft prior to issuing an RVSM approval. RMAs maintain a list of all recognised RVSM group definitions and can provide guidance on specific cases.

### **3.3 Validity of an RVSM operational approval**

3.3.1 As the RVSM Operational Approval issued by a State includes verification of the operator's continued airworthiness and flight crew procedures, the approval cannot be transferred between

operators. In the event that an operator changes its technical support structure (i.e. changes maintenance supplier) then it may be necessary to re-issue the approval.

3.3.2 Under certain circumstances it may be necessary to withdraw an RVSM approval from an operator. Such circumstances may include a breach of procedures, including Large Height Deviations, operator non-compliance with performance or fleet monitoring target requirements, or any other reason determined appropriate by the approval authority. Withdrawal of approval may apply to individual airframes or a complete fleet. Rarely, it may be necessary for the original airworthiness authority to withdraw approval for a complete build standard.

3.3.3 In accordance with paragraph 3.2.3 of Annex 8 to the Convention on International Civil Aviation, the State Authority should ensure a periodic inspection to demonstrate that the RVSM airworthiness remains valid, and that the aircraft and operator remain in compliance with the established requirements. As part of the height keeping performance monitoring programme the RMA conducts trend analysis and can assist in monitoring the efficacy of an operator's RVSM continuous airworthiness procedures. If RVSM continuous airworthiness procedures are determined to be inadequate the RVSM approval may be considered to be invalid.

3.3.4 In accordance with the requirements of Annex 6 any aircraft that operates with a reduced separation minima in RVSM airspace must hold a valid RVSM approval. Similarly, any aircraft which is non-compliant with Altimetry System Error requirements (due to inadequate RVSM continuous airworthiness procedures) can be considered to be non-compliant with general airworthiness requirements defined in Annex 8, paragraph 3.2.8. Under the precepts of this requirement, any non-compliance renders the aircraft ineligible for operation.

3.3.5 State authorities should also consider the RVSM approval status of any aircraft/operator under the following circumstances:

- a) The conditions under which an initial approval was issued have changed. For example, the construction or equipment configuration of the aircraft has been changed such that the original RVSM data approval package is no longer valid;
- b) The operator is not in compliance with the long-term monitoring requirements, and so cannot demonstrate the effectiveness of continued airworthiness procedures.

3.3.6 In such circumstances as those described above, the State should satisfy itself that corrective action has been taken before the aircraft is permitted to continue operations in RVSM airspace. Such action may include submission of a new RVSM approval data package, but in all cases should include height monitoring in accordance with a plan agreed between the State and operator and coordinated with the RMA. Such a monitoring programme should demonstrate compliance with all airworthiness requirements within a reasonable time frame which should not exceed 6 months. Failure to comply with an agreed monitoring plan should result in the removal of the RVSM type approval for the operator (i.e. removal of approval for all airframes of the type for which the operator is non-compliant with monitoring targets).

3.3.7 There is no formal requirement to limit the duration of an RVSM approval; however many States have implemented a two year limit to ensure that operators comply with all height monitoring requirements before a renewal is issued. States which do not issue an approval with such a limitation should ensure that they have initiated procedures to ensure that operators continue to comply with all height monitoring requirements. It is recommended that all States should adopt a policy of issuing approvals with fixed expiration dates and that authorities implement procedures to verify continued compliance with all height monitoring requirements before a renewal is issued. An operator with an expired approval shall be treated identically to an operator flying with no approval and reported for non-compliance with Asia/Pacific flight rules.

3.3.8 In the event that an aircraft is re-registered then the approval issued to the original operator shall be automatically cancelled. Aircraft which are dry-leased, i.e. leased to a third party operator (lessee) who provides their own crew, shall not be operated on an approval issued to the owner/operator (lessor).

3.3.9 Any aircraft/operator found to be operating as RVSM approved, without an approval being issued by the State exercising operational authority, with an expired approval, or with an approval issued to another operator or registration shall be reported as non-approved to the State exercising operational authority and any other States in whose airspace the aircraft may be operating. It remains the responsibility of individual States to ensure that appropriate action is taken with operators of non-approved aircraft.

### **3.4 RVSM approvals - RMA**

3.4.1 Aircraft approval status verification is delegated to the accredited RMA. The RMA maintains a database of aircraft which is populated with approval records submitted by State representatives and RMAs from other RVSM regions.

3.4.2 The RMA conducts regular audits of flight plans, comparing the registrations of aircraft from flight plans in which RVSM approval has been indicated, to records contained in the RMA database of approvals. The RMA will submit a request to the appropriate State authority if an aircraft which is not listed in the database is found to be operating as RVSM approved. If the aircraft is subsequently confirmed as holding a valid approval then its details are added to the database. If the aircraft is not approved then it remains the responsibility of the State to take appropriate action, which may be to instruct the operator to cease flying in RVSM airspace until a valid approval has been issued.

3.4.3 The RMA functions as a monitoring and reporting agency only. The RMA is not responsible for verifying that any conditions applicable to an RVSM approval issued by a State are met; however the RMA may require clarification if an aircraft is not recognised as an RVSM type. In addition the RMA is not responsible for verifying that the operator is compliant with any operational limitation defined on the AOC or flight manual, or that the aircraft is being flown by the operator or crew to whom the approval has been issued.

3.4.4 It is the responsibility of individual States to implement processes and procedures to verify that aircraft construction, equipment, performance, maintenance instructions and crew training all comply with the RVSM regulatory requirements using Acceptable Means of Compliance (AMC). The RMA cannot be involved in the internal approval process. Specifically height monitoring data cannot be used in lieu of certified and calibrated SSE measurement systems, operated under controlled conditions, to provide engineering substantiation of aircraft height keeping performance.

3.4.5 Non-approved aircraft present potential safety threats in RVSM airspace and so need to be identified and appropriate action taken in an expeditious manner. To improve the effectiveness of the RMA and to avoid unnecessary investigations it is important that States support the RMA by ensuring that the records of RVSM approvals are correct and up to date. Errors in the database result in unnecessary workload for both the RMA and State authority.

3.4.6 States can report individual aircraft approvals to the RMA on form RMA F2 from ICAO Doc. 9937. A copy of this form can be found in Appendix B.

3.4.7 An RVSM approval shall be considered valid indefinitely unless a State issues a specific expiry date or until the State informs the RMA that an approval is no longer valid (i.e. the aircraft has been re-registered, placed in indefinite storage, scrapped, or the approval is withdrawn for any other reason). The RMA will not accept a transfer of an RVSM approval between operators. Upon a change of



operator the RMA will remove the approval confirmation until a new approval is issued. The RMA will not accept RVSM approvals directly from operators.

3.4.8 In addition to conducting audits of flight plans within its own accredited area of responsibility, an RMA may be requested to confirm the approval status of an aircraft operating in another RVSM region. The RMA will forward all such requests to the appropriate State authority.

3.4.9 Aircraft which are confirmed as non-approved will be added to a bulletin issued by the RMA and available to all other States within the region. Additional information regarding the maintenance and procedures for the inclusion of aircraft on this bulletin and the publication can be found below in section 7.

3.4.10 To maintain an accurate database of approvals the RMA will periodically request a State to participate in an audit of the full list, or inventory, of approvals for which the State is responsible.

3.4.11 A structured approach to approvals management and efficient State/RMA coordination procedures is important to ensure the effectiveness of the safety oversight programme. Any breakdown in coordination may result in increased workload and distraction from addressing priority safety issues and may be referenced in the annual Safety Monitoring Report presented by the RASMAG to APANPIRG.

### **3.5 RVSM approvals - States**

3.5.1 In accordance with the precepts of ICAO Annex 6, States are the principle authorities, tasked with ensuring that all aircraft under their operational authority, intending to operate in RVSM airspace, are approved. States are required to ensure that aircraft/operators continue to comply with performance and fleet monitoring target requirements. States are also required to take appropriate action with operators of non-approved aircraft found to be operating within their sovereign airspace.

3.5.2 States should ensure that a list of personnel authorised to issue notifications of RVSM approvals to the RMA are supplied beforehand. States can submit relevant contact information using form RMA F1 from ICAO Doc. 9937. A copy of this form can be found in Appendix C.

3.5.3 To minimise workload and to avoid aircraft being incorrectly identified as non-approved it is important that States have processes and procedures in place to enable the easy verification of the status of any aircraft for which they exercise operational authority. It is recommended that each State implement a centralised database of approvals which can be periodically cross checked with the RMA database.

3.5.4 States must ensure that they have implemented processes and procedures to respond to requests for approval status confirmation received from the RMA and that appropriate action is taken with operators of any aircraft which are found to be operating without approval. Expeditious responses to RMA requests are necessary to avoid aircraft being incorrectly labelled as non-approved.

3.5.5 States should ensure that RVSM approvals are issued prior to operators commencing flights in RVSM airspace. This applies to delivery and ferry flights as well as normal operations. To minimise workload and avoid unnecessary investigative actions, States should ensure that new approval records together with any changes to existing records are forwarded to the RMA with minimum delay. States should pay particular attention to ensure that the RMA is notified when an aircraft is re-registered, removed from service, changes operator or any other situation which may affect the RVSM approval status. Regular cross checks between the RMA and States are necessary to maintain the currency of the region's approvals and to minimise unnecessary workload.

3.5.6 It is recommended that in the event that an operator is found to be flying in RVSM airspace without approval then they should be instructed to cease filing flight plans with ‘W’ in item 10 with immediate effect. Furthermore the State should investigate the circumstances under which the operator was conducting such flights and either, implement procedural changes where necessary, or take appropriate action in the event of wilful action on the part of the operator.

3.5.7 States should also consider the approval status of any aircraft/operator which does not comply with performance or fleet monitoring target requirements, as reported by the RMA. States which issue expiry dates should ensure that aircraft/operators are fully compliant with all requirements before any approval extension is issued. It is important that States ensure that they have instituted procedures to ensure appropriate action is taken with operators of aircraft with approvals due for expiration. An aircraft with an expired approval shall be considered as non-approved.

3.5.8 Upon receipt of any report involving a failure to adhere to RVSM in-flight crew procedures, the State should ensure the investigation of the circumstances of the incident. Where appropriate the State should ensure that remedial training has been implemented to avoid future repetitions and depending on the severity, or frequency, of incidents should consider withdrawal of the operator’s RVSM approval.

3.5.9 In addition to taking appropriate action with any non-compliant aircraft/operator, it may be necessary for a State to implement a review of its own internal approval processes which may have inadvertently contributed to any aircraft/operator non-compliance. Such situations may include:

- Issuing an approval based on an invalid RVSM approval data package (for example when an aircraft is constructed to an STC when the data package is only valid for aircraft constructed to the original TC);
- Inadequate, inappropriate or overdue response upon receipt of a non-compliance by the accredited RMA;
- Lack of operator familiarity with RVSM flight crew procedures or approval requirements;
- Inadequate configuration management control of RVSM approval information including data coordination with the accredited RMA.

### **3.6 RVSM approvals – Flight planning**

3.6.1 All operators of RVSM approved aircraft indicate that a particular aircraft is RVSM approved by filing a ‘W’ in item 10 of the ICAO flight plan (including State approved aircraft). Any filing of the ‘W’ by a non-approved aircraft is in contravention of ICAO Doc. 7030.

3.6.2 State aircraft which are not RVSM approved may be permitted to operate in RVSM airspace with a 2,000 ft. vertical separation minimum; however they must not file a ‘W’ in the flight plan and must indicate STS/NONRVSM in item 18 of the flight plan. Only military, customs and police may file flight plans as State aircraft. Formation flights are not permitted in RVSM airspace even if the individual aircraft themselves are RVSM approved.

3.6.3 No civilian non-approved aircraft will normally not be provided with an ATC clearance into RVSM airspace with the exception of designated airspaces in the Asia/Pacific region where non-approved civilian aircraft are permitted to operate. States are required by the precepts of ICAO Annex 6 to take appropriate action with aircraft/operators found to be operating in RVSM airspace without approval. Operators should ensure that flight plan dispatchers have accurate information regarding the RVSM approval status of all aircraft within a fleet so that incorrect approval status is not entered into the flight plan.

### **3.7 RMA Bulletin of non-approved and non-compliant aircraft**

3.7.1 Under the precepts of ICAO Annex 6 a State is required to take appropriate action in the event that an aircraft for which it exercises operational authority is found to be operating in RVSM airspace without approval. In addition, a State is also required to take appropriate action against any non-approved aircraft, irrespective of the State of origin, which may be operating within the airspace of the State concerned. The monitoring of this second requirement is problematic for many States as there is no reference document or system which can be easily accessed to confirm the approval status of all aircraft operating within their airspace.

3.7.2 To assist States, a bulletin is now published by the RMA which includes all aircraft which are confirmed as operating in RVSM airspace without approval. In addition to confirmed non-approved aircraft, the bulletin lists aircraft which have been monitored in RVSM airspace, but have not been reported as approved by the State or region exercising operational authority, despite reasonable efforts on the part of the RMA to confirm the status with the appropriate State authority. Typically, the RMA will permit a minimum of one month and 2 messages from the first attempt to request approval confirmation before the aircraft is included on the bulletin. It will be clearly stated on these messages that unless a confirmation of RVSM approval is received then the aircraft shall be listed as non-approved. Due to the sensitive nature of this information the bulletin shall only be made available to authorised users from States, other RMAs and representatives from ICAO and EANPG.

3.7.3 Specific action which any State may take with regard to an aircraft requesting an RVSM clearance, but which is included in the current non-approved aircraft bulletin, remains the responsibility of the individual State concerned. However it should be emphasised that ICAO Doc. 7030 specifically states that an ATC clearance should not be provided to non-approved aircraft.

3.7.4 The RMA will publish a new bulletin on whenever a new aircraft is added to the list or one is removed from the list. The detailed description of the procedures for the formation and maintenance of an RMA's Bulletin for European ICAO region are presented in Chapter 7 of this Guidance.

## **4. RMA/STATE COORDINATION**

### **4.1 RMA contacts**

4.1.1 An RMA is established to support States to demonstrate compliance with ongoing safety oversight and airspace monitoring requirements in RVSM airspace. The five RMAs in the Asia/Pacific Air Navigation region represent 40 States. As the RMA is responsible for managing RVSM approvals (both civil and military), addressing RVSM airworthiness issues and processing operational event reports for risk assessment, it is often necessary for a State to provide multiple contacts to the RMA. Therefore the RMA may be required to maintain connections with a number of individual points of contact within its area of accreditation. The RMA must also maintain communication with all other RMAs which represent the different RVSM regions around the world as well as aircraft manufacturers and regulatory bodies.

4.1.2 The data communications traffic for the RMA is relatively high so it is important that the RMA is aware of the credentials and responsibility/authority of any individual with which it communicates; particularly as some data exchanges involve sensitive and confidential information. The RMA does not encourage direct communication with operators except by prior arrangement and not for the purposes of RVSM approval exchange. Communication with operators is normally limited to confirmation of availability of height monitoring systems and the provision of height monitoring data (also by prior arrangement). The RMA does not accept direct communications from operators or States from other RVSM regions, requesting that all such communications be directed through the host RMA, who can often provide the appropriate information without reference to other RMAs.

4.1.3 Each RMA provides a generic e-mail address to which all information and requests for data and assistance should first be directed. The RMA will review each message and redirect to a specialist if necessary. All messages to the RMA will be acknowledged and if appropriate a dialogue will be initiated either through the generic e-mail address or by a specialist in the area of discussion.

4.1.4 The generic e-mail addresses for the Asia/Pacific RMAs are:

AAMA: aama@airservicesaustralia.com

China RMA: rmachina@rmachina.cn

JASMA: RVSM\_report@mlit.go.jp

MAAR: maar@aerothai.co.th

PARMO: parmo@faa.gov

4.1.5 The RMAs are not operational ATC units and therefore are normally manned during regular working hours only.

## **4.2 State contacts**

4.2.1 To provide a coordinated and effective safety oversight and monitoring programme for RVSM in Asia/Pacific it is important that each State delegates specific units and/or individuals to interface directly with the RMA to which it is accredited. States should ensure that official points of contact are clearly identified and reported to the RMA. States should ensure that authorised points of contact are notified to the RMA for the following areas:

- a) Exchanging RVSM approval information with the RMA; (Civil IGA and commercial, military and other State designated aircraft);
- b) Managing requests for approval status confirmation received from the RMA and taking appropriate action with operators of non-approved aircraft;
- c) Managing reports received from the RMA of aberrant and non-compliant aircraft Altimetry System Error and other airworthiness issues;
- d) Addressing operator non-compliance with fleet monitoring targets received from the RMA;
- e) Collating and distributing operational incident reports in RVSM airspace;
- f) Providing flight plan traffic sample data to support the annual RVSM safety assessment. (as defined in ICAO Doc. 9937)

4.2.2 It is desirable to minimise the number of contacts from each State with which the RMA has to coordinate actions; however in the majority of cases it is accepted that two or more points of contact may be required to ensure appropriate expertise is available for each of the functions described above.

4.2.3 To avoid misunderstanding and the delay in verifying credentials following communications from unknown contacts, States should submit all authorised points of contact to their accredited RMA using RMA F1 from ICAO Doc. 9937. A copy of this form can be found in Appendix C.

4.2.4 It is important that each State ensures that responsibilities are transferred and new RMA F1 forms issued in the event of staff leaving or changing position so that continuity of service with the RMA is maintained.

### **4.3 Inappropriate State Actions**

4.3.1 Effective oversight and resolution of safety issues in RVSM airspace can only be achieved if the RMA and its accredited States function together to ensure that RVSM data is accurate and that appropriate follow up actions are taken in an expeditious manner. It is particularly important that States ensure that appropriate remedial action is taken as quickly as possible in the event that the RMA submits a report requiring State action.

4.3.2 In the event that a State does not take action which is considered appropriate with any non-approved or non-compliant aircraft/operator, then the RMA shall initially contact the Regional Director of the ICAO Asia/Pacific office, to review and implement one of a range of actions appropriate to the specific situation encountered. In the situation where a suitable outcome is not achieved, in spite of the intervention of the ICAO Regional Director, then a request shall be submitted to APANPIRG to recommend an **ICAO Mandatory Information Request**.

## **5. TECHNICAL HEIGHT KEEPING PERFORMANCE AND MONITORING**

### **5.1 Overview**

5.1.1 A major part of the RVSM safety oversight programme involves monitoring aircraft technical height keeping performance, or more specifically, aircraft Altimetry System Error (ASE). 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; or described more simply as the difference between the actual altitude of the aircraft and the indicated altitude of the aircraft. Any aircraft flying at an incorrect level presents a threat to air safety; however ASE is particularly dangerous as the effect is frequently invisible to pilots, ground controllers and aircraft collision avoidance systems such as TCAS.

5.1.2 A major contributor to ASE is the Static Source Error (SSE), which is the error introduced, when attempting to measure the ambient air pressure, caused by the physical presence of the aircraft itself. The SSE characteristic is a variable influenced by a number of parameters including, airframe design and configuration, speed, altitude, weight and attitude of the aircraft. The SSE characteristic of an airframe is modelled at the design phase with corrections applied in the aircraft's avionics system which are intended to remove its effects. However, the SSE characteristic can change over time due to a number of factors including, degradation of sensor components, physical damage to sensor probes or static ports, blockages of the pressure system, or aircraft modifications. In the event that the SSE characteristic changes then the corrections applied in the avionics may no longer be valid, resulting in increased ASE. Validated continuous airworthiness programmes are essential to ensure any changes to SSE are detected and corrected.

5.1.3 The purpose of the height monitoring programme is to verify that the initial Static Source Error Corrections (SSEC) remain valid, that the continuous airworthiness programmes are adequate and that operators have implemented such programmes correctly. Biennial minimum monitoring targets for all operators of RVSM approved aircraft are defined in ICAO Annex 6 to ensure correct application of continuous airworthiness programmes; however increased quantities of monitoring are required when a new RVSM type or variant is developed until such time as the initial and long term ASE characteristic of the design has been confirmed. The actual monitoring target for any operator of an RVSM approved aircraft is therefore determined by the type of aircraft. The monitoring requirements for all RVSM approved aircraft, variants and derivations are defined in a table revised annually by the ICAO RMA Coordination Group (RMACG). Copies of the latest MMR can be obtained from the RMA to which a State is accredited.

5.1.4 The accurate measurement of ASE requires the use of precise and calibrated specialist equipment operated under controlled conditions, and is an expensive process which is normally only performed at the initial airworthiness stage. It is not feasible to expect all operators of RVSM approved aircraft to undergo repeated flight checks under these controlled conditions to demonstrate continued compliance with ASE performance requirements. A number of alternative systems have been developed which provide accurate estimates of aircraft ASE under most conditions. The major advantage of these systems is that they can operate with little or no active participation on the part of the operator and are transparent to the crew. A brief description of techniques employed by RMAs to estimate aircraft ASE characteristics is provided in the following section.

### **5.2 Height Monitoring Systems**

5.2.1 There are 3 independent height monitoring systems currently in use. These are:

- GPS Monitoring Unit (GMU). This is a portable carry on device used to estimate the ASE of a single flight for one aircraft. The advantage is that the aircraft can be monitored almost anywhere that it is scheduled to operate; however the operating and processing costs for the operator are high as they rely on dedicated resources;
- Height Monitoring Unit (HMU). This is a fixed ground based system which operates automatically 24 hours per day and which provides ASE estimates for all aircraft meeting certain flight profile conditions within its coverage area. The advantage is that the unit measurement cost is extremely low and the process is transparent to the crew; however the initial set up costs are high and the aircraft must fly within the coverage area (approximately 45 nm radius); and
- ADS-B Height Monitoring Systems. This is a relatively new method of height monitoring which utilises the geometric height data transmitted in the aircraft's ADS-B broadcasts in the same way that the GMU uses the on-board GPS data.

5.2.2 There are advantages and disadvantages to all the monitoring systems; however they all operate on the same fundamental principle, which is the comparison of the true height of an aircraft against the height of the pressure level which corresponds to the indicated altitude of the aircraft. The implementation of such a system is however quite complex. In the GMU and the ADS-B Height Monitoring System the height of the aircraft is provided by the on-board GPS system, whilst the HMU relies on the estimation of the aircraft height using highly accurate multi-lateration techniques. The determination of the height of the pressure level which corresponds to the indicated altitude of the aircraft is challenging as the pressure levels move up and down depending on the specific meteorological conditions and vary in magnitude over both time and position. Various methods of modelling the continually changing height of the pressure level have been implemented; however they all rely on an initial set of values obtained from various Numerical Weather Prediction models (NWP) provided by national and international meteorological organisations.

5.2.3 It is important to ensure that the monitoring data is correlated to the correct aircraft. GMU and ADS-B monitoring systems extract the aircraft identity including the aircraft ICAO 24-bit aircraft identifier directly from the aircraft system or transmission signal. The HMU is a passive system which only receives the aircraft ICAO 24-bit aircraft identifier. It is necessary to compare the 24-bit aircraft address to the address provided by the State in the RVSM approval data. If the transmitted address is different from the one recorded by the RMA then the monitoring result will not be correlated to the correct aircraft.

### **5.3 Operator Long Term Height Monitoring Programme**

5.3.1 All operators of RVSM approved aircraft are required to participate in the RVSM height monitoring programme. The principle purposes of the long term height monitoring programme are to verify long term ASE stability and the efficacy of an operator's continued airworthiness programme.

5.3.2 All operators of RVSM approved aircraft in the Asia/Pacific Air Navigation Region should comply with the recommended Long Term Height Monitoring requirements (LTHM) defined in the current version of the MMR. Data from any of the recognised RVSM monitoring programmes may be used to satisfy an operator's monitoring target. The monitoring target varies dependent on the total amount and quality of monitoring data available, the period over which time such data was obtained and the quality of the performance data. For aircraft designs which have been monitored, with statistically representative data samples demonstrating stable performance, for in excess of 2 years, the requirement is for all operators to have a minimum of 2 aircraft monitored every 2 years or 1,000 flight hours, whichever the greater. For

aircraft designs which have received a generic RVSM airworthiness approval within the last 2 years operators are required to have 60% of their fleets monitored every 2 years or 1,000 flight hours, whichever the greater. Finally if an aircraft is modified or built to a unique design and presented for RVSM airworthiness approval on an individual basis then that aircraft is required to be monitored every 2 years or 1,000 flight hours, whichever the greater.

5.3.3 States should ensure that all operators of RVSM approved aircraft under their operational authority comply with the minimum fleet monitoring targets. States should ensure that operators have implemented plans to demonstrate compliance with LTHM requirements and that the targets are met in the time frame required. States should take appropriate action with any operator which fails to comply with the LTHM requirements. Such appropriate action includes temporary revocation or suspension of an approval, complete withdrawal of approval and refusing an extension in the event that an approval has expired.

5.3.4 The RMAs conduct regular assessments of operator compliance with monitoring targets, the results of which are forwarded to the various State authorities which have the responsibility for determining what further action should be taken. Operators are encouraged to contact the RMA to check availability and flight requirements for the various height monitoring programmes prior to conducting any dedicated monitoring flights.

## **5.4 ASE Performance Investigations**

5.4.1 ASE data acquired from the height monitoring programmes are used in three ways by the RMA. The total data sample provides the input to the technical collision risk assessment conducted annually by the RMA and presented to RASMAG and the APANPIRG. Data is also grouped by aircraft type and individual airframe to assess generic and discrete airframe ASE performance.

5.4.2 The ICAO Annexes and the various MASPS documents define the maximum tolerable ASE performance requirements for both RVSM groups (i.e. the total population of aircraft built to a common compliance standard), and individual airframes, in order to comply with the technical safety limits. The principle requirements are described below:

- The mean ASE of any RVSM group shall be less than  $\pm 80$  ft.
- The mean plus 3 standard deviations of any RVSM group shall be less than 245 ft.
- The ASE of any individual airframe shall be less than  $\pm 245$  ft.

5.4.3 The RMA collects the measurement results and conducts regular analysis of both group and individual airframe performance. In the event that the group performance results, taking into account the size of the available data sample, indicate non-compliance with one or both of the requirements defined above then it requests a more detailed investigation by the Authority responsible for issuing the original airworthiness certificate. The resolution of any generic RVSM group investigation may be time consuming and expensive. Actions to resolve a generic performance investigation may include design changes, recalculation of SSEC or amendments to continuous airworthiness procedures. Although removal of a generic RVSM airworthiness approval remains the ultimate sanction of any authority, the implications for both the manufacturer and existing operators would be extremely serious making this an unlikely scenario in all but the most extreme cases which impact safety separation standards.



5.4.4 More common than a group investigation is an investigation into the performance of an individual aircraft which exhibits non-compliant ASE performance due to damage or degradation of a component within the static pressure system. In addition to reporting an aircraft which is not compliant with the absolute ASE limit, the RMA monitors performance which is not consistent with the core distribution of aircraft and which may be in the early stages of deterioration towards becoming non-compliant. Such performance is termed aberrant.

5.4.5 Any aircraft which exhibits performance which is not compliant with the ASE performance requirements defined above is subject to a mandatory report submitted to the appropriate State authority for immediate action. An RMA may recommend a State or operator to investigate the performance of an aircraft which is aberrant if the typical performance is over a pre-set limit (typically 200 ft.) or if the ASE characteristic indicates a significant trend towards non-compliance.

5.4.6 Although the RMA may institute an investigation into a non-compliant or aberrant aircraft, it remains the responsibility of the appropriate State authority to ensure that the case is investigated and resolved to its own satisfaction. The RMA can provide assistance and guidance, either directly advising the operator or as consultant to the State. Upon confirmation that remedial action has been completed the RMA will liaise with the State to decide if the investigation can be closed. Additional monitoring should be conducted to ensure any remedial action has been successful. The problems most commonly associated with poor ASE performance include the following:

- Humidity, leaks or corrosion in static pressure lines.
- Damage, blockage corrosion to static vents, pitot heads or probes.
- Air flow disturbance in area of static sensors due to paint damage, contamination or other physical changes.
- Airframe skin waviness effects.
- Angle of Attack vanes stiff or out of tolerance.
- TAT units out of tolerance.
- Air Data Computers out of tolerance.
- Damage to pressure transducers.
- Invalid SSEC.
- Invalid MASPS compliance

5.4.7 Any aircraft which fails to meet the technical vertical navigation performance requirements, particularly with regards to Altimetry System Error, represents a risk to maintaining vertical separation between aircraft. Following the receipt of a report of large ASE the State authority should be expected to take action proportional to the magnitude and characteristic of the non-compliance.

- An individual non-compliant ASE result considered to be inconsistent with typical performance for that airframe and which has subsequently returned to normal levels. The State should investigate the circumstances of the problem and if necessary

implement changes to operational and continuous airworthiness procedures. Dependent on the severity of the problem the operator may be permitted to continue operations in RVSM airspace during the investigation.

- An individual or multiple non-compliant ASE results considered to be representative of typical performance for that airframe. The State should withdraw the RVSM approval until an investigation into the problem is completed and the operator can demonstrate that the non-compliance has been resolved. In the event that non-compliance is due to aircraft modification, equipment change etc., then it may be necessary to re-evaluate the entire RVSM approval data package for the aircraft concerned, prior to issuing a new approval.
- A generic RVSM group fails to comply with group performance requirements. The State which issued the original airworthiness approval for the type should actively investigate the circumstances and if necessary withdraw the type approval until resolved.

5.4.8 The RMA includes any aircraft which has been assessed with non-compliant vertical navigation performance for flights in RVSM airspace in the **RMA Bulletin (see chapter 7)**.

## **6. ALTITUDE DEVIATION AND OTHER OPERATIONAL REPORTS**

### **6.1 Overview**

6.1.1 A key safety objective of the Asia/Pacific RVSM monitoring programme is the estimation of collision risk due to technical and operational reasons. The collision risk estimation process is complex and not within the scope of this document. The key parameters for the collision risk assessment are deviations from assigned (or planned/expected) flight levels, including both the magnitude and the duration of events, and the aircraft dimensions.

6.1.2 The technical risk assessment is conducted using monitoring data which is considered to be generic and so can be extrapolated for the entire population of aircraft throughout the region. The required magnitude and duration parameters are embedded in the data itself and the aircraft dimensions available once the monitoring result is correlated to a known registration.

6.1.3 The calculation of the operational risk is similar in concept; however the data can only be supplied from operational units and is dependent on the specific operational environment and air situation at the time of the event. Each operational risk event is unique in nature and therefore it is not possible to extrapolate the parameters derived from one event to other areas of the region. To enable the RMA to provide a reasonable estimate of risk due to operational factors it is important that all accredited States institute processes to collect operational incident reports and forward the relevant information to the RMA for inclusion in the risk assessment process.

6.1.4 The following sections describe the information which is required by the RMA to conduct the collision risk estimate and the definitions of events which should be reported.

## **6.2 Description of Operational Events**

6.2.1 Altitude deviations and sudden unplanned alterations to ATC clearances inherently carry a greater risk in areas in which a reduced vertical separation minimum has been implemented. It is therefore important that an assessment is periodically conducted to ensure that collision risk estimates satisfy pre-defined Target Levels of Safety (TLS).

6.2.2 The RMA conducts operational environment collision risk estimates using data provided by accredited member States. An event is reportable to the RMA when either an aircraft makes a deviation from a cleared level between FL 280 and FL 420 (cleared or actual) or an ATC clearance results in a risk bearing situation, such as loss of separation or TCAS initiated deviation.

6.2.3 The range of factors which may result in a reportable event include the following:

- Pilot not following an ATC clearance resulting in flight at unassigned flight level;
- Unexpected rate of climb/descent resulting in exceeding or not achieving cleared flight level;
- Pilot not following established contingency procedures for emergency descent;
- Technical failure in the altimetry or automatic altitude control system of an aircraft;
- Turbulence or other weather related phenomena;
- Response to airborne collision avoidance system resolution advisory;
- An error in issuing an ATC clearance which results in flight at incorrect level or which impairs separation minima;
- Coordination errors between adjacent ATC units in the transfer of control responsibility for an aircraft resulting in flight at an incorrect or unexpected flight level;
- Communication loop errors, (undetected or garbled read back/feedback errors).

6.2.4 The important parameters which must be available if the report is to be used for the quantifiable risk assessment include the magnitude of deviation and duration. It is possible that a single event will have multiple phases each with its own set of parameters. As much information as possible should be provided on the report to assist in the estimation of the required parameters and nature of the event.

## **6.3 Reporting of Operational Events**

6.3.1 A number of methodologies are available for estimating the collision risk parameters due to operational events. These may include the analysis of surveillance data with follow up investigations to determine the nature of any deviation, and/or the receipt and analysis of dedicated operational incident reports, or large Height Deviations. In both methodologies it is essential that individual States provide the relevant surveillance data or operational event reports to the accredited RMA.

6.3.2 In the event that a State provides surveillance data for the purpose of risk estimation it is important to ensure that records of events are maintained to assist in follow up investigations to determine the true nature of any event.

6.3.3 If a State submits operational incident reports it is important to ensure that the following minimum information is provided:

- High level description of event including category from list provided in section 6.2.3.
- Aircraft type and identity.
- Location.
- Magnitude of vertical error or deviation (for each phase of event if applicable).
- Duration of deviation (for each phase of event if applicable).

6.3.4 The RMA can provide copies of preformatted forms for the purposes of reporting operational incidents.

6.3.5 The RMA is responsible for reviewing all operational incident reports and compiling the parameters for the collision risk analysis. If a report does not include the minimum information required then the report may not be included in the assessment. In the event that some information is missing the RMA may, based on previous reports and experience, include an estimate for a parameter so that the report may contribute to the risk assessment. If appropriate the RMA may also send a request to the operator directly or through another RMA to clarify the contributory causes of a large height deviation. On the basis of internal investigation the operator should reply to the RMA's request and provide information regarding the cause of any large height deviation. The RMA will clearly distinguish between parameters which have been submitted on reports and those which are estimates based on the evidence available.

6.3.6 In some RVSM regions special arrangements may be made for the submission of RVSM operational incident reports through other safety oversight programmes.

## **7. PROCEDURES FOR THE PUBLICATION OF THE RMA BULLETIN BY A REGIONAL MONITORING AGENCY IN THE ICAO EUROPEAN REGION**

### **7.1 Purpose of the RMA Bulletin**

7.1.1 The purpose of the RMA Bulletin is to publish details of aircraft/operators which are not approved for operations in RVSM airspace and/or non-compliant with performance or long term monitoring requirements. The principle target audience for the bulletin are the State authorities, tasked with operational authority over these aircraft, and in whose airspace the aircraft may be operating. Other airspace users may be granted access to the bulletin for specific purposes. States with access to the bulletin should ensure that appropriate action is taken with regards to any listed aircraft/operator in accordance with the requirements of Annex 6, item 6.10.1.1 of Doc 7030, EANPG recommendations and as required by national and international applicable legislation.

7.1.2 This document refers to 'the RMA bulletin' although in fact it consists of 2 parts maintained separately by each RMA; one by RMA EURASIA and a second by the EUR RMA. To acquaint with the full content of 'the RMA bulletin' the user should not visit the internet sites of both RMAs. It is the responsibility of Regional Monitoring Agencies of the European region of ICAO to combine these two parts in 'the RMA bulletin', keep it in equivalent stage on the both sites and provide the full information to their users. However for ease of understanding only the singular term will be used from this point on.

7.1.3 The RMA Bulletin exists only in an online version and includes information on aircraft/operators, for which the RMA has sufficient grounds to assume that they are non-compliant with requirements for operations within RVSM airspace. Regional Monitoring Agencies of the European region of ICAO (EUR RMA and RMA EURASIA) are authorized by the European Air Navigation Planning Group (EANPG) to independently assume responsibility for the inclusion (and removal) of aircraft on the bulletin.

### **7.2 Users of the RMA Bulletin**

7.2.1 The users of the RMA Bulletin are as follows:

- accredited representatives of the state authorities of the States accredited to the ICAO EUR/NAT Office;
- accredited representatives of the ATS providers within the States accredited to the ICAO EUR/NAT Office;
- accredited representatives of the operators registered in the States accredited to the ICAO EUR/NAT Office;
- accredited representatives of EANPG approved international organizations;
- Regional Monitoring Agencies of other ICAO RVSM regions.

*Note: In order to establish cooperation with the RMA and to obtain access to the RMA Bulletin, all accredited representatives shall send contact information to the RMA on the F1 Form to the RMA (Doc 9937).*

### **7.3 Contents of the RMAs' Bulletin**

7.3.1 For the aircraft/operators included in the RMAs' Bulletin the following information may be provided:

- date of inclusion of aircraft into the RMAs' Bulletin (Mandatory);

- aircraft serial number. (Mandatory if data pertains to an individual airframe);
- aircraft registration. (Mandatory if data pertains to an individual airframe);
- 24 bit aircraft identifier code (Mode S). (Mandatory if data pertains to an individual airframe);
- ICAO type of the aircraft. (Mandatory if data pertains to an individual airframe);
- date of initial RVSM approval (if applicable);
- date of RVSM approval expiry (if applicable);
- 3 letter ICAO code of the operator (or IGA). (Mandatory if data pertains to an individual airframe);
- name of the operator;
- ICAO code of the State of Operator. (Mandatory);
- RMA of the State of the Operator;
- RMA of the State of Registry;
- RMA responsible for the decision to include the aircraft on the RMA Bulletin. (Mandatory);
- Comments (reason for inclusion of the aircraft into the RMAs' Bulletin). (Mandatory).

7.3.2 The exact structure of the RMA bulletin is contained in Appendix D.

## **7.4 Procedure for the Management of the RMA Bulletin**

7.4.1 In accordance with the approved Terms of Reference, each RMA conducts collection and analysis of data on compliance with RVSM requirements in its area of responsibility (Doc 9937). In the event that an aircraft is found to be operating in the RVSM airspace of the European region of ICAO and there is no information regarding the RVSM approval status for this aircraft, despite the best efforts of the RMA to clarify the status, the aircraft shall be placed on the RMA Bulletin as non-approved. If an aircraft is non-compliant with height keeping performance requirements or if an operator is non-compliant with long-term monitoring targets the aircraft/operator information shall be placed on the RMA Bulletin.

7.4.2 The RMA shall ensure that all reasonable efforts, in accordance with procedures defined below, are made to verify the approval status of any aircraft before it is added to the bulletin list. Each RMA may act independently to place an aircraft/operator on the bulletin. As far as practical the RMA shall ensure that the State exercising approval authority is fully cognisant of the situation and why an aircraft is placed on the bulletin. Upon receipt of appropriate information from the State authority an aircraft/operator record shall be removed from the bulletin as expeditiously as practical.

7.4.3 Upon receipt of notification through usual channels, that an aircraft has been placed on the RMA bulletin, the responsibility to provide appropriate information for removal of the aircraft from the bulletin shall rest with the State concerned.

7.4.4 Each record within the bulletin shall explicitly state which RMA has made the decision to include the aircraft/operator. All user communication should be directed through the RMA to which the State, exercising operational authority for any listed aircraft/operator, is accredited. The RMA shall communicate any requests for approval status confirmation directly to the State concerned when the aircraft/operator is under the operational authority of a State accredited to that RMA. In the event that the aircraft/operator is under the operational authority of a State accredited to another RMA in the EUR navigation region, then the request shall be submitted to that RMA for further investigation. The decision on

whether to include this aircraft under investigation onto the bulletin shall also be delegated. The similar approach is used in the cases of non-compliant aircraft.

7.4.5 In the event that an aircraft/operator being investigated is under the operational authority of a State accredited to another RVSM region, not accredited to the ICAO EUR/NAT office, then the request shall be submitted to the designated RMA in that region for further investigation with the appropriate State authority. However, the decision to include the aircraft/operator details on the RMA bulletin will remain with the originating RMA within EUR navigation region.

7.4.6 The practical procedures associated with the operation of the RMA bulletin may be liable to change following the initial implementation.

## **7.5 Application Procedure – Addition of a Record to the RMA Bulletin**

### **Non-Approved Aircraft**

7.5.1 Each RMA conducts regular flight plan audits within its area of responsibility. The purpose of the audit is to identify aircraft which are operating in RVSM without approval in violation of requirement 2.1.6.1 of ICAO Doc. 7030 (5<sup>th</sup> amendment). During the audit the validity of Field 10 of flight plan is checked against the RMA records of aircraft approved to fly RVSM within the region. The RMA may also conduct audits from surveillance data if a suitable infrastructure is available.

7.5.2 Aircraft are identified as potential candidates for the RMA bulletin as non-approved by the following processes:

- a. Any aircraft identifier with a flight plan including a "W" in data item 10 of the ICAO flight plan and a requested flight level in the range from FL290 to FL410 inclusive, which is not listed in the RMA's central database of RVSM approvals, or
- b. Any aircraft identifier extracted from air surveillance (or height monitoring) data analysis in the range from FL290 to FL410 inclusive, which is not listed in the RMA's central database of RVSM approvals
- c. Information provided by another RMA from their own independent audits of flight plans cross checked with the approval records submitted by the RMA accredited to the ICAO EUR/NAT region.

7.5.3 The RMA conducts a proactive investigation into all potentially non-approved aircraft identified by the processes described above. The first stage of the investigation is to clarify which State exercises operational authority of the aircraft concerned. The second stage is to request the State to confirm the RVSM approval status of the aircraft concerned.

7.5.4 In the event that the aircraft is confirmed as approved no further action is required. If the aircraft is confirmed as non-approved then the aircraft shall be added to the bulletin until such time as an approval is received or other information is received justifying the removal of the record. In the event that no response is received to the RMA request in a reasonable timeframe, and an appropriate notification is issued to the State concerned, then the aircraft shall be added to the bulletin. All requests shall include a warning that the aircraft may be added to the RMA bulletin if the aircraft is not approved or confirmation of approval is not received within a predefined period of time.

7.5.5 Once an aircraft is included on the RMA bulletin a notification e-mail shall be sent to the accredited representative of the State exercising operational authority and if appropriate to the aircraft operator directly.

#### **Detailed Procedure for Identifying an Aircraft as Not RVSM Approved**

7.5.6 If during a flight plan audit or evaluation of air surveillance data an aircraft was detected, for which no approval information was available, the RMA initiates an approval status investigation for this aircraft. The procedure to be followed before any addition of an aircraft/operator record to the RMA bulletin is as follows:

1. State accredited to the RMA. The RMA sends a request to the accredited representative of the state authority by e-mail requesting clarification of aircraft RVSM approval status,
2. State accredited to another RVSM region. The RMA sends a request to the appropriate RMA from the RVSM region from which the aircraft originates, for forward transmission to the State exercising operational authority requesting clarification of aircraft RVSM approval status,
3. The accredited State, or other RMA, shall be requested to send confirmation of RVSM approval status, including all data fields completed on Form F2 within 20 days from the date of the initial request. If no response is received within 20 the RMA sends a second request by e-mail to the State or other RMA;
4. Unless confirmation is received from the State or other RMA contacted, that the aircraft has a valid RVSM approval within 30 days then the assumption shall be made that there is no valid RVSM approval and the aircraft details shall be added to the bulletin. A communication to this effect shall be sent to the State or RMA concerned;
5. **If within 30 days the RMA, which has requested the state authority, does not receive the answer confirming the availability of the approval for this aircraft from the accredited representative (para 1), it is concluded that the aircraft does not hold an RVSM;**
6. **If within 30 days the RMA, which has requested another RMA, does not receive the answer (para 2) confirming the availability of the approval for this aircraft, it is concluded that the aircraft does not hold an RVSM approval.**

#### **Inclusion of State Aircraft in the Bulletin**

7.5.7 Any State aircraft which operates in RVSM airspace with a 1,000 ft. vertical separation is required to be RVSM approved and its details forwarded to the RMA. Therefore, any State aircraft which is associated with a flight plan with a 'W' included in item 10 and a requested flight level between FL 290 and FL 410, but which is not reported as RVSM approved shall be included in the bulletin.

7.5.8 State aircraft which do not include a 'W' in the flight plan and which are provided a 2,000 ft. vertical separation minimum shall not be included in the bulletin. Operators of non-RVSM approved State aircraft wishing to operate in RVSM airspace are reminded that they are required to insert STS/NONRVSM in item 18 of the flight plan.

#### **Aircraft with Non-Compliant Technical Height Keeping Performance Characteristic**



7.5.9 The RMA monitors aircraft Altimetry System Error with EGMU units and/or ground monitoring systems, which include HMU, EAGM and AHMS. The RMA threshold for determining an aircraft to be non-compliant, and hence to be included in the RMA Bulletin as a non-RVSM-compliant in the following situation:

- The RMA determines the true characteristic of one or more altimetry systems of the aircraft to be in excess of 85 meters (275 feet).

#### **Operators Non-Compliant with Long-Term Monitoring Requirements (LTHM)**

7.5.10 In accordance with the requirements of Annex 6, aircraft must undergo periodic technical height monitoring for the purpose of determining Altimetry System Error characteristics and the validity of continued airworthiness procedures. The RMA monitors operator compliance with these requirements. Operators who are not compliant with fleet monitoring targets may be included in the RMA bulletin.

7.5.11 The RMA may communicate directly with a non-compliant operator to agree a monitoring plan, or may communicate through the appropriate State authority. An operator may be included on the RMA bulletin in the following situations:

1. The operator, having received notification (directly or through the State authority) from the RMA on failure to comply with long term height monitoring requirements and the failure to agree a monitoring plan for future compliance, continues to perform flights within RVSM airspace.
2. An operator not in compliance with the LTHM requirements, which has agreed a monitoring plan to demonstrate compliance within a fixed timeframe, but does not do so, and continues to perform flights within RVSM airspace.

## **7.6 Application Procedure – Removal of a Record from the RMA Bulletin**

### **Removal of (previously) Non-Approved Aircraft**

7.6.1 The RMA, which has included an aircraft in the RMA Bulletin as non-RVSM-approved, shall removal this aircraft from the Bulletin in the following circumstances:

- The RMA has received, from the accredited representative of the appropriate State authorities the F2 Form confirming the validity of the approval for this aircraft, or
- An RMA from another ICAO RVSM region confirms receipt of the approval confirmation from the applicable State authority and has updated their regional records to include the relevant aircraft approval information.
- It is confirmed by the appropriate authority that the aircraft is no longer in operation, has been de-registered from the operator cited as operating without approval or it is confirmed that the operator will restrict future operations to outside of RVSM airspace.

### **Removal of (previously) Non RVSM compliant Aircraft**

7.6.2 The RMA, which has included an aircraft in the RMA Bulletin as non-compliant with aircraft technical height keeping performance requirements, shall removal this aircraft from the Bulletin in the following circumstances:

- Appropriate evidence is provided to the RMA from an accredited source, indicating that the causes of the detected error have been removed; or
- The RMA receives confirmation from the accredited State approval representative that the operator has taken appropriate steps to eliminate the causes of the detected error; or
- New monitoring results from any RVSM region support the statement that the error no longer exceeds the stipulated limits.

### **Removal of Operator (previously) Non-Compliant with Long-Term Monitoring Requirements**

7.6.3 The RMA, which has included an aircraft in the RMA Bulletin as non-compliant with long-term monitoring requirements, shall removal this aircraft from the Bulletin in the following circumstances:

- The operator has demonstrated compliance with the requirement, by achieving successful and compliant height monitoring results for the required minimum number of airframes. Data can be provided by any of the globally recognised RVSM monitoring programmes.

7.6.4 For all cases above, the RMA shall remove the aircraft/operator details from the RMA Bulletin within 1 working day, after receiving the data confirming the resolution of the issue for which the initial listing was made

## 7.7 User access

7.7.1 The RMA Bulletin shall be located on the official web-sites of the Regional Monitoring Agencies. Accredited users can request access to the information contained in the RMA Bulletin through the EUR RMA and RMA EURASIA. The RMAs will provide verified users of the RMA Bulletin with user names (logins) and passwords. In order to get this access the accredited representatives of the users must send an F1 Form (Doc 9937) to the RMA at the following e-mail addresses: **RMA@RMA-EURASIA.ru** for RMA EURASIA or **EurRMA.Support@eurocontrol.int** for EUR RMA.

7.7.2 In order to access the RMAs' Bulletin available at the RMA EURASIA website the users shall use the following URL address **http://rma.rma-eurasia.ru**, where it is necessary to choose an appropriate user category.

7.7.3 In order to access the RMAs' Bulletin at the EUROCONTROL (EUR RMA) website the users shall use the following URL address **https://extranet.eurocontrol.int/http://onesky2.eurocontrol.int/amserver/UI/Login?gw=extranet.eurocontrol.int&org=eurocontrol**.

7.7.4 Accredited representatives EANPG States shall be provided with access to all information provided on the bulletin.

7.7.5 Where appropriate, accredited representatives of the ATS providers of the EANPG States will be provided access to all information on all aircraft/operators included in the RMA Bulletin.

7.7.6 Where appropriate, accredited representatives of operators from within EANPG States, will be provided with access to information on any of their aircraft included in the RMA Bulletin.

7.7.7 Accredited representatives of EANPG approved international organisations will be provided access to all information on all aircraft/operators included in the RMA Bulletin.

7.7.8 Accredited representatives of RMAs from other ICAO RVSM regions will be provided access to all information on all aircraft/operators included in the RMA Bulletin.

7.7.9 In addition to web access, all users shall have the possibility of downloading data for which they have access rights.

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## **APPENDIX A - TERMS OF REFERENCE**

### **EANPG REGIONAL MONITORING AGENCIES OF EUROPEAN ICAO REGION**

#### **TERMS OF REFERENCE**

The European Regional Monitoring Agency (EUR RMA) and Regional Monitoring Agency Eurasia (RMA Eurasia) were established by the European Air Navigation Planning Group (EANPG) to organize and conduct the RVSM monitoring program within the European ICAO region in accordance with the requirements detailed in Annex 11 (13th Edition) and Doc 9574 (3d Edition).

On request of the EANPG (EANPG Conclusions 43/36 and 45/29 refer), the EUROCONTROL Commission established the European Regional Monitoring Agency (EUR RMA) as part of the EURCONTROL Agency (CN Ad hoc 11/2003 refers).

In agreement with the EANPG (EANPG Conclusion 51/17) during the RVSM implementation in the eastern part of the European ICAO region the Russian Federation took the special obligation to organize and maintain the RVSM monitoring program in this part of European ICAO region. The RMA Eurasia was established in accordance with the Ministry of Transport Order of the Russian Federation No 125 from 3.05.2012.

The RMAs were established to support the European Air Navigation Planning Group (EANPG) for safety maintaining of the RVSM in European ICAO region. RMAs provide the continued safety oversight of the European RVSM airspace.

The RMA is tasked with safety oversight of a defined region of RVSM airspace by EANPG. The RMA operates on behalf of accredited States within its region for reporting operator non-compliance with RVSM approval and performance requirements and other safety related issues. However it remains the responsibility of the individual States to ensure that corrective or remedial action is taken in response to any incident reported to it by the RMA.

These functions of the RMA, as agreed by EANPG, are as follows:

1. Establish and operate a regional database of RVSM approvals issued by accredited State aviation authorities. Implement configuration (quality) control checks to verify the veracity of the data.
2. Conduct regular audits to verify the RVSM approval status of aircraft operating in RVSM airspace and ensure that flights by non-approved aircraft are reported to the relevant State Authority for appropriate action.
3. Maintain a height monitoring infrastructure to provide aircraft technical height keeping performance data.
4. Act as the custodian of all aircraft technical height keeping data collected.

5. Provide approved operators and State aviation authorities with height monitoring results on request<sup>2</sup>.
6. Evaluate the vertical navigation performances of individual aeroplanes and aircraft type groups and monitor compliance with performance requirements defined in ICAO SARPS and guidance material. Report aberrant and non-compliant performance of individual aircraft and groups to aircraft certification and approval authorities for the application of appropriate remedial action.
7. Assist States to develop remedial action plans to ensure operator compliance with RVSM approval and performance requirements. If necessary the RMA should notify the Director General of the National Supervisory Authority of the State which exercises operational authority over the aircraft if such remedial actions are considered to be insufficient.
8. Initiate appropriate action through the EANPG/ICAO EUR/NAT Regional Director with States which continue to have not implemented appropriate remedial actions with non-approved or non-compliant operators.
9. Track operator compliance with global and regional minimum monitoring requirements. Report operator non-compliance with fleet monitoring targets to relevant RVSM approval authorities for appropriate action.
10. Establish and amend, as required, mechanisms for the collection and analysis of occurrence data including large height deviations, for contribution towards risk assessment.
11. Liaise with other Regional Monitoring Agencies in order to achieve an exchange of RVSM approval and monitoring data.
12. Investigate and analyze the generic causes of occurrences, including large height deviations and operational errors and report such causes to EANPG to decide on appropriate follow-up action as required.
13. If appropriate the RMA should notify the State aviation authorities and operators of any events requiring corrective action regarding the correct implementation of flight crew procedures.
14. Establish and maintain a regional bulletin for the general information of States regarding aircraft and operators which are in violation of ICAO RVSM approval, performance and fleet monitoring requirements so that appropriate actions can be taken to preserve safety levels in their sovereign RVSM airspace.
15. Produce, and submit to EANPG for approval, an annual safety RVSM report, including the assessment of the operational and technical risk measured against the published Target Level of Safety. The report shall also include all safety related issues associated with the continued operation of RVSM in the ICAO EUR region.
16. Participate in RVSM related discussions at EANPG and associated sub groups. Implement and/or monitor applicable RVSM related EANPG decisions and conclusions.

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<sup>2</sup> Data shall not be provided in lieu of recognised engineering substantiation techniques in advance of an initial RVSM approval.

EUR RMA and RMA Eurasia cooperate closely and effort in order to harmonize of methods and procedures used for maintenance of RMA's functions and develop synergies in conducting the continue safety oversight in European RVSM airspace.

## APPENDIX B – EXAMPLE OF FORM RMA F2

**RMA F2  
RECORD OF APPROVAL TO OPERATE IN RVSM AIRSPACE**

**FOR USE BY APPROVAL ISSUING AUTHORITIES ONLY**

This form must be completed and returned to the Regional Monitoring Agency to which the State is accredited. For a full list of State/RMA accreditations please see ICAO Doc. 9937. For States accredited to the EUR RMA please forward this form to the address below. (PLEASE USE BLOCK LETTERS.)

State of Registry. <sup>1</sup>	<input type="text"/>
Name of Operator. <sup>2</sup>	<input type="text"/>
3 Letter ICAO Operator Code. <sup>3</sup>	<input type="text"/>
State of Operator. <sup>4</sup>	<input type="text"/>
Aircraft type. <sup>5</sup>	<input type="text"/>
Aircraft series. <sup>6</sup>	<input type="text"/>
Manufacturer's serial number. <sup>7</sup>	<input type="text"/>
Registration mark. <sup>8</sup>	<input type="text"/>
Date of registry. <sup>9</sup>	<input type="text"/>
24 bit ICAO address (Mode S). <sup>10</sup>	<input type="text"/>
Date of RVSM Approval. <sup>11</sup>	<input type="text"/>
Date of expiry (If applicable). <sup>12</sup>	<input type="text"/>
RVSM Airworthiness Compliance Ref. <sup>13</sup>	<input type="text"/>

Approvals from States accredited to the EUR RMA should be sent to:







E-mail      **EURRMA.support@eurocontrol.int**  
 Fax            +32 27 29 51 85

**INSTRUCTIONS FOR COMPLETING FORM RMA F2**

- 1 Enter the one or two letter ICAO State identifier as contained in ICAO Doc. 7910, or full name.
- 2 Enter the full operator name as contained in ICAO Doc. 8585 or full legal name.
- 3 Enter the operator 3 letter code as contained in ICAO Doc. 8585 or for General Aviation enter IGA.
- 4 Enter the one or two letter ICAO State identifier as contained in ICAO Doc. 7910, or full name.
- 5 Enter full manufacturer model, or as a minimum the ICAO designator as contained in ICAO Doc. 8643.
- 6 Enter the aircraft series or manufacturer's custom designator.
- 7 Enter the manufacturer's serial number.
- 8 Enter the registration mark of the aircraft.
- 9 Enter the date this registration was allocated to this airframe.
- 10 Enter the 24 bit ICAO aircraft address (Mode S) allocated by the State. Use 6 digit hexadecimal format.
- 11 Enter the date that the RVSM approval was officially issued. Approvals must not be retrospective. Use UTC day/Month/Year format.
- 12 Enter the date that the RVSM approval expires (if appropriate). Use UTC day/Month/Year format.
- 13 Enter the TC, TC amendment, SB or STC number which confirms compliance with RVSM aircraft airworthiness requirements.



## EXAMPLE OF ELECTRONIC FORM RMA F2

RMA F2	
State of registry AC:*	<p>ABCDEFGHIJKLMNOPQRSTUVWXYZ</p> <p>Russian Federation (U) ▾</p> <p>RMA: EURASIA RMA</p>
Operator:*	<p>Name: TRANSAERO AIRLINES (TSO) (U) ✕ [A-Z]</p> <p>Operator state: Russian Federation</p> <p>Operator's RMA: EURASIA RMA</p> <p>ICAO code of operator: TSO</p>
AC type:*	<p>Manufacturer: BOEING ▾</p> <p>Icao Code/series: B763 ▾ 300 ▾ +</p> <p>Manufacturer: BOEING</p> <p>Manufacturer type: B763-300</p>
S/N:*	24746
Reg. Number:*	EIDBG
Modes:*	4CA1D9
Airworthiness certificate issued:	20.06.2011 
Airworthiness certificate valid:	24.03.2016 
RVSM approval issued:	25.03.2014 
RVSM approval valid:	24.03.2016 
Method of compliance:	<p>Method: TC – Type Certificate ▾</p> <p>Number: <input type="text"/></p> <p>Date: <input type="text"/> </p>
Files:	 <i>Select file</i>
Notes:	Example of the RMA F2 Form

**APPENDIX C – EXAMPLE OF FORM RMA F1**

**EUR RMA F1  
STATE CONTACT DETAILS FOR MATTERS RELATING TO RVSM**

This form should be used to supply the contact information of people/positions responsible for coordinating RVSM information on behalf of their State with the EUR RMA.

A new form should be submitted whenever any of the required information changes. In the event that there are multiple contacts please submit separate forms for each one. (PLEASE USE BLOCK LETTERS.)

Area of Responsibility: (delete as appropriate) RVSM APPROVALS/AIR WORTHINESS/OPERATIONAL INCIDENT REPORTS/OTHER (please specify)

Name of State or Registry:

Post/Position:

Name:

Address:

Telephone Number:

E-mail:

Fax Number:

Please send completed forms to the EUR RMA at the following e-mail address or fax number:

E-mail      **EURRMA.support@eurocontrol.int**  
Fax            **+32 27 29 51 85**

## APPENDIX D – RMA BULLETIN DATA FORMAT

Date of Entry	Operator ICAO code	Operator Name	State of Operator	Aircraft ICAO type	Series	Serial No.	Reg. No.	Hex Mode S	AC Reg. State	Reason	Remarks
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## Format of the fields

No	Field	Type	Size	Data format	Mandatory fields
1	Date of inclusion	Date	16	17.10.2014 15:34:28	Mandatory
2	Operator ICAO code	Text	3	AFL	Optional
3	Operator Name	Text	200	AEROFLOT - RUSSIAN AIRLINES	Mandatory
4	State of Operator	Text	3	U	Mandatory
5	Aircraft ICAO type	Text	4	F900	Optional
6	Series	Text	40	X	Optional
7	Serial No	Text	20	0055	Optional
8	Reg. No.	Text	11	VQBZZ	Mandatory, and empty when operator is in non-compliance with the MMR requirements - "M"
9	Hex Mode S	Text	6	424972	Optional
10	AC Reg. State	Text	2	TX	Optional
11	Reason	Text	4	"AD", "AD", "DO" A – Lack of RVSM approval D - non-compliance with the RVSM requirements; M - non-compliance with the MMR requirements. O - other	Mandatory
12	Remarks	Text	200		Optional

– END –



**RVSM MINIMUM MONITORING REQUIREMENTS:**

**AS OF: 20 May 2016**

**Version: 2016.0**

1. **UPDATE OF MONITORING REQUIREMENTS TABLE AND WEBSITE.** As significant data is obtained, monitoring requirements for specific aircraft types may change. When Table 1 below, is updated, a letter will be distributed by the Regional Monitoring Agencies (RMAs) to the States concerned. The updated table will be posted on the RMA website being maintained by the International Civil Aviation Organization (ICAO). The secure website address is: <http://portal.icao.int>
2. **INITIAL MONITORING.** All operators that operate or intend to operate in airspace where RVSM is applied are required to participate in the RVSM monitoring program. Table 1 establishes requirements for initial monitoring associated with the RVSM approval process. In their application to the appropriate State authority for RVSM approval, operators must show a plan for meeting the applicable initial monitoring requirements.
3. **AIRCRAFT STATUS FOR MONITORING.** Aircraft engineering work that is required for the aircraft to receive RVSM airworthiness approval must be completed prior to the aircraft being monitored. Any exception to this rule will be coordinated with the State authority.
4. **APPLICABILITY OF MONITORING FROM OTHER REGIONS.** Monitoring data obtained in conjunction with RVSM monitoring programs from other regions can be used to meet regional monitoring requirements. The RMAs, which are responsible for administering the monitoring program, have access to monitoring data from other regions and will coordinate with States and operators to inform them on the status of individual operator monitoring requirements.
5. **MONITORING PRIOR TO THE ISSUE OF RVSM OPERATIONAL APPROVAL IS NOT A REQUIREMENT.** Operators should submit monitoring plans to the responsible civil aviation authority and the RMA that show how they intend to meet the requirements specified in Table 1. Monitoring will be carried out in accordance with this table.
6. **AIRCRAFT GROUPS NOT LISTED IN TABLE 1.** Contact the RMA for clarification if an aircraft group is not listed in Table 1 or for clarification of other monitoring related issues. An aircraft group not listed in Table 1 will probably be subject to Category 2 monitoring requirements.
7. **TABLE OF MONITORING GROUPS.** Table 2 shows the aircraft types and series that are grouped together for operator monitoring purposes.
8. **TABLE OF NON-GROUP AIRCRAFT:** Table 3 shows the aircraft types and series that are Non-Group aircraft (i.e., Not certified under group approval requirements) for monitoring purposes.
9. **TRAILING CONE DATA.** Altimetry System Error estimations developed using Trailing Cone data collected during RVSM certification flights can be used to fulfill monitoring requirements. It must be documented, however, that aircraft RVSM systems were in the approved RVSM configuration for the flight.
10. **MONITORING OF AIRFRAMES THAT ARE RVSM COMPLIANT ON DELIVERY.** If an operator adds new RVSM compliant airframes of a type for which it already has RVSM operational approval and has completed monitoring requirements for the type in accordance with the attached table, the new airframes are not required to be monitored. If an operator adds new RVSM compliant airframes of an aircraft type for which it has NOT previously received RVSM operational approval, then the operator should complete monitoring in accordance with the attached table.
11. **FOLLOW-ON MONITORING.** Monitoring is an on-going program that will continue after the RVSM approval process. Long term minimum monitoring requirements are established in the Annex 6 to the Convention on International Civil Aviation. On a regional basis, a programme shall be instituted for monitoring the height-keeping

RASMAG/21-WP/XX

14-17/06/2016

Attachment 2

performance of aircraft operating in RVSM airspace in order to ensure that continued application of this vertical separation minimum meets regional safety objectives.

**Table 1: MONITORING REQUIREMENTS TABLE (Civilian)**

<b>MONITORING IS REQUIRED IN ACCORDANCE WITH THIS TABLE</b>			
MONITORING PRIOR TO THE ISSUE OF RVSM APPROVAL IS <b><u>NOT</u></b> A REQUIREMENT			
<b>CATEGORY</b>		<b>GROUP DESCRIPTOR</b>	<b>MINIMUM MONITORING REQUIREMENTS</b>
<b>1</b>	GROUP APPROVED: DATA INDICATES COMPLIANCE WITH THE RVSM MASPS	A124, <b>A30B</b> , A306, A310-GE, A310-PW, A318, A320, A330, A340, A345, A346, A380, A3ST, AVRO, B712, B727, B737C, B737CL, B737NX, B747CL, B74S, B744-5, B744-10, B752, B753, B764, B767, B772, B773, BD100, BE40, C25A, C25B, C510, C525, C560, C56X, C650, C680, C750, CARJ, CL600, CL604, CL605, CRJ7, CRJ9, DC10, E135-145, E170-190, E50P, E55P, F100, F900, FA7X, GALX, GLEX, GLF4, GLF5, H25B-800, J328, LJ40, LJ45, LJ60, MD10, MD11, MD80, MD90, <b>PC12</b> , PRM1, T154	Operators of aircraft types contained in this category shall have a minimum of 2 airframes monitored every 2 years or 1,000 flight hours, whichever is longer calculated from the date of the last successful height monitoring. Operators with fleets consisting of aircraft from more than one Monitoring Group shall meet this requirement for each group in the fleet. In the event that an operator has a single airframe from a Group, then that aircraft shall be monitored every 2 years or 1,000 flight hours, whichever is longer calculated from the date of the last successful height monitoring.
<b>2</b>	GROUP APPROVED: INSUFFICIENT DATA ON APPROVED AIRCRAFT	Other group aircraft other than those listed above including: A148, A158, A350, AC90, AC95, AJ27, AN72, ASTR, ASTR-SPX, B701, B703, B731, B732, B744-LCF, B748, B787, BCS1, BD700, BE20, BE30, C25C, C441, C500, C550-B, C550-II, C550-SII, CRJ10, D328, DC85, DC86-87, DC91, DC93, DC94 DC95, E120, E45X, EA50, <b>E545-550</b> , F2TH, F70, FA10, FA20, FA50, G150, G280, GLF2, GLF2B, GLF3, GLF6, H25B-700, H25B-750, H25C, HA4T, HDJT, IL62, IL76, IL86, IL96, L101, L29B-2, L29B-731, LJ23, LJ24, LJ25, LJ28, LJ31, LJ35-36, LJ55, MU30, <b>PC24</b> , P180, PAY4, SB20, SBR1, SBR2, SU95, T134, T204, T334, TBM, WW24, YK42	Operators of aircraft types contained in this category shall have a minimum of 60% of airframes monitored every 2 years or 1,000 flight hours, whichever is longer calculated from the date of the last successful height monitoring, (the number of airframes to be monitored shall be rounded up to the nearest whole integer). Operators with fleets consisting of aircraft from more than one Monitoring Group shall meet this requirement for each Group in the fleet.
<b>3</b>	NON-GROUP	Aircraft types for which no generic compliance method exists: A225, AN12, AN26, B190, B462, B463, B74S-SOFIA, BA11, BE9L, GSPN, H25A, L29A, PAY3, R721, R722, SJ30, STAR	Operators of aircraft types contained in this category shall have 100% of airframes monitored every 2 years or 1,000 flight hours., whichever is longer calculated from the date of the last successful height monitoring.

**Table 2: MONITORING GROUPS FOR AIRCRAFT CERTIFIED UNDER GROUP APPROVAL REQUIREMENTS**

Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
A124	A124	AN-124 RUSLAN	
A148	A148	AN-148	
A158	A158	AN-158	
A30B	A30B	A300	
A306	A306	A300	
A310-GE	A310	A310	Series: 200, 200F, 300, 300F
A310-PW	A310	A310	Series: 220, 220F, 320, 320F
A318	A318	A318	
A320	A319 A320 A321	A319 A320 A321	
A330	A332 A333	A330 A330	
A340	A342 A343	A340 A340	
A345	A345	A340	
A346	A346	A340	
A350	A359 A358	AIRBUS 350-900 AIRBUS 350-800	
A380	A388	A380	
A3ST	A3ST	A300	
AC90	AC90	COMMANDER 690 COMMANDER 840 COMMANDER 900	
AC95	AC95	AERO COMMANDER 695	
AJ27	AJ27	COMAC ARJ-21-700	
AN72	AN72	ANTONOV AN-72 ANTONOV AN-74	
ASTR	ASTR	1125 ASTRA	S/n 1-78, except 73
ASTR-SPX	ASTR	1125 ASTR SPX, G100	S/n 73, 79-145 S/n > 145
AVRO	RJ1H RJ70 RJ85	RJ100 Avroliner RJ70 Avroliner RJ85 Avroliner	
B701	B701	B707	
B703	B703	B707	Series 320, 320B, 320C
B712	B712	B717	
B727	B721 B722	B727 B727	
B731	B731	B737	
B732	B732	B737	



Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
B737CL	B733 B734 B735	B737-300 B737-400 B737-500	
B737NX	B736	B737-600	
	B737	B737-700	Series: 700, BBJ only
	B738	B737-800	
	B739	B737-900	
B737C	B737	B737-700	Series: 700C
B747CL	B741 B742 B743	B747-100 B747-200 B747-300	
B74S	B74S B74R	B747SP B747SR	
B744-5	B744 B74D	B747-400	5 inch Probes up to SN 25350
B744-10	B744 B74D	B747-400	10 inch Probes from SN 25351
B744-LCF	BLCF	B747-400	
B748	B748	B747-800	
B752	B752	B757-200	
B753	B753	B757-300	
B767	B762	B767-200	
	B763	B767-300	
B764	B764	B767-400	
B772	B772	B777-200	
	B77L	B777-F	
	B77L	B777-200LR	
B773	B773	B777-300	
	B77W	B777-300ER	
B787	B788	B787-8	
	B789	B787-9	
BCS1	BCS1	BOMBARDIER 500 C SERIES CS100	
	BCS3	BOMBARDIER 500 C SERIES CS300	
BD100	CL30	CHALLENGER 300	
	CL35	CHALLENGER 350	Begins at s/n 20501
BD700	GL5T	GLOBAL 5000	
BE20	BE20	200 KINGAIR	
BE30	BE30	B300 SUPER KINGAIR	
	B350	B300 SUPER KINGAIR 350	
BE40		BEECHJET 400	
		BEECHJET 400A	
		BEECHJET 400XP	
		HAWKER 400XP	
C441	C441	CONQUEST II	

Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
C500	C500 C500 C501	500 CITATION 500 CITATION I 501 CITATION I SINGLE PILOT	
C510	C510	MUSTANG	
C525	C525	525 CITATIONJET 525 CITATIONJET 1 525 CITATIONJET PLUS C525-M2	
C25A	C25A	525A CITATIONJET II	
C25B	C25B	CITATIONJET III 525B CITATIONJET III	
C25C	C25C	525C CITATIONJET IV	
C550-B	C550	550 CITATION BRAVO	s/n 550-0801 and on
C550-II	C550 C551	550 CITATION II 551 CITATION II SINGLE PILOT	s/n 550-0001 to 550-0800
C550-SII	C550	S550 CITATION SUPER II	s/n starts with "S"
C560	C560	560 CITATION V 560 CITATION V ULTRA 560 CITATION V ENCORE	
C56X	C56X	560 CITATION EXCEL 560 CITATION XLS	
C650	C650	650 CITATION III 650 CITATION VI 650 CITATION VII	
C680	C680	680 CITATION SOVEREIGN 680-A LATITUDE	"A" in s/n
C750	C750	750 CITATION X	
CARJ	CRJ1 CRJ2 CRJ2 CRJ2	CRJ-100 CRJ-200 CHALLENGER 800 CHALLENGER 850	
CRJ7	CRJ7	CRJ-700	
CRJ9	CRJ9	CRJ-900	
CRJ10	CRJX	CRJ-1000	
CL600	CL60	CL-600 CL-601	S/n < 5000
CL604	CL60	CL-604 CL-601-3A CL-601-3R	5000 < S/n < 5700 5001-5134 5135-5300
CL605	CL60	CL-605	S/n > 5700
DC10	DC10	DC-10	
D328	D328	328 TURBOPROP	
DC85	DC85	DC-8	
DC86-87	DC86 DC87	DC-8 DC-8	
DC91	DC91	DC-9	

Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
DC93	DC93	DC-9	
DC94	DC94	DC-9	
DC95	DC95	DC-9	
E120	E120	EMB-120 Brasilia	
E135-145	E135 E145 E35L	EMB-135 EMB-145 EMB-135BJ Legacy 600/650	
E45X	E45X	EMB-145 XR	
E170-190	E170 E170 E75S E190 E190	EMB-170 EMB-175 ERJ-170-200 (short wing) EMB-190 EMB-195	
E50P	E50P	PHENOM 100	
E545-550	E545 E550	EMB-545 Legacy 450 EMB-550 Legacy 500	
E55P	E55P	PHENOM 300	
EA50	EA50	ECLIPSE	
F100	F100	FOKKER 100	
F2TH	F2TH	FALCON 2000 FALCON 2000-EX FALSON 2000LX	
F70	F70	FOKKER 70	
F900	F900	FALCON 900 FALCON 900DX FALCON 900EX FALCON 900LX	
FA10	FA10	FALCON 10	
FA20	FA20	FALCON 20 FALCON 200	
FA50	FA50	FALCON 50 FALCON 50EX	
FA7X	FA7X FA8X	FALCON 7X FALCON 8X	
G150	G150	G150	
G280	G250 G280	G250 G280	
GALX	GALX	1126 GALAXY G200	
GLEX	GLEX	BD-700 GLOBAL EXPRESS	
GLF2	GLF2	GULFSTREAM II (G-1159)	
GLF2B	GLF2	GULFSTREAM IIB (G-1159B)	
GLF3	GLF3	GULFSTREAM III (G-1159A)	

Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
GLF4	GLF4	GULFSTREAM IV (G-1159C) G300 G350 G400 G450	
GLF5	GLF5	GULFSTREAM V (G-1159D) G500 G550	
GLF6	GLF6	G650	
H25B-700	H25B	BAE 125 / HS125	Series: 700A, 700B
H25B-750	H25B	HAWKER 750	
H25B-800	H25B	BAE 125 / HS125 HAWKER 800XP HAWKER 800XPI HAWKER 800 HAWKER 850XP HAWKER 900XP HAWKER 950XP	Series: 800A, 800B
H25C	H25C	HAWKER 1000	
HA4T	HA4T	HAWKER 4000	
HDJT	HDJT	HONDAJET HA-420	
IL62	IL62	ILYUSHIN-62	
IL76	IL76	ILYUSHIN-76	
IL86	IL86	ILYUSHIN-86	
IL96	IL96	ILYUSHIN-96	
J328	J328	328JET	
L101	L101	L-1011 TRISTAR	
L29B-2	L29B	L-1329 JETSTAR II	
L29B-731	L29B	L-1329 JETSTAR 731	
LJ23	LJ23	LEARJET 23	
LJ24	LJ24	LEARJET 24	
LJ25	LJ25	LEARJET 25	
LJ28	LJ28	LEARJET 28 LEARJET 29	
LJ31	LJ31	LEARJET 31	
LJ35-36	LJ35	LEARJET 35 LEARJET 36	
LJ40	LJ40 LJ70	LEARJET 40 LEARJET 70	
LJ45	LJ45 LJ75	LEARJET 45 LEARJET 75	
LJ55	LJ55	LEARJET 55	
LJ60	LJ60	LEARJET 60	
MD10	MD10	MD-10	
MD11	MD11	MD-11	

Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
MD80	MD81 MD82 MD83 MD87 MD88	MD-80 MD-80 MD-80 MD-80 MD-80	
MD90	MD90	MD-90	
MU30	MU30	MU-300 DIAMOND	
P180	P180	P-180 AVANTI P-180 AVANTI II	
PAY4	PAY4	PA-42 Cheyenne 400	Series: 1000 CHEYENNE
PC12	PC12	Pilatus PC-12	
PC24	PC24	Pilatus PC-24	
PRM1	PRM1	PREMIER 1	
SB20	SB20	SAAB 2000	
SBR1	SBR1	SABRELINER 40 SABRELINER 60 SABRELINER 65	
SBR2	SBR2	SABRELINER 80	
SU95	SU95	SUKHOI SUPERJET 100-95	
T134	T134	TU-134	
T154	T154	TU-154	
T204	T204	TU-204 TU-214 TU-224 TU-234	
T334	T334	TU-334	
TBM	TBM7 TBM8 TBM9	TBM-700 TBM-850 TBM-900	TBM8 with winglets, begins at s/n 1000
WW24	WW24	1124 WESTWIND	
YK42	YK42	Yakovlev YAK-42 Yakovlev YAK-40	

**Table 3: Non-GROUP AIRCRAFT (i.e., Not certified under group approval requirements) (Civilian)**

<b>Non-Group Descriptor</b>	<b>A/C ICAO</b>	<b>Manufacturer Type</b>	<b>Additional Defining Criteria</b>
A225	A225	ANTONOV AN-225	Non-Group
AN12	AN12	ANTONOV AN-12	Non-Group
AN26	AN26	ANTONOV AN-26	Non-Group
B190	B190	BEECH 1900	Non-Group
B462	B462	BAe-146-200	Non-Group
B463	B463	BAe-146-300	Non-Group
B74S-SOFIA	B74S	NASA B74SP with Sofia telescope	Non-Group: N747NA (s/n 21441)
BA11	BA11	BAC-111	Non-Group
BE9L			Non-Group
GSPN	GSPN	GROB G-180 SPn Utility Jet	Non-Group
H25A	H25A	HS125-400, -600	Non-Group
L29A	L29A	L-1329 JETSTAR 6/8	Non-Group
PAY3	PAY3	PIPER Cheyenne 3	Non-Group
R721	R721	B-727-100: Re-engined	Non-Group
R722	R722	B-727-200: Re-engined	Non-Group
SJ30	SJ30	SWEARINGEN SJ-30	Non-Group
STAR	STAR	BEECH 2000 STARSHIP	Non-Group

**Table 1: MONITORING REQUIREMENTS TABLE (Military)**

<b>MONITORING IS REQUIRED IN ACCORDANCE WITH THIS TABLE</b>			
MONITORING PRIOR TO THE ISSUE OF RVSM APPROVAL IS <b><u>NOT</u></b> A REQUIREMENT			
<b>CATEGORY</b>		<b>GROUP DESCRIPTOR</b>	<b>MINIMUM MONITORING REQUIREMENTS</b>
<b>1</b>	GROUP APPROVED: DATA INDICATES COMPLIANCE WITH THE RVSM MASPS	C17, C130, KC135	Operators of aircraft types contained in this category shall have a minimum of 2 airframes monitored every 2 years or 1,000 flight hours, whichever is longer calculated from the date of the last successful height monitoring. Operators with fleets consisting of aircraft from more than one Monitoring Group shall meet this requirement for each group in the fleet. In the event that an operator has a single airframe from a Group, then that aircraft shall be monitored every 2 years or 1,000 flight hours, whichever is longer calculated from the date of the last successful height monitoring.
<b>2</b>	GROUP APPROVED: INSUFFICIENT DATA ON APPROVED AIRCRAFT	Other group aircraft other than those listed above including: A400, E3, C5, C550-552	Operators of aircraft types contained in this category shall have a minimum of 60% of airframes monitored every 2 years or 1,000 flight hours, whichever is longer calculated from the date of the last successful height monitoring, (the number of airframes to be monitored shall be rounded up to the nearest whole integer). Operators with fleets consisting of aircraft from more than one Monitoring Group shall meet this requirement for each Group in the fleet.
<b>3</b>	NON-GROUP	<b>Aircraft types for which no generic compliance method exists:</b>  GLF5-AEW, GLEX-ASTOR	Operators of aircraft types contained in this category shall have 100% of airframes monitored every 2 years or 1,000 flight hours., whichever is longer calculated from the date of the last successful height monitoring.

**Table 2: MONITORING GROUPS FOR AIRCRAFT CERTIFIED UNDER GROUP APPROVAL REQUIREMENTS (Military)**

Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
A30B-M	A30B	A300	B2-100 (Zero-G)
A310-M	A310	A310	MRT, MRTT
A332-M	A332	KC30-A KC45-A Voyager KC2, KC3	MRTT
A400	A400	A400M	
ASTR-M	ASTR	1125 ASTRA	NAV&COM
B737-AWACS	E737	B737	Series: 700W (AWACS)
E3	E3TF E3CF	E-3 Sentry	
E4	B742	E-4	
E6	E6	E-6 Mercury	
E8	B703	E-8 J-Stars	
C12	BE20	C-12	
C130	C130	C-130 Hercules	Series: H only
	C30J	C-130J Hercules	
C17	C17	C-17 Globemaster III	
C21	LJ35	C-21	
C32	B752	C-32	Series: A, B
C40	B737	C-40 Clipper	
C5	C5	C5 Galaxy	
C550-552	C550	552 CITATION II (USN)	
C550-B-M	C550	550 CITATION BRAVO	
C550-M	C550	550 CITATION II	
C35	C560	560 CITATION V UC-35	
C9	DC93	C-9 VC-9	Series: A, B Series: C
CL60-M	CL60	CL604	MPA
E135-M	E135	EMB-135	MRT
FA10-M	FA10	FALCON 10	MRT
FA20-M	FA20	FALCON 20	EW/ELINT, MRT, EXP
FA50-M	FA50	FALCON 50	MPA/SAR
GLF3-M	GLF3	C-20	Series: A, B, C, D, E
GLF4-M	GLF4	C-20 S102B TP102	Series: F, G, H
C37	GLF5	C-37 TP102D	



Monitoring Group	A/C ICAO	Manufacturer Type	Additional Defining Criteria
IL76-M	IL76	IL-76	MRT, T
KC10	DC10	KC-10 Extender KDC-10 DC-10	
KC135	B703 K35E K35R	KC-135 Stratotanker KC-135 Stratotanker C-135 Stratotanker	
KC46		Boeing KC-46 Pegasus	
P180-M	P180	P-180 AVANTI	
R135	R135	RC-135	
VC25	B742	VC-25	

Abbreviations:

EW/ELINT	Electronic Warfare/Electronic Intelligence
EXP	Experimental
MPA	Maritime Patrol Aircraft
MRT	Multi Role Transporter
MRTT	Multi Role Transporter and Tanker
SAR	Search and Rescue
T	Transporter

**Table 3: Non-GROUP AIRCRAFT (i.e., Not certified under group approval requirements)  
(Military)**

<b>Non-Group Descriptor</b>	<b>A/C ICAO</b>	<b>Manufacturer Type</b>	<b>Additional Defining Criteria</b>
GLEX-ASTOR	GLEX	Raytheon Sentinel aka RAF's ASTOR (Airborne Stand-Off Radar)	Non-Group
GLF5-AEW	GLF5	GULFSTREAM G550	Non-Group : AEW

Abbreviations:

AEW

Airborne Early Warning

RASMAG/21-WP/XX

14-17/06/2016

Attachment 2