

INTERNATIONAL CIVIL AVIATION ORGANIZATION



RVSM/RNAV/RNP TF/3 MEETING REPORT

(NAIROBI, 22 – 23 APRIL 2004)

Prepared by the APIRG RVSM/RNAV/RNP TASK FORCE

The RVSM/RNAV/RNP Task Force is a Task Force of the AFI Planning and Implementation Regional Group (APIRG).

Its Reports are therefore submitted to APIRG through the ATS/AIS/SAR Sub-Group for review and action.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of ICAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table of Contents

	Page
PART I - HISTORY OF THE MEETING.....	2
Introduction.....	2
Officers and Secretariat.....	2
Attendance	2
Working Language	2
Agenda	3
Conclusions.....	4
 PART II REPORT ON AGENDA ITEMS.....	 8
Report on Agenda Item 1.....	8
Report on Agenda Item 2.....	8
Report on Agenda Item 3.....	9
Report on Agenda Item 4	11
 APPENDICES	
APPENDIX A:	List of Participants
APPENDIX B:	AFI RMA Reporting Format
APPENDIX C:	ATS Training Guidance Material
APPENDIX D:	JAA Temporary Guidance Leaflet
APPENDIX E:	Sample AIC, NOTAM and AIP Supplement
APPENDIX F:	AFI SUPPs Doc.7030
APPENDIX G:	RVSM Action Plan
APPENDIX H:	Monitoring of Height Deviation by ATS Units
APPENDIX I:	Reference Documents on RVSM

PART I - HISTORY OF THE MEETING

1. Introduction

1.1 The Third meeting of the RVSM/RNAV/RNP Task Force (RVSM/RNAV/RNP TF/3) was convened pursuant to AFI/7 RAN Meeting Recommendations 5/7, 5/17 and APIRG/13 Decision 13/58 by the International Civil Aviation Organization at the ICAO ESAF Office, Nairobi, from 22 to 23 April 2004.

1.2 The meeting was opened by Mr. Lot Mollel, Regional Director of the ICAO Eastern and Southern African Office. He emphasized the preliminary studies which have to be done prior to the implementation of the required procedures aimed at increasing or improving the capacity of a given airspace in order to satisfy the demand of ever growing air traffic. In that regard, the Regional Director emphasized the importance of the Third Meeting of the RVSM/RNAV/RNP Task Force being organized pursuant to APIRG/13 Decision 13/58. He recalled APIRG 14 Conclusion 14/21 relating to the development of an AFI RVSM strategy/action plan within specific target dates and wished the members a fruitful deliberation with a view to further enhance the safety of air navigation in the Region.

2. Officers and Secretariat

2.1 The meeting nominated Mr. Yami Girma of Ethiopia as its moderator.

2.2 Mr. Apolo Kharuga, Regional Officer, Air Traffic Management of the ICAO ESAF Office, acted as the Secretary of the meeting. He was assisted by Messrs. Marcel Munyakazi (RO/ATM), Vic Van Der Westhuizen (ICAO RVSM Consultant) and Brou Konan (RO/ATM, WACAF Office, Dakar).

3. Attendance

3.1 The meeting was attended by 32 participants from 12 States and 3 International Organizations namely IATA, IFALPA and IFATCA. The list of participants is given at **Appendix A** to this report.

4. Working Language

4.1 The meeting was conducted in the English language only.

5. Agenda

5.1 The following Agenda was adopted:

Agenda Item 1: Review and follow-up action of conclusions of the second meeting of RVSM/RNAV/RNP Task Force

Agenda Item 2: Review of RVSM Strategy/Action Plan

Agenda Item 3: Review of the outcome of RVSM Seminar

Agenda Item 4: Any Other Business

6. Conclusions

6.1 The Task Force recorded its actions in the form of Conclusions.

Summary of Conclusions

Number	Title
Conclusion 3/1:	Safety assessment That: AFI RMA commence safety assessment as soon as possible but not later than 1 June 2004 .
Conclusion 3/2:	Civil/military coordination That: In order to ensure the safe and coordinated implementation of RVSM in the AFI Region, States should ensure that the military aviation authorities are fully involved in the planning and implementation process.
Conclusion 3/3:	Nomination of a National RVSM programme manager That: States/service providers who have not done so, nominate, as soon as possible, but not later than 31 May 2004 , a National RVSM Programme Manager who will be responsible for ensuring that the proper mechanism are put in place for the safe implementation of the RVSM programme and will also act as the focal point or contact person.
Conclusion 3/4	Reporting of data for monitoring and/or carrying out safety assessment That: <ul style="list-style-type: none"> a) All States institute procedures for reporting of data, incidents and conditions necessary for performing the collision risk calculations prerequisite for RVSM implementation to the AFI monitoring agency. The data will include, but not necessarily be limited to: <ul style="list-style-type: none"> i) Height deviations of 300 ft or more. ii) Total number of IFR movements for each month.

Number	Title
	<ul style="list-style-type: none"> iii) The average time per movement spent in the level band FL 290 to FL 410. iv) ATC/ATC coordination failures. v) Turbulence; and vi) Traffic data. <p>b) All States institute procedures for reporting to the AFI monitoring agency data, incidents and conditions necessary for performing the collision risk calculations prerequisite for RVSM implementation.</p> <p>c) AFI Regional monitoring agency should use the reporting format at Appendix B to this report.</p>
Conclusion 3/5:	<p>Implementation of RVSM in the AFI Region</p> <p>That:</p> <ul style="list-style-type: none"> a) All RVSM implementation preparation works (safety, assessment, training) be done taking into consideration the FL band between 290 and 410 inclusive. b) The final decision for implementation be taken at the informal coordination meeting planned for September/October 2004 (TF/5 meeting) taking into account status of readiness of States and operators. c) Implementation of RVSM in the AFI Region be harmonized and coordinated with the implementation time frames of adjacent Regions.
Conclusion 3/6:	<p>Training of all personnel involved with the implementation of RVSM in the AFI Region</p> <p>That:</p> <ul style="list-style-type: none"> a) Seminars/Workshops be organized in the Region for training of air traffic services personnel in the RVSM field. b) States having difficulties in implementing RVSM implementation programme, may either individually or in group explore the possibility of seeking outside expertise. <p>ATS Training guidance material at Appendix C to this report be used by States for ATS Training on RVSM.</p>

Number	Title
Conclusion 3/7:	<p>Guidance material for Airworthiness and Operational Approval</p> <p>That:</p> <p>States in the AFI Region be urged to include in their national legislation and regulations the Airworthiness and Operational Approval process for aircraft and operators intending to operate within a designated RVSM airspace based on provisions of ICAO Annex 6 Part 1 Chapt 7 para. 7.2.3 and the guidance material contained in JAA Temporary Guidance Leaflet (TGL) N°6. (Appendix D refers).</p>
Conclusion 3/8:	<p>Enforcement in national legislation</p> <p>That :</p> <p>States which have not done so, take the appropriate measures in order:</p> <ul style="list-style-type: none"> a) to publish an AIC informing the users of their intention to implement RVSM. b) to include the necessary provisions in their national legislation (AIPs). c) for ICAO Regional Office concerned to circulate to States the Sample AIC, NOTAM and AIP Supplement on RVSM (Appendix E refers).
Conclusion 3/9:	<p>Amendment to ICAO Doc. 7030</p> <p>That:</p> <p>ICAO process as soon as possible but not later than 15 May 2004 an amendment proposal to the AFI SUPPs Doc.7030 at Appendix F to this report.</p>
Conclusion 3/10:	<p>Funding of the RVSM implementation programme</p> <p>That:</p> <p>National Governments, Regulatory bodies, operators, service providers and other stakeholders be granted budgetary allocations for acquisitions and other activities necessary for ensuring that all the requirements are met in a timely manner in order to safely implement RVSM in the AFI Region.</p>

Number	Title
Conclusion 3/11:	AFI RVSM Action Plan That: The updated RVSM Action Plan at Appendix G be circulated to States for action.
Conclusion 3/12:	Aircraft/Operators readiness survey That: <div style="margin-left: 40px;"> a) ICAO carry out a survey on the reactions of non-IATA/AFRAA operators. b) The results of ICAO/IATA surveys be presented at the RVSM TF/4 meeting for consideration. </div>
Conclusion 3/13:	Monitoring of Height Deviations That: <div style="margin-left: 40px;"> a) ICAO request the States of Botswana, Cape Verde, Egypt, Ghana, Kenya, South Africa, Spain, Tanzania, Tunisia and Nigeria to establish at the ACC where radar is implemented, a unit to conduct monitoring of aircraft height deviations in the AFI RVSM airspace using the format at Appendix H to this report. b) The data collected at a) above be forwarded to AFI RMA for action. </div>
Conclusion 3/14:	AFI RVSM Documents That the documents at Appendix I be circulated to States for action.
Conclusion 3/15:	Organization of AFI airspace in respect of AFI RVSM airspace That the ATS/SG of APIRG consider as one of its tasks the issue of restructuring of the AFI Region airspace in light of the introduction of RVSM.

PART II REPORT ON AGENDA ITEMS**Agenda Item 1: Review and follow-up action of conclusions of the second meeting of RVSM/RNAV/RNP Task Force**

1.1 Under this Agenda Item the meeting reviewed and noted the action taken on the conclusions of the second meeting of the RVSM/RNAV/RNP/Task Force. It reinstated those conclusions which were still in force and proposed the action to be taken before the Forth Task Force Meeting planned for June 2004. These conclusions including those formulated at RVSM/TF/3 appear at Part I of this report.

Agenda Item 2: Review of RVSM Strategy/Action Plan

2.1 The meeting recalled that in noting the APIRG/14 Conclusion 14/21 (implementation of RVSM in the AFI Region) the ANC had expressed its concern that RVSM required a sophisticated implementation process and requested the States to monitor preparations and assist to the extent possible as an acceptable level of safety should be achieved and maintained.

2.2 The meeting noted that the ANC emphasized the provision of ATC and the required airworthiness approach as a pre-requisite to the RVSM implementation.

2.3 It recalled that the RVSM TF/2 meeting had developed the strategy/action plan and reviewed relevant comments from States for Task Force Members and the interested international organizations. The comments thereby received have been incorporated in the new revised version of the strategy/action plan.

2.4 The meeting agreed that the implementation of RVSM in AFI should be pursued in a pragmatic manner and in detail following the steps in the revised strategy/action plan. The meeting agreed that the strategy/action plan will be reviewed on each of the several TF meetings scheduled for this quarter before any decision is made to implement the RVSM.

2.5 Furthermore, the meeting agreed that the revised AFI strategy/action plan at **Appendix G** and the documents relating to RVSM implementation at **Appendix I** be circulated to States for action.

In view of the foregoing, the following conclusions were formulated.

Conclusion 3/11 AFI RVSM Action Plan

That:

The updated RVSM Action Plan at Appendix G be circulated to States for action.

Conclusion 3/14 AFI RVSM Documents

That the documents at Appendix I be circulated to States for action.

Report on Agenda Item 3: Review of the outcome of RVSM Seminar

3.1 The Task Force considered the following topics which were covered by the seminar and incorporated them as appropriate in the AFI RVSM strategy/action plan and developed also relevant conclusions on these issues and included some material in the relevant RVSM documents for application in AFI region.

Subjects/Topics:**1. RVSM requirements:**

- 1.1 RVSM MASPS.
- 1.2 Guidance Material (OPS/AIR).
- 1.3 Crew requirements approvals.
- 1.4 Performance criteria.
- 1.5 Training.
- 1.6 Aircraft systems.

2. Air Traffic Management

- 2.1 Flight rules.
- 2.2 State aircraft.
- 2.3 Vertical Separation Minima.
- 2.4 Flight Planning.
- 2.5 RVSM Transition airspace.
- 2.6 In-flight control grounds.
- 2.7 Phraseologies.
- 2.8 COM failure procedures.
- 2.9 ATM options for RVSM.
- 2.10 Letters of Agreements.
- 2.11 Air Traffic System support.

3. Height monitoring

- 3.1 ICAO prerequisites.
- 3.2 Monitoring requirements.
- 3.3 HMUs and GMUs.
- 3.4 Role of RMAs.
- 3.5 State responsibilities and coordination with RMSs.

4. ATC and Pilot Training.**5. RVSM Safety Assurance.**

- 5.1 Overall safety requirements.
- 5.2 RVSM safety managements.
- 5.3 Stakeholders responsibilities.
- 5.4 ATM and safety objective.
- 5.5 RVSM safety policy.
- 5.6 Switch-over planning CVSM to RVSM.
- 5.7 Switch-over Risk Analysis.
- 5.8 ICAO RVSM TLS.

3.2 The Task Force revised the time scales in the action plan and identified the initial RVSM airspace. It considered further work needed to be done on airspace restructuring. Aircraft altimetry (avionics) in meters and feet was also considered.

3.3 Readiness of AFI RMA

3.3.1 It was noted that South Africa had established an RMA located at ATNS HQ in Johannesburg.

3.4 Amendment to Doc.7030

3.4.1 Draft amendment proposal to Doc.7030 relating to RVSM was provided to Task Force members and will be further refined by the secretariat for circulation in accordance with the ICAO established procedures.

3.5 Operation in RVSM airspace

3.5.1 Conclusions were drawn on the following issues and relevant material incorporated in the related RVSM documents:

- RVSM approved aircraft.
- Non-RVSM aircraft.
- State aircraft.
- Exemptions.

3.6 Determination of the ACC to conduct flight monitoring

3.6.1 The Task Force identified these ACCs and a conclusion was drawn in this respect.

3.7 Wake Turbulence

3.7.1 Wake Turbulence issues were addressed and incorporated in Doc.7030.

3.8 ICAO provisions on ACAS and RVSM

3.8.1 The Task Force addressed these issues in relation to enhancing air safety.

3.9 Transition airspaces and interface FIRs.

3.9.1 The Task Force addressed these issues and incorporated them in the RVSM relevant documents.

3.10 Radio communication failure

3.10.1 Radio communications failure procedures, flight planning and ATM system support were also addressed.

Agenda Item 4: Any other business - Nil.

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AFI RMA Reporting Format

NAVIGATION DEVIATION INVESTIGATION FORM				
Type of Report: PILOT – Flight CONTROLLER – ATC Unit				
Date/Time (UTC):		Type of Deviation: VERTICAL Type (A to O) (*) LATERAL Type (A to G)		
Causes: WEATHER (See 2-G) OTHERS (Specify)				
Conflict Alert Systems:				
DETAILS OF AIRCRAFT		First Aircraft		Second Aircraft (for vertical)
Aircraft Identification:				
Name of Owner/Operator:				
Aircraft Type:				
Departure Point:				
Destination:				
Route Segment:				
Flight Level:		Cleared	Actual	Cleared Actual
Cleared Track:				
Extent of deviation - magnitude and direction: (NM for lateral; feet for vertical)				
Amount of time at incorrect Flight Level/Track:				
Position where deviation was observed: (BRG/DIST from fixed point or LAT/LONG)				
WAS ATC Clearance obtained:		<u>If ATC clearance NOT obtained</u>		
YES NO		WERE Contingency procedures followed: YES NO		
Action Taken by ATC/Pilot:				
Other comments:				

(*) See deviation classification

NAVIGATION DEVIATION INVESTIGATION FORM

- The ATCO/Pilot should fill as many items as possible.
- Complementary data can be attached.

- The notification of any deviation (vertical or lateral) has to be classified, when possible, according to the following types:

1.- For Large Height Deviations (vertical deviation)

A
B
C
D
E
F
G
H
I
J

2.- For lateral deviations

A
B
C
D
E
F
G

Note that there are data that have to be notified by the pilot.

Remarks:

- 1.
- 2.

DEVIATIONS MONITORING REPORT**AREA CONCERNED :****ALTITUDE :** From FL 290 up TO FL 410 both included**ACC/AO :****MONTH :****YEAR :**

- ☐ (Number) Deviation Report Form attached (including TCAS RA and Airproxes)
- ☐ NO Deviations reported (mark with an X)

The ACC/AO Responsible**Name :****Phone/E-mail :**

Send to**E-mail :****Fax :**

The activities undertaken by the AFI Regional Monitoring Agency (ARMA) are performed through the two components of the permanent structure:

- The ARMA Manager who will be responsible for performing the functions assigned by the Agency and maintaining permanent communication with the representatives of the ACC's of the AFI Region.

- A Secretariat to facilitate the technical, operative and administrative tasks required by the Agency in order to follow the ARMA Manager's guidelines.

3. SUBMISSION OF STATISTICAL AND EQUIPMENT DATA

3.1 States and Organizations concerned are requested to submit to the ARMA the necessary statistical data to assist in the timely completion of the safety analysis.

3.2 The Operators flying through the AFI Region corridor are requested to notify ARMA, in an independent stage of the state regulator authorities, the aircraft equipment certification on RVSM and RNP-5.

3.3 In order to arrange sufficient data for safety assessment and testing for the implementation of CNS/ATM systems, aircraft operators are requested to include all the navigation and communications system availability, including ADS and CPDLC capability, in the flight plans (box no.10).

3.4 The ACC's of the AFI Region and the aircraft operators are also requested to send to ARMA the "Navigational Deviation Investigation Form" at page 1 above.

4. AFI RMA COOPERATIVE REQUEST

Any other cooperation in whatever way which may be required by the ARMA will ensure that all those tasks commissioned to ARMA by the corresponding ICAO forum may be duly performed.

5. ADDITIONAL INFORMATION

The ARMA is located in South Africa and can be reached at the following E-mail address: afirma@atns.co.za

The RMA Manager, Mr Rob Rands, can also be contacted by telephone and Fax:
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ATS Training Guidance Material

AFI AIR TRAFFIC SERVICES REDUCED VERTICAL
SEPARATION MINIMA
COURSE OUTLINE (ICAO 59)

Version: Draft
Page 1/9

Course Aim:	The course will equip participants with the knowledge, skills and attitudes required to provide air traffic services within the designated RVSM and transition airspaces in the AFI Region, after completion of a period of on-the-job-training as prescribed by the specific national authority.
Delivery Method:	The training will be delivered by means of Theoretical lectures, Classroom exercises and Simulator exercises.
Language:	The course will be delivered in the English language.
Pre-requisite Learning:	Trainees should hold valid Area Procedural and/or Area Radar ratings.
Who Should Attend the Course:	<ul style="list-style-type: none">• Managers of Air Traffic Service Units where Area control is provided for the designated AFI RVSM airspace and airspace adjoining RVSM airspace.• Supervisors of Air Traffic Service Units where Area control is provided for the designated AFI RVSM airspace and airspace adjoining RVSM airspace.• Air traffic controllers providing Area control for the designated AFI RVSM airspace and airspace adjoining RVSM airspace. <p>Note: The information contained in this course will be also of use to air traffic controllers not working in the Area Control Centres. Examples are Approach and Aerodrome controllers working in sectors adjoining the designated RVSM or RVSM Transition airspaces or where those controllers have to interact with the Area Control Centres providing the service in the designated RVSM or RVSM Transition airspaces. Such controllers should be regarded as the secondary target population for the training.</p>
Course Duration:	Five days, consisting of: <ul style="list-style-type: none">• Nine (9) periods of theory lectures and one period of theory assessment.• Twenty six (24) periods of practical, this includes one (1) assessment per delegate.• Two periods for course administration (course opening and closing and delegate arrival etc).
Assessment criteria:	Trainees are required to successfully complete: <ul style="list-style-type: none">• A written assessment, by achieving seventy (70) percent or more.• A practical assessment, by achieving seventy (70) percent or more.

Trainees will be allowed a once off reassessment in each of the above-mentioned assessments provided that a score of at least fifty (50) percent is achieved during the first attempt. Reassessments must be completed during the normal duration of the course.

1. Historical Background of RVSM. (Duration: 1 Period)

This module will provide the trainees with an awareness of the historical development of RVSM in ICAO.

1.1 Topic: The Origins of 2000 feet above FL 290.

Objective: Trainees will be aware of the origins of 2000 feet above FL 290.

Content:

- 1947 PANS RAC Vertical Separation.
- Reason for formation of Vertical Separation Panel in June 1954.
- 1960 PANS RAC Vertical Separation.
- Disbandment of the Vertical Separation Panel.

1.2 Topic Development of RVSM in other Regions

1.3 Topic: The need for RVSM in Europe.

Objective: Trainees will be aware of the need for RVSM in Europe.

Content:

- Cost/benefit analysis.
- Benefits of RVSM.

1.4 RVSM in AFI Region.

1.4.1 Topic: Background of RVSM in AFI.

Objective: Trainees will be aware of the background to RVSM in AFI.

Content:

- Extension of RVSM in AFI Region.

1.4.2 Topic: The need for RVSM in AFI Region.

Objective: Trainees will be aware of the need for RVSM in AFI Region.

Content:

- Cost/benefit analysis.
- Benefits of RVSM.

1.4.3 Topic: The RVSM programme organisation in the AFI Region.

Objective: Trainees will be aware of programme organisation and structures for RVSM in AFI Region.

Content:

- AFI RVSM Strategy.
- Regional RVSM Structure.
- RMA.
- National RVSM Structure.

2. Aircraft Certification. (Duration: 1 Period)

This module will provide the trainees with an awareness of the requirements and processes involved with the certification and approval of aircraft to operate with the designated RVSM airspace in the AFI region.

2.1 Approval Procedure.

2.1.1 Topic: State Approval Process.

Objective: Trainees will be aware of the state approval process.

Content:

- Responsibilities of the aircraft operator.

2.1.2 Topic: RVSM Approval Application.

Objective: Trainees will be aware of the content of an operator's RVSM approval application.

Content:

- Approval requirements.
- Content of operator application.

2.1.3 Topic: Issue of RVSM Approval

Objective: Trainees will be aware of the procedure for issue of an RVSM approval.

Content:

- Approval documents.

2.1.4 Topic: Suspension or Revocation of RVSM Approval.

Objective: Trainees will be aware of the procedure for the suspension or revocation of an RVSM approval.

Content:

- Occurrences to be reported.
- Operator's action.
- Reinstatement of approval.

2.2 Certification Requirements.

2.2.1 Topic: Airworthiness Requirements.

Objective: Trainees will be aware of the airworthiness requirements for RVSM approval

Content:

- Aircraft groupings.
- Flight envelopes.
- Performance data.
- Continued airworthiness.

2.2.2 Topic: Operational Requirements.

Objective: Trainees will be aware of the operational requirements for RVSM approval.

Content:

- Training programmes.
- Operating practices, procedures, manuals and checklists.

2.3 ACAS.

2.3.1 Topic: ACAS.

Objective: Trainees will be aware of the ACAS requirements for the AFI RVSM environment.

Content:

- ACAS II requirements.
- TCAS II Version 6.04A.
- TCAS II Version 7.

3. Safety and Monitoring. (Duration: 1 Period)

This module will provide the trainees with an awareness of the safety case and monitoring of RVSM

3.1 Safety.

3.1.1 Topic: Collision Risk Model.

Objective: Trainees will be aware of the state approval process.

Content:

- Responsibilities of the aircraft operator.

3.2 Monitoring.

3.2.1 Topic: The need for monitoring.

Objective: Trainees will be aware of the need to monitor.

Content:

- TLS

3.2.2 Topic: Height Monitoring Targets.

Objective: Trainees will be aware of the height monitoring targets.

Content:

- Height keeping errors.
- Monitoring targets.

3.2.3 Topic: Height Monitoring Systems.

Objective: Trainees will be aware of the height monitoring systems.

Content:

- HMU.
- GMU.
- Height monitoring programme.

4. Flight Planning. (Duration: 1 Period)

This module will provide the trainees with an awareness of the flight planning elements of RVSM.

4.1 Flight Planning.

4.1.1 Topic: Flight plans (FPL).

Objective: Trainees will be aware of the RVSM flight planning requirements for FPLs.

Content:

- RVSM specific inclusions for FPLs.

4.1.2 Topic: Repetitive flight plans (RPL).

Objective: Trainees will be aware of the RVSM flight planning requirements for RPLs.

Content:

- RVSM specific inclusions for RPLs.

5. Operational Procedures. (Duration: 3 Periods)

This module will provide the trainees with the ability to explain the RVSM Operational Procedures.

5.1 Overview.

5.1.1 Topic: Flight operations within the AFI RVSM airspace.

Objective: Trainees will explain the regulations governing flight operations within the AFI RVSM airspace.

Content:

- Aircraft restrictions.
- Flight conditions.
- Allocation of flight levels.

5.1.2 Topic: Provision of Service to Non-RVSM Approved State Aircraft.

Objective: Trainees will explain the general procedures governing the provision of service to non-RVSM approved State aircraft.

Content:

- Definition of State aircraft.
- Vertical separation minimum.

5.2 General Procedures.

5.2.1 Topic: General Procedures.

Objective: Trainees will explain the general procedures for operations within AFI RVSM airspace.

Content:

- Clearance into RVSM airspace.
- Minimum vertical separation between RVSM aircraft.
- Minimum vertical separation between non-RVSM aircraft and any other.
- Vertical separation minimum for transition task.
- Formation flights by civil aircraft and State aircraft.
- Flight level allocation to non-RVSM approved aircraft other than State aircraft.

5.2.2 Topic: Procedures for State Aircraft Operating as Operational Air Traffic, Crossing ATS Routes, Within the RVSM Airspace.

Objective: Trainees will explain the procedures for State aircraft operating as OAT crossing ATS Routes within the RVSM airspace.

Content:

- Definition of OAT.
- RVSM approval status for OAT.
- Minimum vertical separation.
- Vertical separation minimum where RVSM approval status is known.

5.2.3 Topic: Inter-Centre Co-ordination.

Objective: Trainees will explain the inter-centre co-ordination requirements.

Content:

- Computer-assisted co-ordination of estimate messages.
- Verbal co-ordination of estimate messages.

5.2.4 Topic: Contingency Procedures.

Objective: Trainees will explain the RVSM contingency procedures.

Content:

- Overview.
- Equipment- related procedures.
- Weather-related procedures.

5.2.5 Topic: Vertical Spacing from Prohibited, Restricted, Danger and Temporary Segregated Areas.

Objective: Trainees will explain the minimum vertical spacing associated with activity within Prohibited, Restricted, Danger and Temporary Segregated Areas.

Content:

- Delineation of airspace restrictions.
- Vertical spacing requirements.

5.3 Transition Procedures.

5.3.1 Topic: Traffic exiting RVSM airspace.

Objective: Trainees will explain the procedures applicable to aircraft leaving AFI RVSM airspace.

Content:

- Responsibility.
- Vertical separation minimum.
- Level allocation.

5.3.2 Topic: Traffic entering RVSM airspace.

Objective: Trainees will explain the procedures applicable to aircraft entering AFI RVSM airspace.

Content:

- Responsibility.
- Level allocation.

5.3.3 Topic: Aircraft landing within the lateral limits of RVSM airspace.

Objective: Trainees will explain the procedures applicable to aircraft landing within the lateral limits of RVSM airspace

Content:

- Responsibility.
- Level allocation.

5.3.4 Topic: Aircraft landing outside, and transiting the lateral limits of, RVSM airspace.

Objective: Trainees will explain the procedures applicable to aircraft landing outside, and transiting the lateral limits of, RVSM airspace.

- Content:**
- Responsibility.
 - Level allocation.

5.4 Communications Failure in Flight.

5.4.1 Topic: Communications Failure in transition airspace.

Objective: Trainees will explain the procedures applicable to aircraft within AFI RVSM transition airspace.

- Content:**
- RVSM airspace west or north of non-RVSM airspace.
 - RVSM airspace east or south of non-RVSM airspace.
 - Adaptation of route structures.
 - Adaptation of ATS local/regional agreements.
 - Combination of route structure and agreement adaptation.
 - General procedures.

5.4.2 Topic: Communications Failure in Non-Transition RVSM Airspace

Objective: Trainees will explain the procedures applicable to non-transition RVSM airspace.

- Content:**
- ICAO Communication Failure Procedure.

6. Phraseology. (Duration: 1 Period)

This module will provide the trainees with an appreciation for correct RVSM phraseologies.

6.1 Phraseology.

6.1.1 Topic: Flight operations within the AFI RVSM airspace.

Objective: Trainees will describe the correct controller-pilot RTF phraseology for given situations.

- Content:**
- To ascertain RVSM approval status.
 - Pilot indication of non-RVSM approval status.
 - Denial of clearance into RVSM airspace.
 - Non-compliance with RVSM due to turbulence.
 - Non-compliance with RVSM due to equipment failure.
 - Pilot indication of ability to resume RVSM operations.
 - Controller request for pilot ability to resume RVSM operations.

6.1.2 Topic: Co-ordination between ATS Units.

Objective: Trainees will describe the correct phraseology to be used in inter-unit co-ordination messages.

- Content:**
- Supplementary information to automated message exchange without Item 18.
 - Supplementary information on non-RVSM approved aircraft.
 - Supplementary information on contingency aircraft.

7. **Airspace Changes. (Duration: 1 Period)**

This module will provide the trainees with an appreciation for the possible changes to airspace structures offered by RVSM.

7.1 **Topic: Airspace Considerations.**

7.1.1 **Topic: Flight Level Allocation Scheme.**

Objective: Trainees will consider the impact of RVSM on existing Flight Level Allocation Schemes.

Content:

- Optimisation of existing FLAS.
- Strategic de-confliction of major crossing points.
- FLAS to and from transition areas.

7.1.2 **Topic: Sectorisation.**

Objective: Trainees will consider the impact of RVSM on sectorisation.

Content:

- Vertical limits of control sectors.
- Reduction in co-ordination of non-RVSM traffic.
- Sector boundary levels.
- Areas of Common Interest.

7.1.3 **Topic: Optimisation of ATS Route Structure.**

Objective: Trainees will consider the impact of RVSM on the existing route structures.

Content:

- Overview.
- Extension of uni-directional route structure.
- Creation of uni-directional routes in transition areas.

8. **Simulated Practical Exercises. (Duration: 24 Periods)**

This module will allow the trainees the opportunity to practice and demonstrate competence in various aspects related to RVSM in the operational environment.

8.1 **Topic: Simulated practical exercises.**

8.1.1 **Topic: Exercise 1.**

Objective: Introduce trainees to the application of RVSM in designated RVSM airspace.

Content:

- Approved aircraft.
- Application of information indicated on flight progress strips.
- Phraseology.
- Co-ordination with other sectors where RVSM is applied.

8.1.2 **Topic: Exercise 2.**

Objective: Introduce trainees to the application of RVSM in designated RVSM and adjoining transition airspace.

- Content:**
- Approved and state aircraft.
 - Non-approved aircraft.
 - Application of information indicated on flight progress strips.
 - Phraseology.
 - Co-ordination with other sectors where RVSM is applied and transition airspace.

8.1.3 Topic: Exercise 3.

Objective: Introduce trainees to the application of RVSM in designated RVSM and adjoining transition airspace whilst accommodating contingency procedures related to onboard equipment malfunction.

- Content:**
- Approved and state aircraft.
 - Non-approved aircraft.
 - Phraseology.
 - Application of information indicated on flight progress strips.
 - Co-ordination with other sectors where RVSM is applied and transition airspace.
 - Contingency procedures related to onboard equipment malfunction.

8.1.4 Topic: Exercise 4.

Objective: Introduce trainees to the application of RVSM in designated RVSM and adjoining transition airspace whilst accommodating contingency procedures related to weather.

- Content:**
- Approved and state aircraft.
 - Non-approved aircraft.
 - Phraseology.
 - Application of information indicated on flight progress strips.
 - Co-ordination with other sectors where RVSM is applied and transition airspace.
 - Contingency procedures related to weather.

8.1.5 Topic: Exercise 5.

Objective: Assess trainees in the application of RVSM in designated RVSM and adjoining transition airspace whilst accommodating contingency procedures related to weather and onboard equipment malfunction.

- Content:**
- Approved and state aircraft.
 - Non-approved aircraft.
 - Phraseology.
 - Application of information indicated on flight progress strips.
 - Co-ordination with other sectors where RVSM is applied and transition airspace.
 - Contingency procedures related to weather.

The assessment will be based only on the objectives related to RVSM. The aspects related to normal VSM and ATC operations will not be assessed since trainees will be competent on those aspects.

APPENDIX D

RVSM/RNAV/RNP/TF/3 Meeting Report

**Joint Aviation Authority (JAA) Temporary
Guidance Leaflet No.6 (TGL 6)**

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

LEAFLET NO 6: Revision 1 GUIDANCE MATERIAL ON THE APPROVAL OF AIRCRAFT AND OPERATORS FOR FLIGHT IN AIRSPACE ABOVE FLIGHT LEVEL 290 WHERE A 300M (1,000 FT) VERTICAL SEPARATION MINIMUM IS APPLIED

This Temporary Guidance Leaflet No. 6 cancels and supersedes JAA Information Leaflet No. 23, dated April 1994. The leaflet provides guidance material for the approval of aircraft and operations in airspace where the vertical separation minimum above FL 290 is 300m (1,000 ft) (RVSM Operations).

Revision 1 of this TGL deletes from this document the specific procedures for RVSM operations in Europe and for the North Atlantic, and refers for guidance on operational matters to the EUROCONTROL ATC Manual for RVSM in Europe and to the applicable ICAO material for the North Atlantic and other regions.

LIST OF CONTENTS

Preamble	6-3
1 Purpose	6-4
2 Related Regulations	6-4
3 Related Reading Material	6-4
4 Background	6-4
5 Definitions and Abbreviations	6-6
6 The Approval Process	6-8
6.1 General	6-8
6.2 Approval of Aircraft	6-8
6.3 Operational Approval	6-8
7 RVSM Performance	6-8
7.1 General	6-8
7.2 RVSM Flight Envelopes	6-8
7.3 Altimetry System Error	6-8
7.4 Altitude Keeping	6-9
8 Aircraft Systems	6-10
8.1 Equipment for RVSM Operations	6-10
8.2 Altimetry	6-10
8.3 Altitude Alerting	6-11
8.4 Automatic Altitude Control System	6-11
8.5 System Limitations	6-11
9 Airworthiness Approval	6-12
9.1 General	6-12
9.2 Contents of the Data Package	6-12
9.3 Aircraft Groupings	6-13
9.4 Flight Envelopes	6-13
9.5 Performance Data	6-14
9.6 Compliance procedures	6-16
9.7 Continued Airworthiness	6-16
9.8 Post Approval modification	6-17
10 Continued Airworthiness (Maintenance Procedures)	6-17
10.1 General	6-17
10.2 Maintenance Programmes	6-17
10.3 Maintenance Documents	6-17
10.4 Maintenance Practices	6-18
11 Operational Approval	6-19
11.1 Purpose and Organisation	6-19
11.2 RVSM Operations	6-19
11.3 Content of Operator RVSM Application	6-20
11.4 Demonstration Flight(s)	6-21

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

11.5	Form of Approval Documents	6-21
11.6	Airspace Monitoring	6-21
11.7	Suspension, Revocation and Reinstatement of RVSM Approval	6-21
12	Availability of Documents.	6-22
12.1	EUROCONTROL documents	6-22
12.2	FAA documents	6-22
12.3	ARINC documents	6-22
12.4	RTCA documents	6-22
12.5	ICAO and JAA documents	6-22
Appendix 1 - Explanation of W/δ		6-23
Appendix 2 - Altimetry System Error Components		6-25
1	Introduction	6-25
2	Objective of ASE Budget	6-25
3	Altimetry System Error	6-25
3.1	Breakdown	6-25
	Figure 2-1 Altimetry System Error	6-26
3.2	Components	6-27
	Table 2-1 Static Source Error	6-28
	Table 2-2 Residual Static Source Error	6-28
	Figure 2-2 SSE/SSEC Relationships For ASE Where Static Lines Pressure Measurement And Conversion Errors Are Zero	6-29
Appendix 3 - Establishing and Monitoring Static Source Errors		6-31
1	Introduction	6-31
2	Example 1	6-31
3	Example 2	6-31
	Figure 3-1 Process for Showing Initial and Continued Compliance of Airframe Static Pressure Systems	6-32
	Figure 3-2 Compliance Demonstration Ground -to-Flight Test Correlation Process Example	6-32
	Figure 3-3 Process for Showing Initial and continued Compliance of Airframe Static Pressure Systems for New Model Aircraft	6-33
Appendix 4 - Training Programmes and Operating Practices and Procedures		6-35
1	Introduction	6-35
2	Flight Planning	6-35
3	Pre-flight Procedures at the Aircraft for each Flight	6-35
4	Procedures Prior to RVSM Airspace Entry	6-35
5	In-flight Procedures	6-36
6	Post Flight	6-37
7	Special Emphasis Items: Flight Crew Training	6-38
8	Specific Regional Operational Procedures	6-38
Appendix 5 - Review of ICAO Document 9574 - Height Keeping Parameters		6-39
Appendix 6 - deleted		
Appendix 7 - deleted		

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

PREAMBLE

In 1994, the original version of this text was adopted as JAA Interim Policy and published in JAA Information Leaflet No. 23. The intention is to include this information in a proposed new JAA publication containing interpretative and explanatory material with acceptable means of compliance applicable to aircraft in general. The new publication is not yet established, therefore, the information, now revised, is being published in this Temporary Guidance Leaflet.

The revised material of this leaflet is derived directly from IL 23. The material has been updated to reflect the current status of RVSM operations in general, and to add guidance concerning the application of RVSM within designated airspace in the EUR region (referred to as European RVSM airspace) as defined in ICAO Doc 7030/4. The opportunity has been taken also to make a number of editorial corrections and clarifications of the original text. These revisions include:

- updates to the Background section;
- addition of a list of abbreviations;
- where appropriate, substitution of the mandatory terms "shall" and "must" with "should" consistent with the document's status as guidance material. Where criteria is stated reflecting mandatory requirements of ICAO or other regulatory material, the expression "will need to" is used;
- adoption of the generic term "responsible authority" to replace the various terms previously used to denote the organisations or persons, empowered under national laws, to be responsible for airworthiness certification, operational or maintenance approvals;
- substitution of the previously used terms "acquired altitude" and "commanded altitude" with the term "selected altitude" to represent the altitude/flight level the aircraft is required to keep irrespective of the method used by the pilot to select it;
- deletion of text which is no longer relevant;
- clarification and expansion of the guidance material dealing with the RVSM approval procedure;
- re-numbering of some paragraphs to improve the logical structure;

The units of measurement now used in this document are in accordance with the International System of Units (SI) specified in Annex 5 to the Convention on International Civil Aviation. Non-SI units are shown in parentheses following the base units. Where two sets of units are quoted, it should not be assumed that the pairs of values are equal and interchangeable. It may be inferred, however, that an equivalent level of safety is achieved when either set of units is used exclusively.

Revision marks in the left hand margin show the differences between this Revision and the first issue of TGL No. 6.

It is not intended that aircraft which have received airworthiness approval in compliance with JAA Information Leaflet No. 23, or the equivalent FAA Interim Guidelines 91-RVSM, should be re-investigated. It is accepted that these aircraft satisfy the airworthiness criteria of this TGL No. 6.

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1. PURPOSE

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

This document provides a Minimum Aircraft Systems Performance Specification (MASPS) for altimetry to support the use of a 300m (1,000 ft) vertical separation above FL 290. It establishes an acceptable means, but not the only means, that can be used in the approval of aircraft and operators to conduct flights in airspace or on routes where Reduced Vertical Separation Minimum (RVSM) is applied. The document contains guidance on airworthiness, continued airworthiness, and operational practices and procedures for RVSM airspace. RVSM airspace is any airspace or route between FL 290 and FL 410 inclusive where aircraft are separated vertically by 300m (1,000 ft).

2. RELATED REGULATIONS

National regulations relating to the granting of an Air Operator's Certificate (AOC), approval for flight in RVSM airspace, testing and inspection of altimeter systems, and maintenance procedures.

Note: National Regulations will be replaced by the appropriate JARs, when implemented. The following regulations are included in JAR OPS 1 for Commercial Air Transportation:

JAR-OPS 1.240	Routes and Areas of Operation.
JAR-OPS 1.241	Operations in Defined Airspace with RVSM.
JAR-OPS 1.872	Equipment for Operations in Defined Airspace with RVSM

3. RELATED READING MATERIAL

International Civil Aviation Organisation (ICAO) Document 9574, Manual on the Implementation of a 300m (1,000 ft) Vertical Separation Minimum Between FL 290 - FL 410 Inclusive.

ICAO Document NAT/DOC/001, the Consolidated Guidance Material North Atlantic Region.

ICAO Document: Guidance Material on the Implementation and Application of a 300m (1,000 ft) Vertical Minimum.

ICAO Document 9536, Review of the General Concept of Separation (RGCSP).

ICAO Document 7030/4, Regional Supplementary Procedures.

EUROCONTROL Document ASM.ET1.ST.5000. Manual for Reduced Vertical Separation (RVSM) in Europe.

4. BACKGROUND

4.1 In 1982, under the overall guidance of the ICAO Review of the General Concept of Separation Panel (RGCSP), several States initiated a series of comprehensive work programmes to examine the feasibility of reducing the vertical separation minimum above FL 290 from 600m (2,000 ft) to 300m (1,000 ft). Studies were made by member states of EUROCONTROL (France, Germany, the Kingdom of the Netherlands, and the United Kingdom - in an extensive co-operative venture which was co-ordinated by the EUROCONTROL Agency), Canada, Japan, the former Union of the Soviet Socialist Republics (USSR), and the United States of America (USA).

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

4.2 The primary objectives of these studies was to decide whether a global implementation of the Reduced Vertical Separation Minimum (RVSM) :

- a) would satisfy predetermined safety standards;
- b) would be technically and operationally feasible, and
- c) would provide a positive Benefit to Cost ratio.

4.3 These studies employed quantitative methods of risk assessment to support operational decisions concerning the feasibility of reducing the vertical separation minimum. The risk assessment consisted of two elements. First, risk estimation which concerns the development and use of methods and techniques with which the actual level of risk of an activity can be estimated; and second, risk evaluation which concerns the level of risk considered to be the maximum tolerable value for a safe system. The level of risk that is deemed acceptable is termed the Target Level of Safety (TLS). The basis of the process of risk estimation was the determination of the accuracy of height keeping performance of the aircraft population operating at/above FL 290. This was achieved through the use of high precision radar to determine the actual geometric height of aircraft in straight and level flight. This height was then compared with the geometric height of the flight level to which the aircraft had been assigned to determine the total vertical error (TVE) of the aircraft in question. Given this knowledge, it was possible to estimate the risk of collision solely as a consequence of vertical navigation errors of aircraft to which procedural vertical separation had been correctly applied. The RGCSP then employed an assessment TLS (2.5×10^{-9} fatal accidents per aircraft flight hour) to assess the technical feasibility of a 300m (1,000 ft) vertical separation minimum above FL 290 and also for developing aircraft height keeping capability requirements for operating with a 300m (1,000 ft) vertical separation minimum.

4.4 Using the assessment TLS of 2.5×10^{-9} fatal accidents per aircraft flight hour, the RGCSP concluded that a 300 m (1,000 ft) vertical separation minimum above FL 290 was technically feasible without imposing unreasonably demanding technical requirements on the equipment and that it would provide significant benefits in terms of economy and en-route airspace capacity. The technical feasibility referred to the fundamental capability of aircraft height keeping systems, which could be built, maintained, and operated in such a way that the expected, or typical, height keeping performance would be consistent with the safe implementation and use of a 300 m (1,000 ft) vertical separation minimum above FL 290. In reaching this conclusion on technical feasibility, the panel identified the need to establish:

- (a) airworthiness performance requirements in the form of a comprehensive Minimum Aircraft Systems Performance Specification (MASPS) for all aircraft which would be operated in RVSM airspace;
- (b) new operational procedures; and
- (c) a comprehensive means of monitoring for safe operation.

4.5 In the USA, RTCA Special Committee SC 150 was established with the purpose of developing minimum system performance requirements, identifying required aircraft equipment improvements and operational procedure changes and assessing the impact of RVSM implementation on the aviation community. SC 150 served as the focal point for the study and development of RVSM criteria and programmes in the US from 1982 to 1987.

4.6 In Europe, EUROCAE Working Group WG 30 was established in 1987 to prepare an altimetry specification appropriate for 300m (1,000 ft) vertical separation above FL 290. Draft specification documents produced in WG-30 formed a major input to the technical documentation on altimetry requirements developed by the ICAO North Atlantic System Planning Group/Vertical Studies Implementation Group.

4.7 The second major report published by RGCSP on RVSM was the Report of RGCSP/7 (Montreal, 30 October - 20 November 1990). This report provided the draft "Manual on Implementation of a 300m (1,000 ft) Vertical Separation Minimum (VSM) Between FL 290 and 410 Inclusive". This material was approved by the ICAO Air Navigation Commission in February 1991 and published as ICAO Document 9574.

4.8 ICAO Doc 9574 provides guidance on RVSM implementation planning, airworthiness requirements, flight crew procedures, ATC considerations and system performance monitoring. This material was the basis of two MASPS documents which were issued for the application of RVSM in the Minimum Navigation Performance Specification (MNPS) Airspace of the North Atlantic (NAT) Region :

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

- (a) JAA Information Leaflet No. 23: "Interim Guidance Material On The Approval Of Operators/ Aircraft For RVSM Operations", and
- (b) FAA Document 91-RVSM: "Interim Guidance for Approval of Operations/ Aircraft for RVSM Operations".

Note: This Temporary Guidance Leaflet No. 6 replaces JAA Information Leaflet No. 23.

4.9 Appendix 5 provides a discussion of certain major conclusions detailed in Doc. 9574 which have served as the foundation for the development of the specific aircraft and operator approval criteria.

5. DEFINITIONS AND ABBREVIATIONS

Aircraft Group A group of aircraft that are of nominally identical design and build with respect to all details that could influence the accuracy of height keeping performance.

Altimetry System Error (ASE) The difference between the pressure altitude displayed to the flight crew when referenced to the International Standard Atmosphere ground pressure setting (1013.2 hPa /29.92 in.Hg) and free stream pressure altitude.

Assigned Altitude Deviation (AAD) The difference between the transmitted Mode C altitude and the assigned altitude/ flight level.

Automatic Altitude Control System Any system that is designed to automatically control the aircraft to a referenced pressure altitude.

Avionics Error (AVE) The error in the processes of converting the sensed pressure into an electrical output, of applying any static source error correction (SSEC) as appropriate, and of displaying the corresponding altitude.

Basic RVSM Envelope The range of Mach numbers and gross weights within the altitude ranges FL 290 to FL 410 (or maximum attainable altitude) where an aircraft can reasonably expect to operate most frequently.

Full RVSM Envelope The entire range of operational Mach numbers, W/ δ , and altitude values over which the aircraft can be operated within RVSM airspace.

General Air Traffic (GAT) Flights conducted in accordance with the rules and provisions of ICAO.

Height keeping Capability Aircraft height keeping performance that can be expected under nominal environmental operating conditions, with proper aircraft operating practices and maintenance.

Height keeping Performance The observed performance of an aircraft with respect to adherence to a flight level.

Non-Group Aircraft An aircraft for which the operator applies for approval on the characteristics of the unique airframe rather than on a group basis.

Operational Air Traffic (OAT) Flights which do not comply with the provisions stated for GAT and for which rules and procedures have been specified by appropriate authorities.

RVSM Approval The approval that is issued by the appropriate authority of the State in which the Operator is registered.

Residual Static Source Error The amount by which static source error (SSE) remains under-corrected or overcorrected after the application of SSEC.

State Aircraft Aircraft used in military, customs and police services shall be deemed to be State aircraft

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

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

Static Source Error Correction (SSEC) A correction for static source error.

Total Vertical Error (TVE) Vertical geometric difference between the actual pressure altitude flown by an aircraft and its assigned pressure altitude (flight level).

W/δ Aircraft weight, W, divided by the atmospheric pressure ratio, δ.

Abbreviation	Meaning
AAD	Assigned Altitude Deviation
ADC	Air Data Computer
AOA	Angle of Attack
AOC	Air Operator's Certificate
ASE	Altimetry System Error
ATS	Air Traffic Service
GAT	General Air Traffic
δ	Atmospheric Pressure Ratio
Hp	Pressure Altitude
hPa	Hecto-Pascals
in.Hg	Inches of Mercury
M	Mach number
MASPS	Minimum Aircraft System Performance Specification
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
Mmo	Maximum Operating Limit Mach
MNPS	Minimum Navigation Performance Specification
NAT	North Atlantic
NOTAM	Notice to Airmen
OAT	Operational Air Traffic
OTS	Organised Track Structure
QFE	Atmospheric pressure at aerodrome elevation (or at runway threshold)
QNH	Altimeter sub-scale setting to obtain elevation when on ground
RTF	Radio Telephony
SSE	Static Source Error
SSEC	Static Source Error Correction
TVE	Total Vertical Error
VMO	Maximum Operating Limit Velocity
W	Weight

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

6. THE APPROVAL PROCESS

6.1 General

Airspace where RVSM is applied should be considered special qualification airspace. The specific aircraft type or types that the operator intends to use will need to be approved by the responsible authority before the operator conducts flight in RVSM airspace. In addition, where operations in specified airspace require approval in accordance with an ICAO Regional Navigation Agreement, an operational approval will be needed. This document provides guidance for the approval of specific aircraft type or types, and for operational approval.

6.2 Approval of Aircraft

6.2.1 Each aircraft type that an operator intends to use in RVSM airspace should have received RVSM airworthiness approval from the responsible authority, in accordance with paragraph 9, prior to approval being granted for RVSM operations, including the approval of continued airworthiness programmes. Paragraph 9 provides guidance for the approval of newly built aircraft and for aircraft that have already entered service. Paragraph 10 contains guidance on the continued airworthiness (maintenance and repair) programmes for all RVSM operations.

6.2.2 It is accepted that aircraft which have been approved in compliance with JAA Information Leaflet No. 23 or FAA Interim Guidelines 91-RVSM satisfy the airworthiness criteria of this TGL No. 6.

Note: Operators are advised to check existing approvals and the Aircraft Flight Manual for redundant regional constraints.

6.3 Operational Approval

For certain airspace, as defined by ICAO Regional Navigation Agreements, operators are required to hold State approval to operate in that airspace, which may or may not include RVSM. Paragraph 11 contains guidance on operational procedures that an operator may need to adopt for such airspace where RVSM is applied including advice on the operational material that may need to be submitted for review by the responsible authority.

7. RVSM PERFORMANCE

7.1 General

The objectives set out by the RGCSP have been translated into airworthiness standards by assessment of the characteristics of altimetry system error (ASE) and automatic altitude control.

7.2 RVSM Flight Envelopes

For the purposes of RVSM approval, the aircraft flight envelope may be considered as two parts; the Basic RVSM flight planning envelope and the Full RVSM flight envelope (referred to as the Basic envelope and the Full envelope respectively), as defined in paragraph 5 and explained in 9.4. For the Full envelope, a larger ASE is allowed.

7.3 Altimetry System Error

7.3.1 To evaluate a system against the ASE performance statements established by RGCSP (see Appendix 5, paragraph 2), it is necessary to quantify the mean and three standard deviation values for ASE, expressed as ASE_{mean} and ASE_{3SD} . To do this, it is necessary to take into account the different ways in which variations in ASE can arise. The factors that affect ASE are:

- (a) Unit to unit variability of avionics equipment.
- (b) Effect of environmental operating conditions on avionics equipment.
- (c) Airframe to airframe variability of static source error.
- (d) Effect of flight operating conditions on static source error.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

7.3.2 Assessment of ASE, whether based on measured or predicted data will need to consider sub-paragraphs (a) to (d) of 7.3.1. The effect of item (d) as a variable can be eliminated by evaluating ASE at the most adverse flight condition in an RVSM flight envelope.

7.3.3 The criteria to be met for the Basic envelope are:

- (a) At the point in the envelope where the mean ASE reaches its largest absolute value that value should not exceed 25 m (80 ft);
- (b) At the point in the envelope where absolute mean ASE plus three standard deviations of ASE reaches its largest absolute value, the absolute value should not exceed 60 m (200 ft).

7.3.4 The criteria to be met for the Full envelope are:

- (a) At the worst point in the Full envelope where the mean ASE reaches its largest absolute value, the absolute value should not exceed 37 m (120 ft).
- (b) At the point in the Full envelope where the mean ASE plus three standard deviations of ASE reaches its largest absolute value, the absolute value should not exceed 75 m (245 ft).
- (c) If necessary, for the purpose of achieving RVSM approval for a group of aircraft (see 9.3), an operating limitation may be established to restrict aircraft from conducting RVSM operations in parts of the Full envelope where the absolute value of mean ASE exceeds 37 m (120 ft) and/or the absolute value of mean ASE plus three standard deviations of ASE exceed 75 m (245 ft). When such a limitation is established, it should be identified in the data submitted to support the approval application, and documented in appropriate aircraft operating manuals. However, visual or aural warning/indication associated with such a limitation need not be provided in the aircraft.

7.3.5 Aircraft types for which an application for a Type Certificate is made after 1 January 1997, should meet the criteria established for the Basic envelope in the Full RVSM envelope.

7.3.6 The standard for aircraft submitted for approval as non-group aircraft, as defined in sub-paragraph 9.3.2, is as follows:

- (a) For all conditions in the Basic envelope:
 - | Residual static source error + worst case avionics | \leq 50 m (160 ft)
- (b) For all conditions in the Full envelope:
 - | Residual static source error + worst case avionics | \leq 60 m (200 ft)

Note. Worst case avionics means that a combination of tolerance values, specified by the aircraft constructor for the altimetry fit into the aircraft, which gives the largest combined absolute value for residual SSE plus avionics errors.

7.4 Altitude Keeping

An automatic altitude control system is required capable of controlling altitude within ± 20 m (± 65 ft) about the selected altitude, when the aircraft is operated in straight and level flight under non-turbulent non-gust conditions.

Note: Automatic altitude control systems with flight management system/ performance management system inputs allowing variations up to ± 40 m (± 130 ft) under non-turbulent, non-gust conditions, installed in aircraft types for which an application for Type Certificate was made prior to January 1, 1997, need not be replaced or modified.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

8. AIRCRAFT SYSTEMS

8.1 Equipment for RVSM Operations

The minimum equipment fit is:

8.1.1 Two independent altitude measurement systems. Each system will need to be composed of the following elements:

- (a) Cross-coupled static source/system, with ice protection if located in areas subject to ice accretion;
- (b) Equipment for measuring static pressure sensed by the static source, converting it to pressure altitude and displaying the pressure altitude to the flight crew;
- (c) Equipment for providing a digitally encoded signal corresponding to the displayed pressure altitude, for automatic altitude reporting purposes;
- (d) Static source error correction (SSEC), if needed to meet the performance criteria of sub-paragraphs 7.3.3, 7.3.4 or 7.3.6, as appropriate; and
- (e) Signals referenced to a pilot selected altitude for automatic control and alerting. These signals will need to be derived from an altitude measurement system meeting the criteria of this document, and, in all cases, enabling the criteria of sub-paragraphs 8.2.6 and 8.3 to be met.

8.1.2 One secondary surveillance radar transponder with an altitude reporting system that can be connected to the altitude measurement system in use for altitude keeping.

8.1.3 An altitude alerting system.

8.1.4 An automatic altitude control system.

8.2. Altimetry

8.2.1 *System Composition* The altimetry system of an aircraft comprises all those elements involved in the process of sampling free stream static pressure and converting it to a pressure altitude output. The elements of the altimetry system fall into two main groups:

- (a) Airframe plus static sources.
- (b) Avionics equipment and/or instruments.

8.2.2 *Altimetry System Outputs* The following altimetry system outputs are significant for RVSM operations:

- (a) Pressure altitude (Baro-corrected) for display.
- (b) Pressure altitude reporting data.
- (c) Pressure altitude or pressure altitude deviation for an automatic altitude control device.

8.2.3 *Altimetry System Accuracy* The total system accuracy will need to satisfy the criteria of sub-paragraphs 7.3.3, 7.3.4 or 7.3.6 as appropriate.

8.2.4 *Static Source Error Correction* If the design and characteristics of the aircraft and its altimetry system are such that the criteria of sub-paragraphs 7.3.3, 7.3.4 or 7.3.6 are not satisfied by the location and geometry of the static sources alone, then suitable SSEC will need to be applied automatically within the avionics equipment of the altimetry system. The design aim for static source error correction, whether applied by aerodynamic/ geometric means or within the avionics equipment, should be to produce a

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

minimum residual static source error, but in all cases it should lead to compliance with the criteria of sub-paragraphs 7.3.3, 7.3.4 or 7.3.6, as appropriate.

8.2.5 Altitude Reporting Capability The aircraft altimetry system will need to provide an output to the aircraft transponder as required by applicable operating regulations.

8.2.6 Altitude Control Output

- (a) The altimetry system will need to provide a signal that can be used by an automatic altitude control system to control the aircraft to a selected altitude. The signal may be used either directly, or combined with other sensor signals. If SSEC is necessary to satisfy the criteria of sub-paragraph 7.3.3, 7.3.4 or 7.3.6, then an equivalent SSEC may be applied to the altitude control signal. The signal may be an altitude deviation signal, relative to the selected altitude, or a suitable absolute altitude signal.
- (b) Whatever the system architecture and SSEC system, the difference between the signal output to the altitude control system and the altitude displayed to the flight crew will need to be kept to the minimum.

8.2.7 Altimetry System Integrity The RVSM approval process will need to verify that the predicted rate of occurrence of undetected failure of the altimetry system does not exceed 1×10^{-5} per flight hour. All failures and failure combinations whose occurrence would not be evident from cross cockpit checks, and which would lead to altitude measurement /display errors outside the specified limits, need to be assessed against this value. Other failures or failure combinations need not be considered.

8.3 Altitude Alerting

The altitude deviation system will need to signal an alert when the altitude displayed to the flight crew deviates from selected altitude by more than a nominal threshold value. For aircraft for which an application for a Type Certificate is made before 1 January 1997, the nominal threshold value will need to be not greater than ± 90 m (± 300 ft). For aircraft for which an application for a Type Certificate is made on or after 1 January 1997, the value will need to be not greater than ± 60 m (± 200 ft). The overall equipment tolerance in implementing these nominal values will need to be not greater than ± 15 m (± 50 ft).

8.4 Automatic Altitude Control System

8.4.1 As a minimum, a single automatic altitude control system with an altitude keeping performance complying with sub-paragraph 7.4, will need to be installed.

8.4.2 Where an altitude select/acquire function is provided, the altitude select/acquire control panel will need to be configured such that an error of no more than ± 8 m (± 25 ft) exists between the value selected by, and displayed to, the flight crew, and the corresponding output to the control system.

8.5 System Limitations

8.5.1 The Aircraft Flight Manual should include a statement of compliance against this TGL (or equivalent guidance material) quoting the applicable Service Bulletin or build standard of the aircraft. In addition the following statement should be included:-

“Airworthiness Approval alone does not authorise flight into airspace for which an RVSM Operational Approval is required by an ICAO Regional Navigation Agreement.”

8.5.2 Non-compliant aspects of the installed systems and any other limitations will need to be identified in the approved Aircraft Flight Manual amendment or supplement, and in the applicable and approved Operations Manual.

For example:-

- Non-compliant altimeter systems, e.g. standby altimeter;
- Non-Compliant modes of the automatic pilot, e.g. altitude hold, vnav, altitude select;
- Weight Limit;
- Mach Limit;
- Altitude Limit.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

9. AIRWORTHINESS APPROVAL

9.1 General

9.1.1 Obtaining RVSM airworthiness approval is a two step process which may involve more than one authority.

9.1.2 For the first step:

- in the case of a newly built aircraft, the aircraft constructor develops and submits to the responsible authority of the state of manufacture, the performance and analytical data that supports RVSM airworthiness approval of a defined build standard. The data will be supplemented with maintenance and repair manuals giving associated continued airworthiness instructions. Compliance with RVSM criteria will be stated in the Aircraft Flight Manual including reference to the applicable build standard, related conditions and limitations. Approval by the responsible authority, and, where applicable, validation of that approval by other authorities, indicates acceptance of newly built aircraft, conforming to that type and build standard, as complying with the RVSM airworthiness criteria.
- in the case of an aircraft already in service, the aircraft constructor (or an approved design organisation), submits to the responsible authority, either in the state of manufacture or the state in which the aircraft is registered, the performance and analytical data that supports RVSM airworthiness approval of a defined build standard. The data will be supplemented with a Service Bulletin, or its equivalent, that identifies the work to be done to achieve the build standard, continued airworthiness instructions, and an amendment to the Aircraft Flight Manual stating related conditions and limitations. Approval by the responsible authority, and, where applicable, validation of that approval by other authorities, indicates acceptance of that aircraft type and build standard as complying with the RVSM airworthiness criteria.

9.1.3 The combination of performance and analytical data, Service Bulletin(s) or equivalent, continued airworthiness instructions, and the approved amendment or supplement to the Aircraft Flight Manual is known as the RVSM approval data package.

9.1.4 For the second step, an aircraft operator may apply to the responsible authority of the state in which the aircraft is registered, for airworthiness approval of specific aircraft. The application will need to be supported by evidence confirming that the specific aircraft has been inspected and, where necessary, modified in accordance with applicable Service Bulletins, and is of a type and build standard that meets the RVSM airworthiness criteria. The operator will need to confirm also that the continued airworthiness instructions are available and that the approved Flight Manual amendment or supplement (see paragraph 8.5) has been incorporated. Approval by the authority indicates that the aircraft is eligible for RVSM operations. The authority will notify the designated monitoring cell accordingly.

For RVSM airspace for which an operational approval is prescribed, airworthiness approval alone does not authorise flight in that airspace.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

9.2 Contents of the RVSM Approval Data Package

As a minimum, the data package will need to consist of the following items:

- (a) A statement of the aircraft group or non-group aircraft and applicable build standard to which the data package applies.
- (b) A definition of the applicable flight envelope(s).
- (c) Data showing compliance with the performance criteria of paragraphs 7 and 8.
- (d) The procedures to be used to ensure that all aircraft submitted for airworthiness approval comply with RVSM criteria. These procedures will 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.

The items listed in 9.2 are explained further in the following sub-paragraphs.

9.3 Aircraft Groupings

9.3.1 For aircraft to be considered as members of a group for the purposes of RVSM approval, the following conditions should be satisfied:

- (a) Aircraft should have been constructed to a nominally identical design and be approved on the same Type Certificate (TC), TC amendment, or Supplemental TC, as applicable.

Note: For derivative aircraft it may be possible to use the data from the parent configuration to minimise the amount of additional data required to show compliance. The extent of additional data required will depend on the nature of the differences between the parent aircraft and the derivative aircraft.

- (b) The static system of each aircraft should be nominally identical. The SSE corrections should be the same for all aircraft of the group.
- (c) The avionics units installed on each aircraft to meet the minimum RVSM equipment criteria of sub-paragraph 8.1 should comply with the manufacturer's same specification and have the same part number.

Note: Aircraft that have avionic units that are of a different manufacturer or part number may be considered part of the group, if it can be demonstrated that this standard of avionic equipment provides equivalent system performance.

9.3.2 If an airframe does not meet the conditions of sub-paragraphs 9.3.1(a) to (c) to qualify as a member of a group, or is presented as an individual airframe for approval, then it will need to be considered as a non-group aircraft for the purposes of RVSM approval.

9.4 Flight Envelopes

The RVSM operational flight envelope, as defined in paragraph 5, is the Mach number, W/δ , and altitude ranges over which an aircraft can be operated in cruising flight within the RVSM airspace. Appendix 1 gives an explanation of W/δ . The RVSM operational flight envelope for any aircraft may be divided into two parts as explained below:

9.4.1 *Full RVSM Flight Envelope* The Full envelope will comprise the entire range of operational Mach number, W/δ , and altitude values over which the aircraft can be operated within RVSM airspace. Table 1 establishes the parameters to be considered.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

TABLE 1 - FULL RVSM ENVELOPE BOUNDARIES

	Lower Boundary is defined by	Upper Boundary is defined by
Level	<ul style="list-style-type: none"> FL 290 	The lower of : <ul style="list-style-type: none"> FL 410 Aircraft maximum certified altitude Altitude limited by: cruise thrust; buffet; other aircraft flight limitations
Mach or Speed	The lower of : <ul style="list-style-type: none"> Maximum endurance (holding speed) Manoeuvre speed 	The lower of : <ul style="list-style-type: none"> M_{MO}/V_{MO} Speed limited by cruise thrust; buffet; other aircraft flight limitations
Gross Weight	<ul style="list-style-type: none"> The lowest gross weight compatible with operations in RVSM airspace 	<ul style="list-style-type: none"> The highest gross weight compatible with operations in RVSM airspace

9.4.2 Basic RVSM Flight Planning Envelope The boundaries for the Basic envelope are the same as those for the Full envelope except for the upper Mach boundary.

9.4.3 For the Basic envelope, the upper Mach boundary may be limited to a range of airspeeds over which the aircraft group can reasonably be expected to operate most frequently. This boundary should be declared for each aircraft group by the aircraft constructor or the approved design organisation. The boundary may be equal to the upper Mach/airspeed boundary defined for the Full envelope or a lower value. This lower value should not be less than the Long Range Cruise Mach Number plus 0.04 Mach, unless limited by available cruise thrust, buffet, or other flight limitations.

9.5 Performance Data

The data package should contain data sufficient to show compliance with the accuracy criteria set by paragraph 7.

9.5.1 General ASE will generally vary with flight condition. The data package should provide coverage of the RVSM envelope sufficient to define the largest errors in the Basic and Full envelopes. In the case of group aircraft approval, the worst flight condition may be different for each of the criterion of sub-paragraph 7.3.3 and 7.3.4. Each should be evaluated.

9.5.2 Where precision flight calibrations are used to quantify or verify altimetry system performance they may be accomplished by any of the following methods. Flight calibrations should be performed only when appropriate ground checks have been completed. Uncertainties in application of the method will need to be assessed and taken into account in the data package.

- (a) Precision tracking radar in conjunction with pressure calibration of atmosphere at test altitude.
- (b) Trailing cone.
- (c) Pacer aircraft.
- (d) Any other method acceptable to the responsible authority.

Note: When using pacer aircraft, the pacer aircraft will need to be calibrated directly to a known standard. It is not acceptable to calibrate a pacer aircraft by another pacer aircraft.

9.5.3 Altimetry System Error Budget It is implicit in the intent of sub-paragraph 7.3, for group aircraft approvals and for non-group approvals, that a trade-off may be made between the various error sources which contribute to ASE. This document does not specify separate limits for the various error sources that contribute to the mean and variable components of ASE as long as the overall ASE accuracy criteria of sub-paragraph 7.3 are met. For example, in the case of an aircraft group approval, the smaller the mean of the group and the more stringent the avionics standard, the larger the available allowance for SSE variations. In all cases, the trade-off adopted should be presented in the data package in the form of an

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

error budget that includes all significant error sources. This is discussed in more detail in the following sections. Altimetry system error sources are discussed in Appendix 2.

9.5.4 Avionic Equipment Avionic equipment should be identified by function and part number. A demonstration will need to show that the avionic equipment can meet the criteria established by the error budget when the equipment is operated in the environmental conditions expected to be met during RVSM operations.

9.5.5 Groups of Aircraft Where approval is sought for an aircraft group, the associated data package will need to show that the criteria of sub-paragraph 7.3.3 and 7.3.4 are met. Because of the statistical nature of these criteria, the content of the data package may vary considerably from group to group.

- (a) The mean and airframe-to-airframe variability of ASE should be established, based on precision flight test calibration of a number of aircraft. Where analytical methods are available, it may be possible to enhance the flight test data base and to track subsequent changes in the mean and variability based on geometric inspections and bench test, or any other method acceptable to the responsible authority. In the case of derivative aircraft it may be possible to use data from the parent as part of the data base. This may be applicable to a fuselage stretch where the only difference in mean ASE between groups could be reliably accounted for by analytical means.
- (b) An assessment of the aircraft-to-aircraft variability of each error source should be made. The error assessment may take various forms as appropriate to the nature and magnitude of the source and the type of data available. For example, for some error sources (especially small ones), it may be acceptable to use specification values to represent three standard deviations. For other error sources (especially larger ones) a more comprehensive assessment may be required. This is especially true for airframe error sources where specification values of ASE contribution may not have been previously established.
- (c) In many cases, one or more of the major ASE error sources will be aerodynamic in nature, such as variations in the airframe surface contour in the vicinity of the static pressure source. If evaluation of these errors is based on geometric measurements, substantiation should be provided that the methodology used is adequate to ensure compliance. An example of the type of data that could be used to provide this substantiation is provided in Appendix 3, figure 3-2.
- (d) An error budget should be established to ensure that the criteria of sub-paragraphs 7.3.3 and 7.3.4 are met. As noted in 9.5.1, the worst condition experienced in flight may differ for each criterion and therefore the component error values may also differ.
- (e) In showing compliance with the overall criteria, the component error sources should be combined appropriately. In most cases this will involve the algebraic summation of the mean components of the errors, root-sum-square (rss) combination of the variable components of the errors, and summation of the rss value with the absolute value of the overall mean. Care should be taken that only variable component error sources that are independent of each other are combined by rss.
- (f) The methodology described above for group approval is statistical. This is the result of the statistical nature of the risk analysis and the resulting statements of Appendix 5 sub-paragraphs 5(a) and 5(b). In the context of a statistical method, the statements of Appendix 5, sub-paragraph 5(c) need further explanation. This item states that 'each individual aircraft in the group shall be built to have an ASE contained within $\pm 60\text{m}$ ($\pm 200\text{ ft}$)'. This statement has not been taken to mean that every airframe should be calibrated with a trailing cone or equivalent to demonstrate that ASE is within $\pm 60\text{m}$ (200 ft). Such an interpretation would be unduly onerous considering that the risk analysis allows for a small proportion of aircraft to exceed 60m (200 ft). However, it is accepted that if any aircraft is identified as having an error exceeding $\pm 60\text{m}$ ($\pm 200\text{ ft}$) then it should receive corrective action.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

9.5.6 *Non-group Aircraft* When an aircraft is submitted for approval as a non-group aircraft, as explained in sub-paragraph 9.3.2, the data should be sufficient to show that the criteria of sub-paragraph 7.3.6 are met. The data package should specify how the ASE budget has been allocated between residual SSE and avionics error. The operator and responsible authority should agree on what data is needed to satisfy approval criteria. The following data should be established:

- (a) Precision flight test calibration of the aircraft to establish its ASE or SSE over the RVSM envelope. Flight calibration should be performed at points in the flight envelope(s) as agreed by the responsible authority. One of the methods listed in sub-paragraphs 9.5.2 (a) to (d) should be used.
- (b) Calibration of the avionics used in the flight test as required to establish residual SSE. The number of test points should be agreed by the responsible authority. Since the purpose of the flight test is to determine the residual SSE, specially calibrated altimetry equipment may be used.
- (c) Specifications for the installed altimetry avionics equipment, identifying the largest allowable errors.

Using the foregoing, compliance with the criteria of sub-paragraph 7.3.6 should be demonstrated. If, subsequent to aircraft approval for RVSM operation, avionic units that are of a different manufacturer or part number are fitted, it should be demonstrated that the standard of avionic equipment provides equivalent altimetry system performance.

9.6 Compliance Procedures

The data package will need to define the procedures, inspections and tests, and the limits that will be used to ensure that all aircraft approved against the data package 'conform to type'; that is all future approvals, whether of new build or in-service aircraft, meet the budget allowances developed according to sub-paragraph 9.5.3. The budget allowances will be established by the data package and include a methodology that allows for tracking the mean and standard deviation for new build aircraft. Limits will need to be defined for each potential source of error. A discussion of error sources is provided in Appendix 2. Examples of procedures are presented in Appendix 3. Where an operating limitation has been applied, the package should contain the data and information necessary to document and establish that limitation.

9.7 Continued Airworthiness

9.7.1 The following items should be reviewed and updated as applicable to RVSM:

- (a) The Structural Repair Manual with special attention to the areas around each static source, angle of attack sensors, and doors if their rigging can affect airflow around the previously mentioned sensors.
- (b) The Master Minimum Equipment List (MMEL).

9.7.2 The data package should include details of any special procedures that are not covered in sub-paragraph 9.7.1, but may be needed to ensure continued compliance with RVSM approval criteria. Examples follow:

- (a) For non-group aircraft, where airworthiness approval has been based on flight test, the continuing integrity and accuracy of the altimetry system will need to be demonstrated by ground and flight tests of the aircraft and its altimetry system at periods to be agreed with the responsible authority. However, alleviation of the flight test requirement may be given if it can be demonstrated that the relationship between any subsequent airframe/system degradation and its effects on altimetry system accuracy is understood and that it can be compensated or corrected.
- (b) In-flight defect reporting procedures should be defined to aid identification of altimetry system error sources. Such procedures could cover acceptable differences between primary and alternate static sources, and others as appropriate.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

- (c) For groups of aircraft where approval is based on geometric inspection, there may be a need for periodic re-inspection, and the interval required should be specified.

9.8 Post Approval Modification

Any variation/modification from the initial installation that affects RVSM approval should be referred to the aircraft constructor or approved design organisation, and accepted by the responsible authority.

10. CONTINUED AIRWORTHINESS (MAINTENANCE PROCEDURES)

10.1 General

- (a) The integrity of the design features necessary to ensure that altimetry systems continue to meet RVSM approval criteria should be verified by scheduled tests and inspections in conjunction with an approved maintenance programme. The operator should review its maintenance procedures and address all aspects of continued airworthiness that may be relevant.
- (b) Adequate maintenance facilities will need to be available to enable compliance with the RVSM maintenance procedures.

10.2 Maintenance Programmes

Each operator requesting RVSM operational approval should establish RVSM maintenance and inspection practices acceptable to, and as required by, the responsible authority, that include any required maintenance specified in the data package (sub-paragraph 9.2). Operators of aircraft subject to maintenance programme approval will need to incorporate these practices in their maintenance programme.

10.3 Maintenance Documents

The following items should be reviewed, as appropriate:

- (a) Maintenance Manuals.
- (b) Structural Repair Manuals.
- (c) Standard Practices Manuals.
- (d) Illustrated Parts Catalogues.
- (e) Maintenance Schedule.
- (f) MMEL.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

10.4 Maintenance Practices

If the operator is subject to an approved maintenance programme, that programme should include, for each aircraft type, the maintenance practices stated in the applicable aircraft and component manufacturers' maintenance manuals. In addition, for all aircraft, including those not subject to an approved maintenance programme, attention should be given to the following items:

- (a) All RVSM equipment should be maintained in accordance with the component manufacturers' maintenance instructions and the performance criteria of the RVSM approval data package.
- (b) Any modification or design change which in any way affects the initial RVSM approval, should be subject to a design review acceptable to the responsible authority.
- (c) Any repairs, not covered by approved maintenance documents, that may affect the integrity of the continuing RVSM approval, e.g. those affecting the alignment of pitot/static probes, repairs to dents or deformation around static plates, should be subject to a design review acceptable to the responsible authority.
- (d) Built-in Test Equipment (BITE) testing should not be used for system calibration unless it is shown to be acceptable by the aircraft constructor or an approved design organisation, and with the agreement of the responsible authority.
- (e) An appropriate system leak check (or visual inspection where permitted) should be accomplished following reconnection of a quick-disconnect static line.
- (f) Airframe and static systems should be maintained in accordance with the aircraft constructor's inspection standards and procedures.
- (g) To ensure the proper maintenance of airframe geometry for proper surface contours and the mitigation of altimetry system error, surface measurements or skin waviness checks will need to be made, as specified by the aircraft constructor, to ensure adherence to RVSM tolerances. These checks should be performed following repairs, or alterations having an effect on airframe surface and airflow.
- (h) The maintenance and inspection programme for the autopilot will need to ensure continued accuracy and integrity of the automatic altitude control system to meet the height keeping standards for RVSM operations. This requirement will typically be satisfied with equipment inspections and serviceability checks.
- (i) Whenever the performance of installed equipment has been demonstrated to be satisfactory for RVSM approval, the associated maintenance practices should be verified to be consistent with continued RVSM approval. Examples of equipment to be considered are:
 - (i) Altitude alerting.
 - (ii) Automatic altitude control system.
 - (iii) Secondary surveillance radar altitude reporting equipment.
 - (iv) Altimetry systems.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

10.4.1 Action for Non-compliant Aircraft Those aircraft positively identified as exhibiting height keeping performance errors that require investigation, as discussed in sub-paragraph 11.7, should not be operated in RVSM airspace until the following actions have been taken:

- (a) The failure or malfunction is confirmed and isolated; and,
- (b) Corrective action is taken as necessary to comply with sub-paragraph 9.5.5 (f) and verified to support RVSM approval.

10.4.2 Maintenance Training New training may be necessary to support RVSM approval. Areas that may need to be highlighted for initial and recurrent training of relevant personnel are:

- (a) Aircraft geometric inspection techniques.
- (b) Test equipment calibration and use of that equipment.
- (c) Any special instructions or procedures introduced for RVSM approval.

10.4.3 Test Equipment

- (a) The test equipment should have the capability to demonstrate continuing compliance with all the parameters established in the data package for RVSM approval or as approved by the responsible authority.
- (b) Test equipment should be calibrated at periodic intervals as agreed by the responsible authority using reference standards whose calibration is certified as being traceable to national standards acceptable to that authority. The approved maintenance programme should include an effective quality control programme with attention to the following:
 - (i) Definition of required test equipment accuracy.
 - (ii) Regular calibrations of test equipment traceable to a master standard. Determination of the calibration interval should be a function of the stability of the test equipment. The calibration interval should be established using historical data so that degradation is small in relation to the required accuracy.
 - (iii) Regular audits of calibration facilities both in-house and outside.
 - (iv) Adherence to approved maintenance practices.
 - (v) Procedures for controlling operator errors and unusual environmental conditions which may affect calibration accuracy.

11. OPERATIONAL APPROVAL

11.1 Purpose and Organisation

Paragraph 6 gives an overview of the RVSM approval processes. For airspace where operational approval is required, this paragraph describes steps to be followed and gives detailed guidance on the required operational practices and procedures. Appendices 4 and 5 are related to this paragraph and contain essential information for operational programmes.

11.2 RVSM Operations

Approval will be required for each aircraft group and each aircraft to be used for RVSM operations. Approval will be required for each operator and the responsible authority will need to be satisfied that

- (a) each aircraft holds airworthiness approval according to paragraph 9;
- (b) each operator has continued airworthiness programmes (maintenance procedures) according to paragraph 10;

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

- (c) where necessary, operating procedures unique to the airspace have been incorporated in operations manuals including any limitations identified in paragraph 8.5.
- (d) high levels of aircraft height keeping performance can be maintained.

11.3 Content of Operator RVSM Application

The following material should be made available to the responsible authority, in sufficient time to permit evaluation, before the intended start of RVSM operations.

- (a) *Airworthiness Documents* Documentation that shows that the aircraft has RVSM airworthiness approval. This should include an Approved Flight Manual amendment or supplement.
- (b) *Description of Aircraft Equipment* A description of the aircraft appropriate to operations in an RVSM environment.
- (c) *Training Programmes and Operating Practices and Procedures* Holders of Air Operators Certificates (AOC) may need to submit training syllabi for initial, and where appropriate, recurrent training programmes together with other appropriate material to the responsible authority. The material will need to show that the operating practices, procedures and training items, related to RVSM operations in airspace that requires State operational approval, are incorporated. Non-AOC operators will need to comply with local procedures to satisfy the responsible authority that their knowledge of RVSM operating practices and procedures is equivalent to that set for AOC Holders, sufficient to permit them to conduct RVSM operations. Guidance on the content of training programmes and operating practices and procedures is given in Appendix 4. In broad terms, this covers flight planning, pre-flight procedures, aircraft procedures before RVSM airspace entry, in-flight procedures, and flight crew training procedures. The procedures used within airspace of the EUR region and the procedures unique to the North Atlantic Airspace for which specific State operational approval is required are stated in Doc 7030/4.
- (d) *Operations Manuals and Checklists* The appropriate manuals and checklists should be revised to include information/guidance on standard operating procedures as detailed in Appendix 4. Manuals should include a statement of the airspeeds, altitudes and weights considered in RVSM aircraft approval; including identification of any operating limitations or conditions established for that aircraft group. Manuals and checklists may need to be submitted for review by the authority as part of the application process.
- (e) *Past Performance* Relevant operating history, where available, should be included in the application. The applicant should show that changes needed in training, operating or maintenance practices to improve poor height keeping performance, have been made.
- (f) *Minimum Equipment List* Where applicable, a minimum equipment list (MEL), adapted from the master minimum equipment list (MMEL) and relevant operational regulations, should include items pertinent to operating in RVSM airspace.
- (g) *Maintenance* When application is made for operational approval, the operator should establish a maintenance programme acceptable to the responsible authority, as detailed in paragraph 10.
- (h) *Plan for Participation in Verification/Monitoring Programmes* The operator should establish a plan acceptable to the responsible authority, for participation in any applicable verification/ monitoring programme (See 11.6). This plan will need to include, as a minimum, a check on a sample of the operator's fleet by an independent height monitoring system.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

11.4 Demonstration Flight(s)

The content of the RVSM application may be sufficient to verify the aircraft performance and procedures. However, the final step of the approval process may require a demonstration flight. The responsible authority may appoint an inspector for a flight in RVSM airspace to verify that all relevant procedures are applied effectively. If the performance is satisfactory, operation in RVSM airspace may be permitted.

11.5 Form of Approval Documents

- (a) *Holders of an Air Operator's Certificate* Approval to operate in designated RVSM airspace areas will be granted by an Approval issued by the responsible authority in accordance with JAR OPS 1, or in compliance with national regulations where operational approval is required by an ICAO Regional Agreement. Each aircraft group for which the operator is granted approval will be listed in the Approval.
- (b) *Non AOC Holders* These operators will be issued with an Approval as required by national regulations or with JAR OPS 2 when this JAR is published. These approvals will be valid for a period specified in national regulations, typically 2 years, and may require renewal.

Note: Subject to compliance with applicable criteria, an RVSM Approval combining the airworthiness approval of sub-paragraph 9.1.4 and the operational approval of paragraph 11.2 may be available from some authorities.

11.6 Airspace Monitoring

For airspace where a numerical Target Level of Safety is prescribed, monitoring of aircraft height keeping performance in the airspace by an independent height monitoring system is necessary to verify that the prescribed level of safety is being achieved. However, an independent monitoring check of an aircraft is not a prerequisite for the grant of an RVSM approval.

11.7 Suspension, Revocation and Reinstatement of RVSM Approval

The incidence of height keeping errors that can be tolerated in an RVSM environment is small. It is expected of each operator to take immediate action to rectify the conditions that cause an error. The operator should report an occurrence involving poor height keeping to the responsible authority within 72 hours. The report should include an initial analysis of causal factors and measures taken to prevent repeat occurrences. The need for follow up reports will be determined by the responsible authority. Occurrences that should be reported and investigated are errors of:

- (a) TVE equal to or greater than ± 90 m (± 300 ft),
- (b) ASE equal to or greater than ± 75 m (± 245 ft), and
- (c) Assigned altitude deviation equal to or greater than ± 90 m (± 300 ft).

11.7.1 Height keeping Errors Height keeping errors fall into two broad categories:

- errors caused by malfunction of aircraft equipment; and
- operational errors.

11.7.2 An operator that consistently experiences errors in either category will have approval for RVSM operations suspended or revoked. If a problem is identified which is related to one specific aircraft type, then RVSM approval may be suspended or revoked for that specific type within that operator's fleet.

Note: The tolerable level of collision risk in the airspace would be exceeded if an operator consistently experienced errors.

11.7.3 *Operators Actions* The operator should make an effective, timely response to each height keeping error. The responsible authority may consider suspending or revoking RVSM approval if the

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

operator's responses to height keeping errors are not effective or timely. The responsible authority will consider the operator's past performance record in determining the action to be taken.

11.7.4 *Reinstatement of Approval* The operator will need to satisfy the responsible authority that the causes of height keeping errors are understood and have been eliminated and that the operator's RVSM programmes and procedures are effective. At its discretion and to restore confidence, the authority may require an independent height monitoring check of affected aircraft to be performed.

12. AVAILABILITY OF DOCUMENTS

- 12.1 Copies of EUROCONTROL documents may be requested from EUROCONTROL Documentation Centre, GS4, Rue de la Fusee, 96, B-1130 Brussels, Belgium: (Fax: 32 2 729 9109), and on the internet at < <http://www.eur-rvsm.com> >.
- 12.2 Copies of FAA documents may be obtained from Superintendent of Documents, Government Printing Office, Washington DC 20402-9325, USA.
- 12.3 Copies of ARINC documents may be obtained from Aeronautical radio Inc., 2551 Riva Road, Annapolis, Maryland 24101-7465, USA.
- 12.4 Copies of RTCA documents may be obtained from RTCA Inc., 1140 Connecticut Avenue, N.W., Suite 1020, Washington, DC 20036-4001, USA, (Tel: 1 202 833 9339).
- 12.5 Information for obtaining ICAO and JAA documents should be requested from the applicant's national authority. (Information for obtaining the North Atlantic MNPS Airspace Operational Manual may be found in UK CAA AIC 149/1998).

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JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

APPENDIX 1 - EXPLANATION OF W/δ

1 Sub-paragraph 9.4 describes the range of flight conditions over which conformity with the ASE criteria should be shown. The description includes reference to the parameter W/δ . The following discussion is provided for the benefit of readers who may not be familiar with the use of this parameter.

2 It would be difficult to show all of the gross weight, altitude, and speed conditions which constitute the RVSM envelope(s) on a single plot. This is because most of the speed boundaries of the envelopes are a function of both altitude and gross weight. As a result, a separate chart of altitude versus Mach would be required for each aircraft gross weight. Aircraft performance engineers commonly use the following technique to solve this problem.

3 For most jet transports the required flight envelope can be collapsed to a single chart with good approximation, by the use of the parameter W/δ (weight divided by atmospheric pressure ratio). This fact is due to the relationship between W/δ and the fundamental aerodynamic variables M and lift coefficient as shown below.

$$W/\delta = 1481.4 C_L M^2 S_{\text{Ref}}, \text{ where:}$$

δ = ambient pressure at flight altitude divided by sea level standard pressure of 1013.25 hPa

W/δ = Weight over Atmospheric Pressure Ratio

C_L = Lift Coefficient

M = Mach Number

S_{REF} = Reference Wing Area

4 As a result, the RVSM flight envelope(s) may be collapsed into one chart by simply plotting W/δ , rather than altitude, versus Mach Number. Since δ is a fixed value for a given altitude, weight can be obtained for a given condition by simply multiplying the W/δ value by δ .

5 Over the RVSM altitude range, it is a good approximation to assume that position error is uniquely related to Mach Number and W/δ for a given aircraft.

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JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

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JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

APPENDIX 2 - ALTIMETRY SYSTEM ERROR COMPONENTS

1. INTRODUCTION

Sub-paragraph 9.5.3 states that an error budget should be established and presented in the approval data package. The error budget is discussed in some detail in subsequent paragraphs for group and non-group aircraft. The purpose of this appendix is to provide guidance to help ensure that all the potential error sources are identified and included in the error budget for each particular model.

2. OBJECTIVE OF ASE BUDGET

2.1 The purpose of the ASE budget is to demonstrate that the allocation of tolerances amongst the various parts of the altimetry system is, for the particular data package, consistent with the overall statistical ASE criteria. These individual tolerances within the ASE budget also form the basis of the procedures, defined in the airworthiness approval data package, which will be used to demonstrate that aircraft satisfy the RVSM criteria.

2.2 It is necessary to ensure that the budget takes account of all contributory components of ASE.

2.3 For group approval it is necessary to ensure either that the budget assesses the combined effect of the component errors in a way that is statistically realistic, or that the worst case specification values are used.

3. ALTIMETRY SYSTEM ERROR

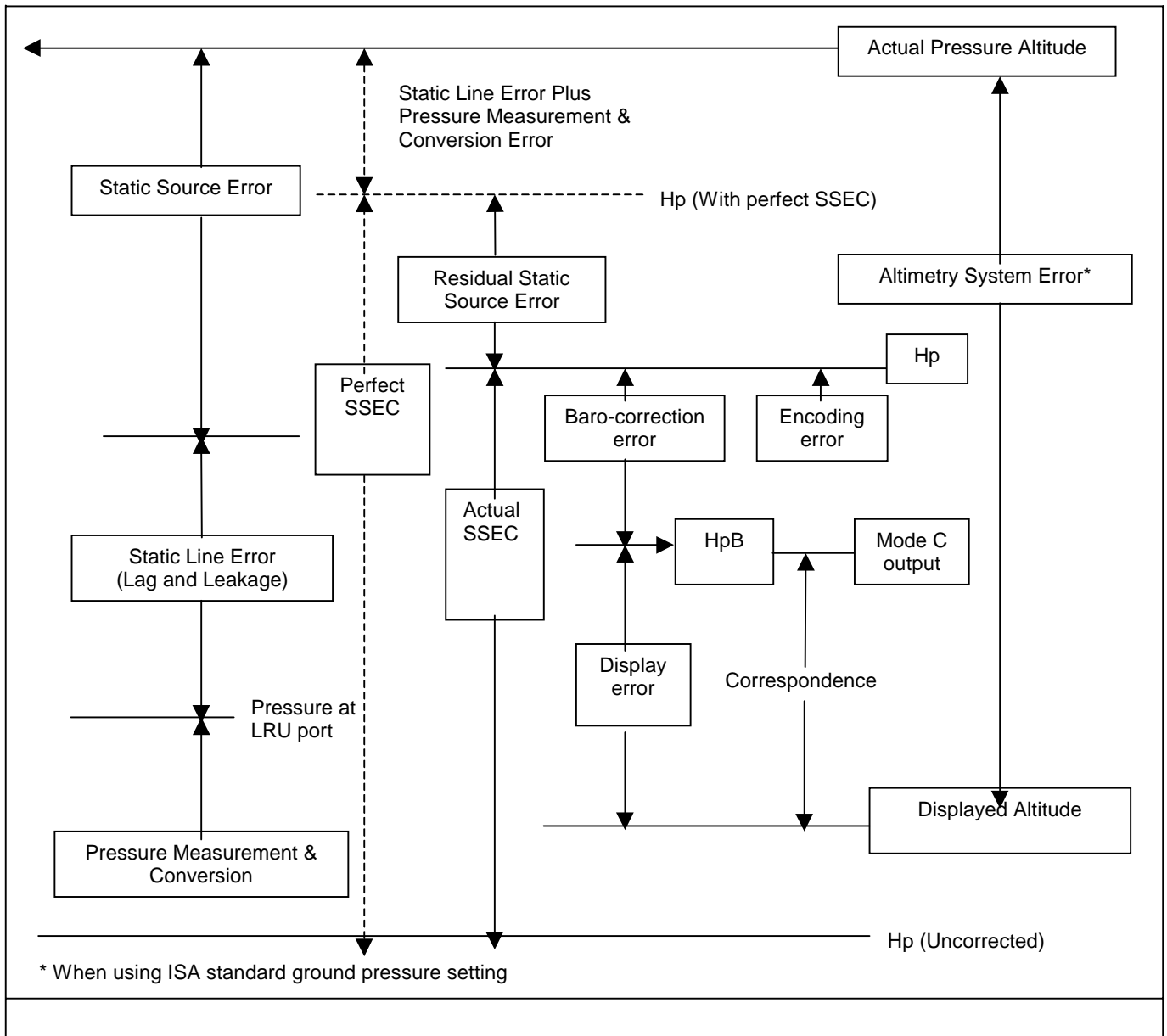
3.1 Breakdown

Figure 2-1 shows the breakdown of total ASE into its main components, with each error block representing the error associated with one of the functions needed to generate a display of pressure altitude. This breakdown encompasses all altimetry system errors that can occur, although different system architectures may combine the components in slightly different ways.

- (a) The 'Actual Altitude' is the pressure altitude corresponding to the undisturbed ambient pressure.
- (b) 'Static Source Error' is the difference between the undisturbed ambient pressure and the pressure within the static port, at the input end of the static pressure line.
- (c) 'Static Line Error' is any difference in pressure along the length of the line.
- (d) 'Pressure Measurement and Conversion Error' is the error associated with the processes of sensing the pneumatic input seen by the avionics, and converting the resulting pressure signal into altitude. As drawn, Figure 2-1 represents a self-sensing altimeter system in which the pressure measurement and altitude conversion functions would not normally be separable. In an air data computer system the two functions would be separate, and SSEC would probably then be applied before pressure altitude (H_p) was calculated.
- (e) 'Perfect SSEC' would be that correction that compensated exactly for the SSE actually present at any time. If such a correction could be applied, then the resulting value of H_p calculated by the system would differ from the actual altitude only by the static line error plus the pressure measurement and conversion error. In general this cannot be achieved, so although the 'Actual SSEC' can be expected to reduce the effect of SSE, it will do so imperfectly.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

FIGURE 2-1 ALTIMETRY SYSTEM ERRORS



(f) 'Residual Static Source Error' is applicable only in systems applying an avionic SSEC. It is the difference between the SSE and the correction actually applied. The corrected value of Hp will therefore differ from actual pressure altitude by the sum of static line error, pressure measurement and conversion error, and residual SSE.

(g) Between Hp and displayed altitude occur the baro-correction error and the display error. Figure 2-1 represents their sequence for a self-sensing altimeter system. Air data computer systems can implement baro-correction in a number of ways that would modify slightly this part of the block diagram, but the errors would still be associated with either the baro-correction function or the display function. The only exception is that those systems that can be switched to operate the display directly from the Hp signal can eliminate baro-correction error where standard ground pressure setting is used, as in RVSM operations.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

3.2 Components

The altimetry system errors presented in Figure 2-1 and described in 3.1 are discussed below in greater detail.

3.2.1 *Static Source Error* The component parts of SSE are presented in Table 2-1, with the factors that control their magnitude.

- (a) The reference SSE is the best estimate of actual SSE, for a single aircraft or an aircraft group, obtained from flight calibration measurements. It is variable with operating condition characteristically reducing to a family of W/δ curves that are functions of Mach. It includes the effect of any aerodynamic compensation that may have been incorporated in the design. Once determined, the reference SSE is fixed for the single aircraft or group, although it may be revised when considering subsequent data.
- (b) The test techniques used to derive the reference SSE will have some measurement of uncertainty associated with them, even though known instrumentation errors will normally be eliminated from the data. For trailing-cone measurements the uncertainty arises from limitations on pressure measurement accuracy, calibration of the trailing-cone installation, and variability in installations where more than one are used. Once the reference SSE has been determined, the actual measurement error is fixed, but as it is unknown it can only be handled within the ASE budget as an estimated uncertainty.
- (c) The airframe variability and probe/port variability components arise from differences between the individual airframe and probe/port, and the example(s) of airframe and probe port used to derive the reference SSE.

3.2.2 *Residual Static Source Error*

- (a) The components and factors are presented in Table 2-1. Residual SSE is made up of those error components which make actual SSE different from the reference value, components 2, 3, and 4 from Table 2-1, plus the amount by which the actual SSEC differs from the value that would correct the reference value exactly, components 2(a), (b) and (c) from Table 2-2.
- (b) There will generally be a difference between the SSEC that would exactly compensate the reference SSE, and the SSEC that the avionics is designed to apply. This arises from practical avionics design limitations. The resulting error component 2(a) will therefore be fixed, for a particular flight condition, for the single aircraft or group. Additional variable errors 2(b) and 2(c) arise from those factors that cause a particular set of avionics to apply an actual SSEC that differs from its design value.
- (c) The relationship between perfect SSEC, reference SSEC, design SSEC and actual SSEC is illustrated in Figure 2-2, for the case where static line errors and pressure measurements and conversion errors are taken as zero.
- (d) Factors that create variability of SSE relative to the reference characteristic should be accounted for twice. First, as noted for the SSE itself in Table 2-2, and secondly for its effect on the corruption of SSEC as in factor 2(a)(i) of Table 2-2. Similarly the static pressure measurement error should be accounted for in two separate ways. The main effect will be by way of the 'pressure measurement and conversion' component, but a secondary effect will be by way of factor 2(a)(ii) of Table 2-2.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

TABLE 2-1 STATIC SOURCE ERROR
(Cause: Aerodynamic Disturbance to Free-Stream Conditions)

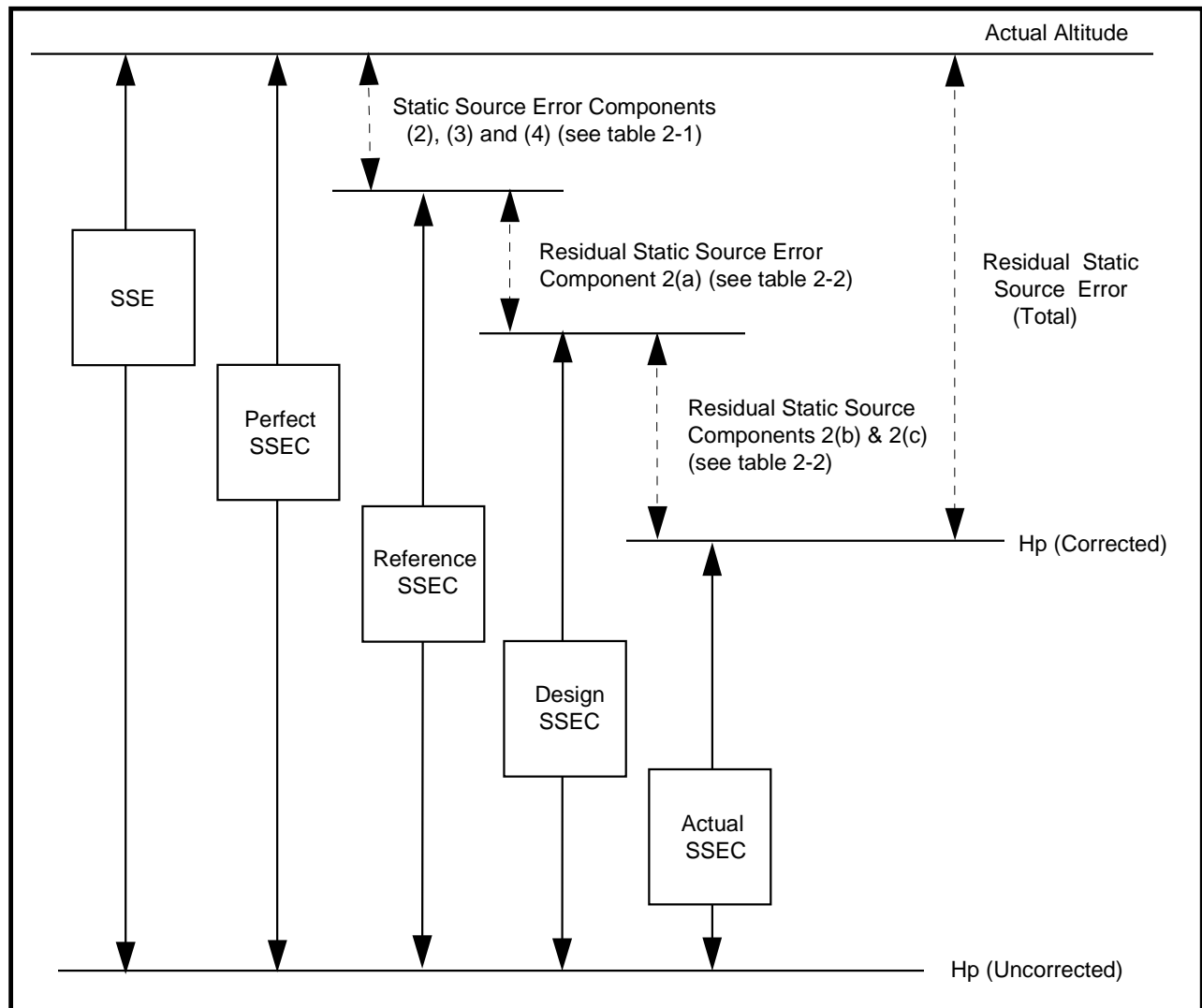
Factors	Error Components
<p>Airframe Effects</p> <p>Operating Condition (Speed, altitude, angle of attack, sideslip)</p> <p>Geometry: Size and shape of airframe; Location of static sources; Variations of surface contour near the sources; Variations in fit of nearby doors, skin panels or other items.</p>	<p>1) Reference SSE values from flight calibration measurements.</p> <p>2) Uncertainty of flight calibration measurements.</p>
<p>Probe/Port Effects</p> <p>Operating Condition (Speed, altitude, angle of attack, sideslip)</p> <p>Geometry: Shape of probe/port; Manufacturing variations; Installation variations.</p>	<p>3) Airframe to airframe variability.</p> <p>4) Probe/port to probe/port variability.</p>

TABLE 2-2 RESIDUAL STATIC SOURCE ERROR: (AIRCRAFT WITH AVIONIC SSEC)
(Cause: Difference between the SSEC actually applied and the actual SSE)

Factors	Error Components
<p>(1) As for Static Source Error PLUS</p> <p>(2) Source of input data for SSEC function</p> <p> (a) Where SSEC is a function of Mach:</p> <p> (i) P_S sensing: difference in SSEC from reference SSE.</p> <p> (ii) P_S measurement: pressure transduction error.</p> <p> (iii) P_T errors: mainly pressure transduction error.</p> <p> (b) Where SSEC is a function of angle of attack:</p> <p> (i) geometric effects on alpha:</p> <p> -sensor tolerances;</p> <p> -installation tolerances;</p> <p> -local surface variations.</p> <p> (ii) measurement error:</p> <p> -angle transducer accuracy.</p> <p>(3) Implementation of SSEC function</p> <p> (a) Calculation of SSEC from input data;</p> <p> (b) Combination of SSEC with uncorrected height.</p>	<p>1) Error Components (2), (3), and (4) from table 2-1 PLUS</p> <p>2(a) Approximation in fitting design SSEC to flight calibration reference SSE.</p> <p>2(b) Effect of production variability (sensors and avionics) on achieving design SSEC.</p> <p>2(c) Effect of operating environment (sensors and avionics) on achieving design SSEC.</p>

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

FIGURE 2-2 SSE/SSEC RELATIONSHIPS FOR ASE WHERE STATIC LINE, PRESSURE MEASUREMENT AND CONVERSION ERRORS ARE ZERO



3.2.3 Static Line Error Static line errors arise from leaks and pneumatic lags. In level cruise these can be made negligible for a system that is correctly designed and correctly installed.

3.2.4 Pressure Measurement and Conversion Error

- (a) The functional elements are static pressure sensing, which may be mechanical, electromechanical or solid-state, and the conversion of pressure signal to pressure altitude.
- (b) The error components are:
 - (i) calibration uncertainty;
 - (ii) nominal design performance;
 - (iii) unit to unit manufacturing variations; and
 - (iv) effect of operating environment.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

- (c) The equipment specification is normally taken to cover the combined effect of the error components. If the value of pressure measurements and conversion error used in the error budget is the worst case specification value, then it is not necessary to assess the above components separately. However, calibration uncertainty, nominal design performance and effect of operating environment can all contribute to bias errors within the equipment tolerance. Therefore if it is desired to take statistical account of the likely spread of errors within the tolerance band, then it will be necessary to assess their likely interaction for the particular hardware design under consideration.
- (d) It is particularly important to ensure that the specified environmental performance is adequate for the intended application.

3.2.5 Baro-Setting Error This is the difference between the value displayed and the value applied within the system. For RVSM operation the value displayed should always be the International Standard Atmosphere ground pressure, but setting mistakes, although part of TVE, are not components of ASE.

- (a) The components of Baro-Setting Error are:
 - (i) resolution of setting knob/display;
 - (ii) sensing of displayed value; and
 - (iii) application of sensed value.
- (b) The applicability of these factors and the way that they combine depend on the particular system architecture.
- (c) For systems in which the display is remote from the pressure measurement function there may be elements of the sensing and/or application or sensed value error components which arise from the need to transmit and receive the setting between the two locations.

3.2.6 Display Error The cause is imperfect conversion from altitude signal to display.

The components are:

- (a) conversion of display input signal;
- (b) graticule/format accuracy, and
- (c) readability.

3.2.7 In self-sensing altimeters the first of these would normally be separate from the pressure measurement and conversion error.

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JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

APPENDIX 3 - ESTABLISHING AND MONITORING STATIC SOURCE ERRORS

1. INTRODUCTION

The data package is discussed in sub-paragraph 9.2. It is stated, in sub-paragraph 9.5.5 (c) that the methodology used to establish the static source error should be substantiated. It is further stated in sub-paragraph 9.6 that procedures be established to ensure conformity of newly manufactured aeroplanes. There may be many ways of satisfying these objectives; two examples are discussed below.

2. EXAMPLE 1

2.1 One process for showing compliance with RVSM criteria is shown in Figure 3-1. Figure 3-1 illustrates those flight test calibrations and geometric inspections will be performed on a given number of aircraft. The flight calibrations and inspections will continue until a correlation between the two is established. Geometric tolerances and SSEC will be established to satisfy RVSM criteria. For aircraft being manufactured, every Nth aircraft will be inspected in detail and every Mth aircraft will be flight test calibrated, where 'N' and 'M' are determined by the aircraft constructor and agreed to by the responsible authority. The data generated by 'N' inspections and 'M' flight calibrations can be used to track the mean and three standard deviation values to ensure continued compliance of the model with the criteria of paragraph 7. As additional data are acquired, they should be reviewed to determine if it is appropriate to change the values of N and M as indicated by the quality of the results obtained.

2.2 There are various ways in which the flight test and inspection data might be used to establish the correlation. The example shown in Figure 3-2 is a process in which each of the error sources for several aeroplanes is evaluated based on bench tests, inspections and analysis. Correlation between these evaluations and the actual flight test results would be used to substantiate the method.

2.3 The method illustrated in Figures 3-1 and 3-2 is appropriate for new models since it does not rely on any pre-existing data base for the group.

3. EXAMPLE 2

3.1 Figure 3-3 illustrates that flight test calibrations should be performed on a given number of aircraft and consistency rules for air data information between all concerned systems verified. Geometric tolerances and SSEC should be established to satisfy the criteria. A correlation should be established between the design tolerances and the consistency rules. For aircraft being manufactured, air data information for all aircraft should be checked for consistency in cruise conditions and every Mth aircraft should be calibrated, where M is determined by the manufacturer and agreed to by the responsible authority. The data generated by the M flight calibrations should be used to track the mean and three standard deviation values to ensure continued compliance of the group with the criteria of paragraph 7.

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JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

FIGURE 3-1 PROCESS FOR SHOWING INITIAL AND CONTINUED COMPLIANCE OF AIRFRAME STATIC PRESSURE SYSTEMS

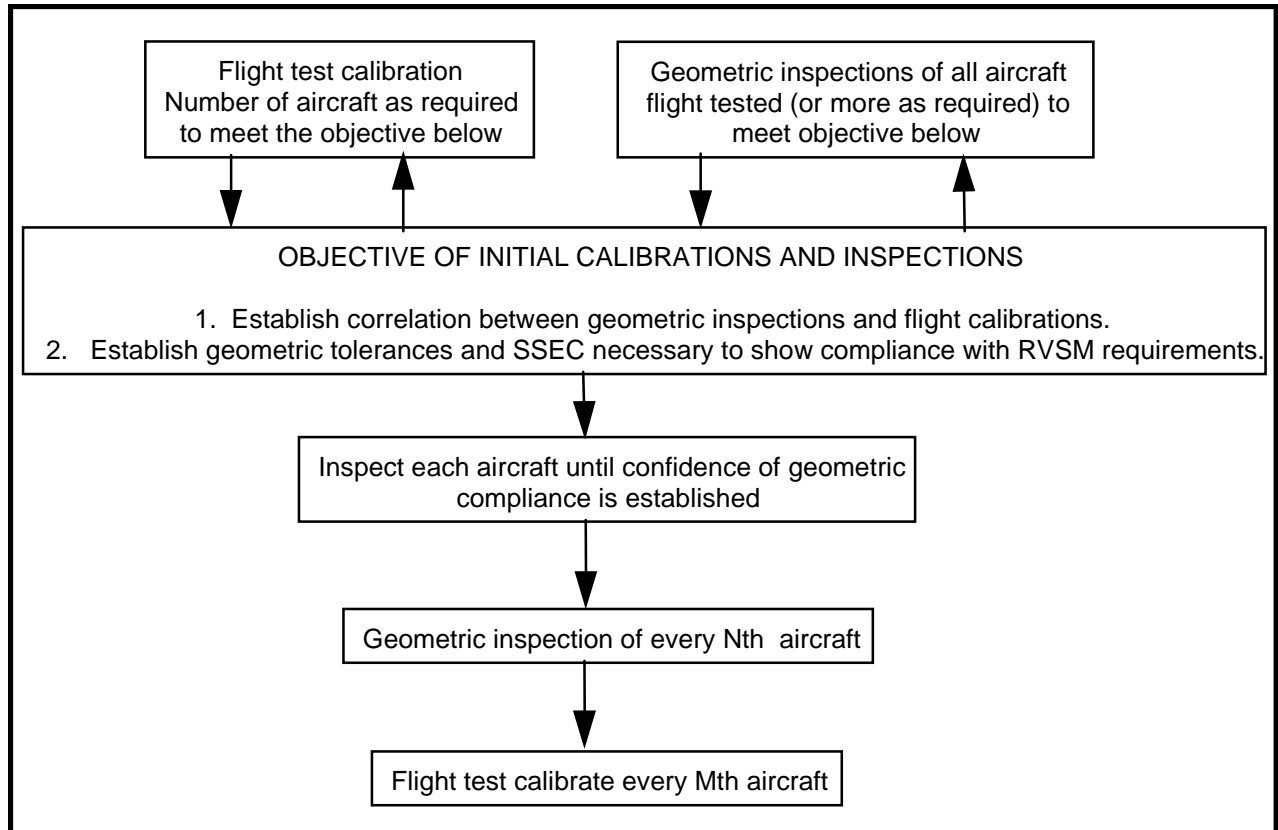
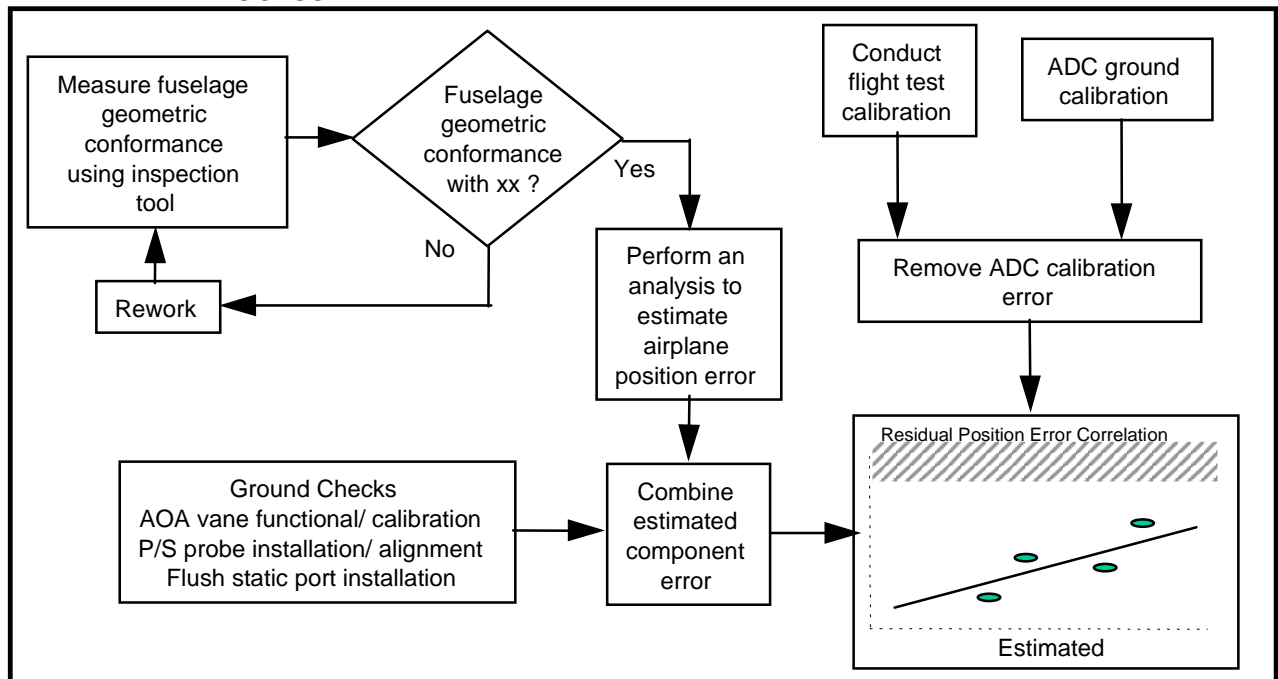


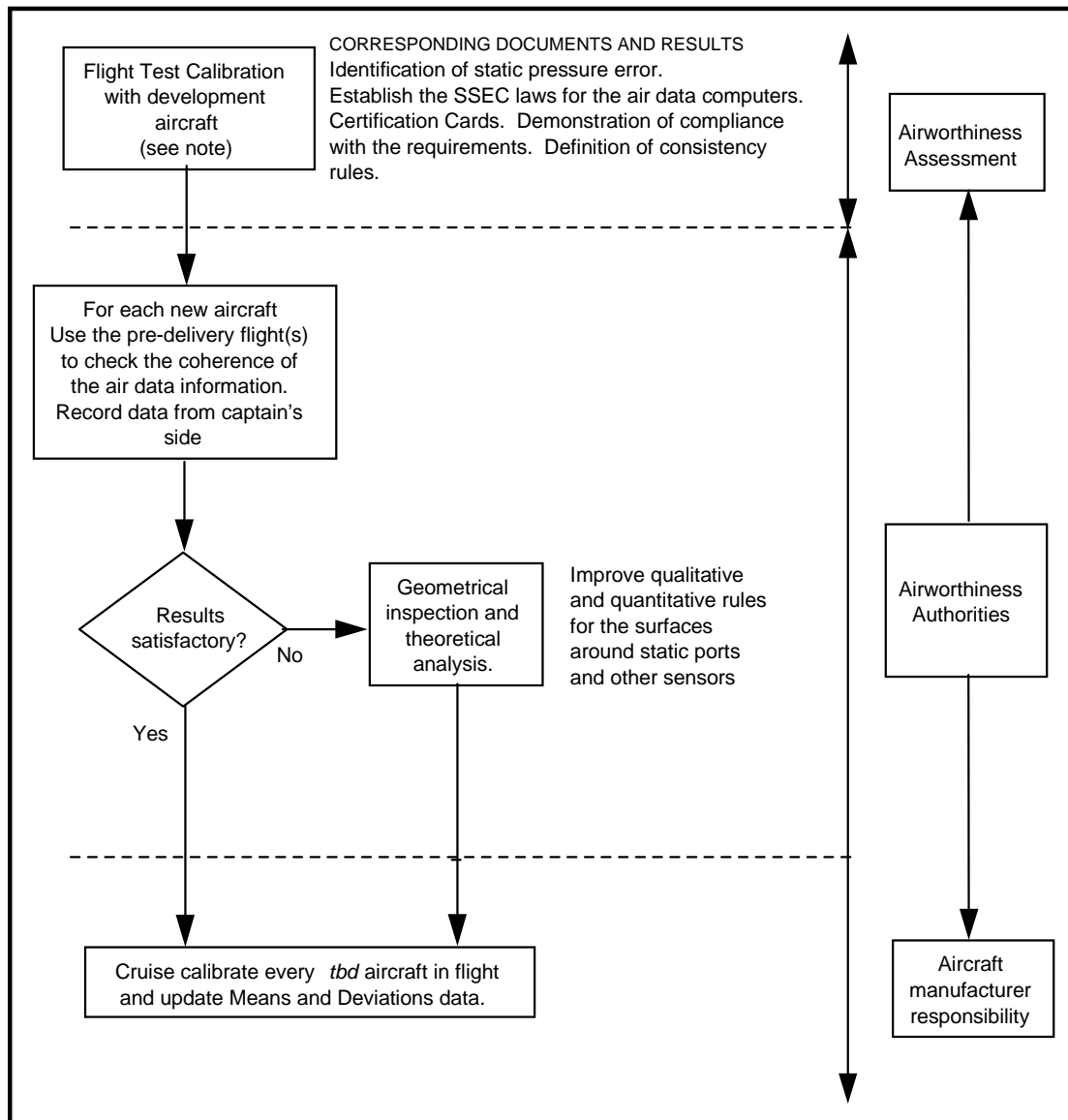
FIGURE 3-2 COMPLIANCE DEMONSTRATION GROUND - TO FLIGHT TEST CORRELATION PROCESS EXAMPLE



JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

FIGURE 3-3 PROCESS FOR SHOWING INITIAL AND CONTINUED COMPLIANCE OF AIRFRAME STATIC PRESSURE SYSTEMS FOR NEW MODEL AIRCRAFT.



Note : The flight test installation chosen to get the calibration data will need to have an accuracy compatible with the level of performance to be demonstrated and an analysis of this accuracy will need to be provided. Any possible degradation of this accuracy will need to be monitored and corrected during the flight test period.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

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Section One: General Part 3: Temporary Guidance Leaflets

APPENDIX 4 TRAINING PROGRAMMES AND OPERATING PRACTICES AND PROCEDURES

1. INTRODUCTION

Flight crews will need to have an awareness of the criteria for operating in RVSM airspace and be trained accordingly. The items detailed in paragraphs 2 to 6 of this appendix should be standardised and incorporated into training programmes and operating practices and procedures. Certain items may already be adequately standardised in existing procedures. New technology may also remove the need for certain actions required of the flight crew. If this is so, then the intent of this guidance can be considered to be met.

Note: This document is written for all users of RVSM airspace, and as such is designed to present all required actions. It is recognised that some material may not be necessary for larger public transport operators.

2. FLIGHT PLANNING

During flight planning the flight crew should pay particular attention to conditions that may affect operation in RVSM airspace.

These include, but may not be limited to:

- (a) verifying that the airframe is approved for RVSM operations;
- (b) reported and forecast weather on the route of flight;
- (c) minimum equipment requirements pertaining to height keeping and alerting systems; and
- (d) any airframe or operating restriction related to RVSM approval.

3. PRE-FLIGHT PROCEDURES AT THE AIRCRAFT FOR EACH FLIGHT

The following actions should be accomplished during the pre-flight procedure:

- (a) review technical logs and forms to determine the condition of equipment required for flight in the RVSM airspace. Ensure that maintenance action has been taken to correct defects to required equipment;
- (b) during the external inspection of aircraft, particular attention should be paid to the condition of static sources and the condition of the fuselage skin near each static source and any other component that affects altimetry system accuracy. This check may be accomplished by a qualified and authorised person other than the pilot (e.g. a flight engineer or ground engineer);
- (c) before takeoff, the aircraft altimeters should be set to the QNH of the airfield and should display a known altitude, within the limits specified in the aircraft operating manuals. The two primary altimeters should also agree within limits specified by the aircraft operating manual. An alternative procedure using QFE may also be used. Any required functioning checks of altitude indicating systems should be performed.

Note. The maximum value for these checks cited in operating manuals should not exceed 23m (75ft).

- (d) before take-off, equipment required for flight in RVSM airspace should be operative, and any indications of malfunction should be resolved.

4. PROCEDURES PRIOR TO RVSM AIRSPACE ENTRY

The following equipment should be operating normally at entry into RVSM airspace:

- (a) Two primary altitude measurement systems.
- (b) One automatic altitude-control system.
- (c) One altitude-alerting device.

JAA Administrative & Guidance Material

Section One: General Part 3: Temporary Guidance Leaflets

Note: Dual equipment requirements for altitude-control systems will be established by regional agreement after an evaluation of criteria such as mean time between failures, length of flight segments and availability of direct pilot-controller communications and radar surveillance.

- (d) Operating Transponder. An operating transponder may not be required for entry into all designated RVSM airspace. The operator should determine the requirement for an operational transponder in each RVSM area where operations are intended. The operator should also determine the transponder requirements for transition areas next to RVSM airspace.

Note: Should any of the required equipment fail prior to the aircraft entering RVSM airspace, the pilot should request a new clearance to avoid entering this airspace;

5. IN-FLIGHT PROCEDURES

5.1 The following practices should be incorporated into flight crew training and procedures:

- (a) Flight crews will need to comply with any aircraft operating restrictions, if required for the specific aircraft group, e.g. limits on indicated Mach number, given in the RVSM airworthiness approval.
- (b) Emphasis should be placed on promptly setting the sub-scale on all primary and standby altimeters to 1013.2 (hPa) /29.92 in.Hg when passing the transition altitude, and rechecking for proper altimeter setting when reaching the initial cleared flight level;
- (c) In level cruise it is essential that the aircraft is flown at the cleared flight level. This requires that particular care is taken to ensure that ATC clearances are fully understood and followed. The aircraft should not intentionally depart from cleared flight level without a positive clearance from ATC unless the crew are conducting contingency or emergency manoeuvres;
- (d) When changing levels, the aircraft should not be allowed to overshoot or undershoot the cleared flight level by more than 45 m (150 ft);

Note: It is recommended that the level off be accomplished using the altitude capture feature of the automatic altitude-control system, if installed.

- (e) An automatic altitude-control system should be operative and engaged during level cruise, except when circumstances such as the need to re-trim the aircraft or turbulence require disengagement. In any event, adherence to cruise altitude should be done by reference to one of the two primary altimeters. Following loss of the automatic height keeping function, any consequential restrictions will need to be observed.
- (f) Ensure that the altitude-alerting system is operative;
- (g) At intervals of approximately one hour, cross-checks between the primary altimeters should be made. A minimum of two will need to agree within ± 60 m (± 200 ft). Failure to meet this condition will require that the altimetry system be reported as defective and notified to ATC;
 - (i) The usual scan of flight deck instruments should suffice for altimeter cross-checking on most flights.
 - (ii) Before entering RVSM airspace, the initial altimeter cross check of primary and standby altimeters should be recorded
 - Note: Some systems may make use of automatic altimeter comparators.
- (h) In normal operations, the altimetry system being used to control the aircraft should be selected for the input to the altitude reporting transponder transmitting information to ATC.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

- (i) If the pilot is advised in real time that the aircraft has been identified by a height-monitoring system as exhibiting a TVE greater than ± 90 m (± 300 ft) and/or an ASE greater than ± 75 m (± 245 ft) then the pilot should follow established regional procedures to protect the safe operation of the aircraft. This assumes that the monitoring system will identify the TVE or ASE within the set limits for accuracy.
- (j) If the pilot is notified by ATC of an assigned altitude deviation which exceeds ± 90 m (± 300 ft) then the pilot should take action to return to cleared flight level as quickly as possible.

5.2 Contingency procedures after entering RVSM airspace are:

5.2.1 The pilot should notify ATC of contingencies (equipment failures, weather) which affect the ability to maintain the cleared flight level, and co-ordinate a plan of action appropriate to the airspace concerned. Detailed guidance on contingency procedures are contained in the relevant publications dealing with the airspace. Refer to Appendix 4, Paragraph 8 of this document.

5.2.2 Examples of equipment failures which should be notified to ATC are:

- (a) failure of all automatic altitude-control systems aboard the aircraft;
- (b) loss of redundancy of altimetry systems;
- (c) loss of thrust on an engine necessitating descent; or
- (d) any other equipment failure affecting the ability to maintain cleared flight level;

5.2.3 The pilot should notify ATC when encountering greater than moderate turbulence.

5.2.4 If unable to notify ATC and obtain an ATC clearance prior to deviating from the cleared flight level, the pilot should follow any established contingency procedures and obtain ATC clearance as soon as possible.

6. POST FLIGHT

6.1 In making technical log entries against malfunctions in height keeping systems, the pilot should provide sufficient detail to enable maintenance to effectively troubleshoot and repair the system. The pilot should detail the actual defect and the crew action taken to try to isolate and rectify the fault.

6.2 The following information should be recorded when appropriate:

- (a) Primary and standby altimeter readings.
- (b) Altitude selector setting.
- (c) Subscale setting on altimeter.
- (d) Autopilot used to control the aeroplane and any differences when an alternative autopilot system was selected.
- (e) Differences in altimeter readings, if alternate static ports selected.
- (f) Use of air data computer selector for fault diagnosis procedure.
- (g) The transponder selected to provide altitude information to ATC and any difference noted when an alternative transponder was selected.

7. SPECIAL EMPHASIS ITEMS: FLIGHT CREW TRAINING

7.1 The following items should also be included in flight crew training programmes:

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

- (a) knowledge and understanding of standard ATC phraseology used in each area of operations;
- (b) importance of crew members cross checking to ensure that ATC clearances are promptly and correctly complied with;
- (c) use and limitations in terms of accuracy of standby altimeters in contingencies. Where applicable, the pilot should review the application of static source error correction/ position error correction through the use of correction cards;

Note: Such correction data will need to be readily available on the flight deck.

- (d) problems of visual perception of other aircraft at 300m (1,000 ft) planned separation during darkness, when encountering local phenomena such as northern lights, for opposite and same direction traffic, and during turns; and
- (e) characteristics of aircraft altitude capture systems which may lead to overshoots;
- (f) relationship between the aircraft's altimetry, automatic altitude control and transponder systems in normal and abnormal conditions;
- (g) any airframe operating restrictions, if required for the specific aircraft group, related to RVSM airworthiness approval.

8. SPECIFIC REGIONAL OPERATIONAL PROCEDURES

- 8.1 The areas of applicability (by Flight Information Region) of RVSM airspace in identified ICAO regions is contained in the relevant sections of ICAO Document 7030/4. In addition these sections contain operational and contingency procedures unique to the regional airspace concerned, specific flight planning requirements, and the approval requirements for aircraft in the designated region.
- 8.2 For the North Atlantic Minimum Navigation Performance Specification (MNPS) airspace, where RVSM have been in operation since 1997, further guidance (principally for State Approval Agencies) is contained in ICAO Document NAT 001 T13/5NB.5 with comprehensive operational guidance (aimed specifically at aircraft operators) in the North Atlantic MNPS Airspace Operational Manual.
- 8.3 Comprehensive guidance on operational matters for European RVSM Airspace is contained in EUROCONTROL Document ASM ET1.ST.5000 entitled "The ATC Manual for a Reduced Vertical Separation (RVSM) in Europe" with further material included in the relevant State Aeronautical Publications.
- 8.4 During the life of this document, it is expected that additional ICAO regions or parts of regions may introduce RVSM into their airspace. For example, plans are well in hand to introduce RVSM into parts of the Pacific region. The area of applicability and associated procedures will be published in Document 7030/4 where reference will be made to additional material as necessary.

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

APPENDIX 5 - REVIEW OF ICAO DOCUMENT 9574 - HEIGHT KEEPING PARAMETERS

1. ICAO Document 9574 Manual on the implementation of a 300m (1,000 ft) Vertical Separation Minimum Between FL 290-FL 410 Inclusive, covers the overall analysis of factors for achieving an acceptable level of safety in a given airspace system. The major factors are passing frequency, lateral navigation accuracy, and vertical overlap probability. Vertical overlap probability is a consequence of errors in adhering accurately to the assigned flight level, and this is the only factor covered in this document.

2. In ICAO Doc. 9574, Section 2.1.1.3, the vertical overlap probability requirement is restated as the aggregate of height keeping errors of individual aircraft that must lie within the total vertical error (TVE) distribution, expressed as the simultaneous satisfaction of the following four criteria:

- (a) " the proportion of height keeping errors beyond 90 m (300 ft) in magnitude must be less than 2.0×10^{-3} ; and
- (b) the proportion of height keeping errors beyond 150 m (500 ft) in magnitude must be less than 3.5×10^{-6} ; and
- (c) the proportion of height keeping errors beyond 200 m (650 ft) in magnitude must be less than 1.6×10^{-7} ; and
- (d) the proportion of height keeping errors between 290 m (950 ft) and 320 m (1,050 ft) in magnitude must be less than 1.7×10^{-8} . "

3. The following characteristics presented in ICAO Doc. 9574 were developed in accordance with the conclusions of ICAO Doc. 9536. They are applicable statistically to individual groups of nominally identical aircraft operating in the airspace. These characteristics describe the performance that the groups need to be capable of achieving in service, exclusive of human factors errors and extreme environmental influences, if the airspace system TVE criteria are to be satisfied. The following characteristics are the basis for development of this document:

- (a) 'The mean altimetry system error (ASE) of the group shall not exceed $\pm 25\text{m}$ ($\pm 80\text{ ft}$); and
- (b) The sum of the absolute value of the mean ASE for the group and three standard deviations of ASE within the group shall not exceed 75 m (245 ft); and
- (c) Errors in altitude keeping shall be symmetric about a mean of 0 m (0 ft) and shall have a standard deviation not greater than 13 m (43 ft) and should be such that the error frequency decreases with increasing error magnitude at a rate which is at least exponential.'

4. ICAO Doc. 9574 recognises that specialist study groups would develop the detailed specifications, to ensure that the TVE objectives can be met over the full operational envelope in RVSM airspace for each aircraft group. In determining the breakdown of tolerances between the elements of the system it was considered necessary to set system tolerances at levels that recognise that the overall objectives must be met operationally by aircraft and equipment subject to normal production variability, including that of the airframe static source error, and normal in-service degradation. It was also recognised that it would be necessary to develop specifications and procedures covering the means for ensuring that in-service degradation is controlled at an acceptable level.

5. On the basis of studies reported in ICAO Doc. 9536, Volume 2, ICAO Doc. 9574 recommended that the required margin between operational performance and design capability should be achieved by ensuring that the performance criteria are developed to fulfil the following, where the narrower tolerance in sub-paragraph 5 (b) is specifically intended to allow for some degradation with increasing age:

- (a) 'the mean uncorrected residual position error (static source error) of the group shall not exceed $\pm 25\text{ m}$ ($\pm 80\text{ ft}$); and
- (b) the sum of the absolute value of the mean ASE for the group and three standard deviations of ASE within the group, shall not exceed 60 m (200 ft); and

JAA Administrative & Guidance Material
Section One: General Part 3: Temporary Guidance Leaflets

- (c) each individual aircraft in the group shall be built to have ASE contained within ± 60 m (± 200 ft); and
- (d) an automatic altitude control system shall be required and will be capable of controlling altitude within a tolerance band of ± 15 m (± 50 ft) about selected altitude when operated in the altitude hold mode in straight and level flight under non-turbulent, non-gust conditions.'

6. These standards provide the basis for the separate performance aspects of airframe, altimetry, altimetry equipment and automatic altitude control system. It is important to recognise that the limits are based on studies (Doc. 9536, Volume 2), which show that ASE tends to follow a normal distribution about a characteristic mean value for the aircraft group and that the in-service performances of the separate groups aggregate together to give an overall performance spread which is distributed about the population mean TVE that is nominally zero. Consequently, controls should be provided which will preclude the possibility that individual aircraft approvals could create clusters operating with a mean significantly beyond 25 m (80 ft) in magnitude, such as could arise where elements of the altimetry system generate bias errors additional to the mean corrected static source error.

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AFRICA- INDIAN OCEAN RVSM SAMPLE AIC, NOTAM, AIP SUPPLEMENT

AERONAUTICAL INFORMATION CIRCULAR (AIC)

IMPLEMENTATION OF REDUCED VERTICAL SEPARATION MINIMA (RVSM) IN (.....) FIR

FIR/Airspace : (.....)

Effective date : 20 January 2005.

Type : Permanent/Temporary

Appendix – A

This AIC serves as Notice of Intent to implement RVSM in the (.....) FIR effective 20 January 2005.

Reduced Vertical Separation Minimum (RVSM) is vertical separation of aircraft by 1,000 ft above FL 290. By 20 November 2004, operators should have received RVSM aircraft (airworthiness) and operational approval from the appropriate State authority. Operator/aircraft approval by 20 November 2004 will enable air traffic services (ATS) to plan for orderly RVSM implementation.

Starting 20 January 2005, only RVSM compliant aircraft will be cleared to operate in the (.....) FIR between FL290 and FL410 (inclusive). Aircraft that are not RVSM compliant (e.g., ferry and maintenance flights) will only be cleared to operate in the (.....) FIR between FLs 290 and FL410 (inclusive) after prior co-ordination with the appropriate center. 2,000 ft vertical separation will be applied to such aircraft. (.....) center contacts will be published on websites (if established) and in follow-up NOTAMs.

RVSM will be implemented in the (.....) FIR in accordance with ICAO regional agreements. ICAO recommends that State authorities and operators use FAA Interim Guidance 91-RVSM (as amended); Joint Airworthiness Authorities (JAA) Temporary Guidance Leaflet 6 (TGL 6) or equivalent State documents as the basis for approving aircraft and operator programs for RVSM.

The AFI Region has established that the task of monitoring safety in conjunction with implementation of RVSM and RNAV/RNP in the AFI Region be assigned to the South Africa. Current information and RVSM approval documents, including revisions, can be found on the website maintained by the FAA, EUROCONTROL, SATMA, MECMA and on individual State websites.

To access the FAA, EUROCONTROL, SATMA and MECMA RVSM websites, type :

<http://www.faa.gov/ats/ato/rvsm1.htm>

<http://www.eur-rvsm.com>

<http://www.satmasat.com>

<http://www.mecma.com>

The RVSM Documentation section of the FAA, EUROCONTROL websites contain guidance on aircraft/operator approval. Operators must begin coordination with the appropriate State authority as soon as possible to ensure that they are approved to begin RVSM operations on 20 January 2005.

Further information on the aircraft and operator approval process, policy planning and implementation issues for RVSM can be obtained from South Africa (ATNS) being responsible for setting up the AFI Regional Monitoring Agency.

NOTAM RELATED TO FLIGHT LEVEL ALLOCATION

In relation with the implementation of the RVSM in the AFI Region (see AIC and AIP/AMDT.....) and in order to avoid the excessive FL's changes for the users, the AFI Region Flight Level Allocation will be established based on the anticipated date to implement RVSM in selected airspace by the AIRAC cycle date of 20 January 2005, concurrently with the CAR/SAM Region.

CRUISING LEVELS APPLICABLE IN AFI RVSM AIRSPACE

The cruising levels that will apply within AFI region airspace will be in accordance with ICAO Annex 2, Appendix 3 a).

All ATS Routes in the upper airspace :

Eastbound Track from 000° to 179° : ODD LEVELS; 410,390,370,350,330,310,290

Westbound Track from 180° to 359° : EVEN LEVELS; 400,380,360,340,320,300

Operators are requested to plan their flights under this flight levels allocation scheme.

TEXT TO NOTAM FOR SUSPENSION OF RVSM

Procedures for Suspension of RVSM

Air Traffic Service providers will consider suspending RVSM procedures within affected area within theFIR and adjacent transition areas when there are pilot reports of greater than moderate turbulence. Within areas where RVSM procedures are suspended, the vertical separation minimum between all aircraft will be 2,000 ft.

AIP SUPPs FOR THE IMPLEMENTATION OF RVSM WITHIN THE (.....) FIR

(NAME OF STATE)

Address : AIP SUPPLEMENT N°
Telephone : DATE OF PUBLICATION
Fax :
E-mail :
Other information:

(to be developed)

**PROPOSAL FOR AMENDMENT TO THE
REGIONAL SUPPLEMENTARY PROCEDURES – DOC.7030/4
AFRICAN INDIAN OCEAN (AFI) REGION**

(Serial No. ESAF-S 04/1 – AFI RAC/1)

a) Proposed by:

AFI Planning and Implementation Regional Group (APIRG)

b) Proposed amendment: (*cf. Regional Supplementary Procedures, Doc.7030/4 – AFI, Part 1, Rules of the Air, Air Traffic Services and Search and Rescue, incorporating Amendment No.206*). Editorial note: Amendments are arranged to show deleted text using strikethrough (~~text to be deleted~~), and added text with grey shading (*text to be inserted*).

Amend the SUPPs in the AFI Region as follows:

AFI REGIONAL SUPPLEMENTARY PROCEDURES

**PART 1 – RULES OF THE AIR, AIR TRAFFIC SERVICES AND
SEARCH AND RESCUE**

These procedures are supplementary to the provisions contained in Annex 2, Annex 6 (Part II), Annex 11, PANS-ATM (Doc 4444) and PANS-OPS (Doc 8168).

Note. - The phrase “specified portions of the associated terminal control area” is intended to signify at least those portions of the TMA used by international IFR flights in association with approach, holding, departure and noise abatement procedures.

1.0 FLIGHT RULES

1.1 Visual flight rules (VFR)
(A2 – 4.7 and 4.8)

1.1.1 At selected aerodromes, only VFR flights to be operated within a control zone established at an aerodrome serving international flights and in specified portions of the associated terminal control area shall:

- a) have two-way radio communications;
- b) obtain clearance from the appropriate ATC unit; and
- c) report positions, as required.

1.2 Instrument flight rules (IFR)
(A2 – 2.2 and Chapter 5)

Note.- Annex 2, 2.2 permits a choice for a flight to comply with either the instrument flight rules or the visual flight rules when operated in visual meteorological conditions subject to certain limitations in Chapter 4 of the Annex. The following indicates certain further restrictions to that choice.

1.2.1 Special application of instrument flight rules

1.2.1.1 Flights shall be conducted in accordance with the instrument flight rules (even when not operating in instrument meteorological conditions) when operated above flight level 150.

1.3 Changes of flight levels (A2 – 5.2.2)

1.3.1 All changes of flight levels required by transition from the system of designated cruising levels for flights along controlled routes to the semicircular system of cruising levels, or vice versa, shall be made at points within controlled airspace.

1.3.2 The specific points to be used for the changes of flight levels mentioned in 1.3.1 shall be subject of coordination between the ATS units concerned, bearing in mind the need to avoid border points or other points where transfer of communications/transfer of responsibility would be adversely affected.

1.4 Air traffic advisory service (P-ATM, 9.1.4)

Note.- The PANS-ATM leaves it to the discretion of the pilot whether or not to obtain air traffic advisory service when available. The following procedures make it compulsory to obtain such service under certain circumstances.

1.4.1 All IFR flights shall comply with the procedures for air traffic advisory service when operating in advisory airspace.

1.5 Reduced Vertical Separation Minimum (RVSM) of 300 m (1,000 ft)

1.5.1 Area of Applicability

1.5.2 RVSM shall be applicable in that volume of airspace between FL290 and FL410 inclusive in the following flight information regions/upper flight information regions (FIRs/UIRs):

Accra, Addis Ababa, Algiers, Antananarivo, Asmara, Beira, Brazzaville, Cairo, Canarias,

Cape Town, Casablanca, Dakar, Dar es Salaam, Entebbe, Gaborone, Harare, Johannesburg, Kano, Khartoum, Kinshasa, Lilongwe, Luanda, Lusaka, Mauritius, Mogadishu, Nairobi, N'Djamena, Niamey, Roberts, Sal Oceanic, Seychelles, Tripoli, Tunis, Windhoek

Note. – The volume of airspace specified in 1.5.2 will be referred to as “ AFI RVSM airspace.

2.0 FLIGHT PLANS

2.1 Contents of flight plans (A2 – 2.3; P-ATM, 4.4.1 and Appendix 2)

2.1.1 Route

2.1.1.1 Whenever possible, flights should be authorized to fly direct between any two intermediate or terminal points of the AFI ATS route network. In this case, flight progress reports should be made in relation to the significant points defining the basic route.

2.1.2 Mach number

2.1.2.1 For turbo-jet aircraft intending to operate at or above FL 250 with FIR Canarias. The Mach number planned to be used shall be specified in Item 15 of the flight plan.

2.2 Presentation of flight plan (A2 – 3.3.1.4)

2.2.1 The appropriate ATS authority exercising the Annex 2 provision, 3.3.1.4, to prescribe a lead-time other than 60 minutes before departure for the submission of a flight plan concerning a flight to be provided with air traffic control service, air traffic advisory service or flight information service shall, as far as practicable, prescribe a period of 30 minutes for that purpose.

2.3 RVSM Approval status and aircraft registration

2.3.1 Item 10 of the flight plan (Equipment) shall be annotated with the letter W if the aircraft and operator have received RVSM State approval. Furthermore, the aircraft registration shall be indicated in Item 18 of the flight plan.

2.3.2 Submission of a flight plan

2.3.2.1 Information relative to an intended flight or portion of a flight, to be provided to air traffic services units, shall be in the form of a flight plan.

2.3.2.2 In addition to military operations, operators of customs or police aircraft shall insert the letter M in Item 8 of the ICAO flight plan form.

2.3.4 Use of repetitive flight plans

2.3.4.1 Provision shall be made so that repetitive flight plans be accepted for any flight conducted on 20 January 2005 in the AFI RVSM airspace.

2.3.5 Flight planning for RVSM approved aircraft

2.3.5.1 Operators of RVSM approved aircraft shall indicate the approval status by inserting the letter W in Item 10 of the ICAO flight plan form, regardless of the requested flight level.

2.3.5.2 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 a repetitive flight plan results in a modification of the RVSM approval status as stated in Item Q, a modification message (CHG) shall be submitted by the operator.

2.3.5.3 Operators of RVSM approved aircraft and non-RVSM approved State aircraft intending to operate within the AFI RVSM airspace, as specified in 2.1, shall include the

following in Item 15 of the ICAO flight plan form:

- a) the entry point at the lateral limits of the AFI RVSM airspace and the requested flight level for that portion of the route commencing immediately after the RVSM entry point; and
- b) the exit point at the lateral limits of the AFI RVSM airspace and the requested flight level for that portion of the route commencing immediately after the RVSM exit point.

2.3.5.4 Operators of non-RVSM approved State aircraft with a requested flight level of FL 290 or above shall insert STS/NON RVSM in Item 18 of the ICAO flight plan form.

2.3.6 Flight planning for non-RVSM approved aircraft

2.3.6.1 Except for operations within the AFI RVSM transition airspace, operators of non-RVSM approved aircraft shall flight plan to operate outside the AFI RVSM airspace.

2.3.6.2 Operators of non-RVSM approved aircraft intending to operate from a departure aerodrome outside the lateral limits of the AFI RVSM airspace to a destination aerodrome within the lateral limits of the AFI RVSM airspace shall include the following in Item 15 of the ICAO flight plan form:

- a) the entry point at the lateral limit of the AFI RVSM airspace; and
- b) a requested flight level below FL 290 or above FL410 for that portion of the route commencing immediately after the entry point.

2.3.6.3 Operators of non-RVSM approved aircraft intending to operate from a departure aerodrome to a destination aerodrome which are both within the lateral limits of the AFI RVSM airspace shall include in Item 15 of the ICAO

flight plan form a requested flight level below FL 290 or above FL410.

2.3.6.4 Operators of non-RVSM approved aircraft intending to operate from a departure aerodrome within the lateral limits of the AFI RVSM airspace to a destination aerodrome outside the lateral limits of the AFI RVSM airspace shall include the following in Item 15 of the ICAO flight plan form:

- a) a requested flight level below FL 290 or above FL410 for that portion of the route within the lateral limits of the AFI RVSM airspace; and
- b) the exit point at the lateral limit of the AFI RVSM airspace, and the requested flight level for that portion of the route commencing immediately after the exit point.

2.3.6.5 Operators of non-RVSM approved aircraft intending to operate from a departure aerodrome to a destination aerodrome which are both outside the lateral limits of the AFI RVSM airspace, with a portion of the route within the lateral limits of the AFI RVSM airspace, shall include the following in Item 15 of the ICAO flight plan form:

- a) the entry point at the lateral limit of the AFI RVSM airspace, and a requested flight level below FL 290 or above FL 410 for that portion of the route commencing immediately after the entry point; and
- b) the exit point at the lateral limit of the AFI RVSM airspace, and the requested flight level for that portion of the route commencing immediately after the exit point.

3.0 AIR-GROUND COMMUNICATIONS AND IN-FLIGHT REPORTING

Note.- Annex 2, 3.6.3, 3.6.5.1 and 5.3.3 and PANS-ATM, 4.11, require controlled flights and certain IFR flights outside controlled airspace to maintain a continuous listening watch on the appropriate radio frequency and to report positions in specified circumstances. The following expands such requirements and specifies additional details regarding the transmission and contents of in-flight reports.

3.1 Application

(A2 – 3.6.3, 3.6.5, 5.3.3; P-ATM, 4.11)

3.1.1 All aircraft on VFR flights, and aircraft on IFR flights outside controlled airspace, shall maintain a watch on a radio station furnishing communications for the unit providing flight information service in the flight information region and file with that station information as to their position unless otherwise authorized by the State overflown.

3.2 Time or place of position reports

(A2 – 3.6.3, 3.6.5, 5.3.3; P-ATM, 4.11)

3.2.1 Position reports additional to those required by the general position-reporting procedures shall be made when entering or leaving controlled or advisory airspace.

3.3 Transmission of position reports

(P-ATM, 4.11)

3.3.1 The last position report before passing from one flight information region to an adjacent flight information region shall also be made to the ATS unit serving the airspace about to be entered.

3.4 Air-Ground Communication Failure Procedures

3.4.1 As soon as it is known that two-way communication has failed, ATC shall maintain separation between the aircraft having the communication failure and other aircraft based

on the assumption that the aircraft will operate in accordance with 3.4.2 or 3.4.3.

Visual Meteorological Conditions (VMC)

3.4.2 Except as provided for in 3.4.3, a controlled flight experiencing communication failure in VMC shall:

- a) set transponder to Code 7600;
- b) continue to fly in VMC;
- c) land at the nearest suitable aerodrome;
- d) report its arrival time by the most expeditious means to the appropriate ATS unit.

Instrument Meteorological Conditions (IMC)

3.4.3 A controlled IFR flight experiencing communication failure in IMC, or where it does not appear feasible to continue in accordance with 5.2, shall:

- a) set transponder to Code 7600; and
- b) maintain for a period of 7 minutes the last assigned speed and level or the minimum flight altitude, if the minimum flight altitude is higher than the last assigned level.

FIRs.

The period of 7 minutes commences:

- i) if the aircraft is operating on a route without compulsory reporting points or has been instructed to omit position reports:
 - 1) at the time the last assigned level or minimum flight altitude is reached, or
 - 2) at the time the aircraft sets transponder to Code 7600, whichever is later; or if the aircraft is operating on a route with compulsory reporting points and has not been instructed to omit position reports:
 - i) at the time the last assigned level or minimum flight altitude is reached, or
 - ii) at the previously reported pilot estimate for the compulsory reporting point, or

- iii) at the time the aircraft fails to report its position over a compulsory reporting point, whichever is later;

Note 1:-The period of 7 minutes is to allow the necessary air traffic control and co-ordination measures.

Note 2:- instrument meteorological conditions (IMC), aircraft will maintain the last assigned speed and level or minimum flight altitude for a period of 20 minutes instead of 7 minutes.

- c) thereafter adjust level and speed in accordance with the filed flight plan;

Note: As regards changes to levels and speed, the Filed Flight Plan, which is the flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes will be used.

- d) if being radar vectored or proceeding offset according to RNAV without a specified limit, proceed in the most direct manner possible to rejoin the current flight plan route no later than the next significant point, taking into consideration the applicable minimum flight altitude;

Note: As regards the route to be flown or the time to begin descent to the arrival aerodrome, the Current Flight Plan, which is the flight plan, including changes, if any, brought about by subsequent clearances, will be used.

- e) proceed according to the current flight plan route to the appropriate designated navigation aid serving the destination aerodrome and, when required to ensure compliance with (f) below, hold over this aid until commencement of descent;

- f) commence descent from the navigation aid specified in (e) above at, or as close as possible to, the expected approach time last received and acknowledged; or, if no expected approach time

has been received and acknowledged, at, or as close as possible to, the estimated time of arrival resulting from the current flight plan;

g) complete a normal instrument approach procedure as specified for the designated navigation aid; and

h) land, if possible, within thirty minutes after the estimated time of arrival specified in (f) above or the last acknowledged expected approach time, whichever is later.

4.0 SPECIAL PROCEDURES FOR IN-FLIGHT CONTINGENCIES EUR/SAM CORRIDOR

4.1 Introduction

4.1.1 The following procedures are intended for guidance only and will be applicable within the EUR/SAM corridor. Although all possible contingencies cannot be covered, they provide for cases of:

- a) inability to maintain assigned flight level due to weather, aircraft performance, pressurization failure and problems associated with high-level supersonic flight;
- b) loss of, or significant reduction in, the required navigation capability when operating in parts of the airspace where the navigation performance accuracy is prerequisite to the safe conduct of flight operations; and
- c) en-route diversion across the prevailing EUR/SAM traffic flow.

4.1.2 With regard to 4.1.1 a) and c) above, the procedures are applicable primarily when rapid descent, turnback, or both are required. The pilots's judgement shall determine the sequence of actions to be taken, having regard to the specific

circumstances. Air traffic control (ATC) shall render all possible assistance.

4.2 General procedures

4.2.1 The following general procedures apply to both subsonic and supersonic aircraft. Although all possible contingencies cannot be covered, they provide for cases of inability to maintain assigned level due to weather, aircraft performance, pressurization failure and problems associated with high-level supersonic flight. They are applicable primarily when rapid descent and/or turnback or diversion to an alternate airport are required. The pilot's judgment shall determine the sequence of actions taken, taking into account specific circumstances.

4.2.1.1 If an aircraft is unable to continue flight in accordance with its ATC clearance, and/or an aircraft unable to maintain the navigation performance accuracy specified for the airspace, a revised clearance shall whenever possible, be obtained prior to initiating any action, using the distress or urgency signals as appropriate. Subsequent ATC action with respect to that aircraft shall be based on the intentions of the pilot and the overall traffic situation.

4.2.1.2 If prior clearance cannot be obtained, an ATC clearance shall be obtained at the earliest possible time and, until revised clearance is received, the pilot shall:

- a) if possible, deviate away from an organized track or route system **before commencing emergency descent;**
- b) establish communications with and alert nearby aircraft by broadcasting, at suitable intervals, aircraft identification, flight level, aircraft position (including the ATS route designator or the track code) and intentions, on the frequency in use, **and as well as** on frequency 121.5

MHz (or, as a back-up[, on the inter-pilot air-to-air frequency 123.45 MHz);

- c) watch for conflicting traffic both visually and by reference to ACAS (if equipped);
- d) turn on all aircraft exterior lights (commensurate with appropriate operating limitations);
- e) switch on the SSR transponder at all times; and
- f) initiate such action as necessary to ensure the safety of the aircraft.

4.3 Subsonic aircraft

4.3.1 Initial action

4.3.1.1 If unable to comply with the provisions of 4.2.1.1 to obtain a revised ATC clearance, the aircraft should leave its assigned route or track by turning 90 degrees to the right or left whenever this is possible. The direction of the turn should, where possible, be determined by the position of the aircraft relative to any organized route or track system, eg. whether the aircraft is outside, at the edge of, or within the system. Other factors ~~that may affect the direction of the turn to consider~~ are the direction to an the alternative airport, terrain clearance and the flight levels allocated to adjacent routes or tracks.

4.3.2 Subsequent action (RVSM airspace)

4.3.2.1 In RVSM airspace, an aircraft able to maintain its assigned flight level should turn to acquire and maintain in either direction a track laterally separated by 46 km (25 NM) from its assigned route or track in a multi-track system space at 93 km (50 NM) or otherwise, at a distance which is mid-point from the adjacent parallel route or track and:

- a) if above FL 410, climb or descend 300 m (1 000 ft); or
- b) if below FL 410, climb or descend 150 m (500 ft); or
- c) if at FL 410, climb 300 m (1 000 ft) or descend 150 m (500 ft).

4.3.2.2 An aircraft that is unable to maintain its assigned flight level should:

- a) initially minimize its rate of descent to the extent that it is operationally feasible;
- b) turn while descending to acquire and maintain in either direction a track laterally separated by 46 km (25 NM) from its assigned route or track in a multi-track system spaced at 93 km (50 NM) or otherwise, at a distance which is the mid-point from the adjacent parallel route or track; and
- c) for the subsequent level flight, select a level which differs from those normally used by 300 m (1 000 ft) if above FL 410, or by 150 m (500 ft) if below FL 410.

4.3.3 Subsequent action (non-RVSM airspace)

4.3.3.1 In non-RVSM airspace, an aircraft able to maintain its assigned flight level should turn to acquire and maintain in either direction or track laterally separated by 46 km (25 NM) from its assigned route or track in a multi-track system spaced at 93 km (50 NM) or otherwise, at a distance which is mid-point from the adjacent parallel route or track and:

- a) if above FL 290, climb or descend 300 m (1 000 ft); or
- b) if below FL 290, climb or descend 150 m (500 ft); or

- c) if at FL 290, climb 300 m (1 000 ft) or descend 150 m (500 ft).

4.3.3.2 An aircraft unable to maintain its assigned flight level should:

- a) initially minimize its rate of descent to the extent that it is operationally feasible;
- b) turn while descending to acquire and maintain in either direction a track laterally separated by 46 km (25 NM) from its assigned route or track in a multi-track system spaced at 93 km (50 NM) or otherwise, at a distance which is mid-point from the adjacent parallel route or track; and
- c) for the subsequent level flight, a level should be selected which differs from those normally used by 300 m (1 000 ft) if above FL 290 or by 150 m (500 ft) if below FL 290.

4.3.2 En-route diversion across the prevailing SAT air traffic flow

4.3.2.1 Before diverting across the flow of adjacent traffic, the aircraft should climb above FL 410 or descend below FL 280 using the procedures specified in 4.3.1 or 4.3.2 or 4.3.3. However, if the pilot is unable or unwilling to carry out a major climb or descent, the aircraft should be flown at a level as defined in 4.3.2.1 or 4.3.3.1 until a revised ATC clearance is obtained.

4.3.3 Extended range operations by aeroplanes with two-turbine power-units (ETOPS)

4.3.3.1 If these contingency procedures are employed by a twin-engine aircraft as a result of an engine shutdown or failure of an ETOPS critical system, the pilot should advise ATC as soon as practicable of the situation reminding ATC of the type of aircraft involved, and request expeditious handling.

4.4 Supersonic aircraft

4.4.1 Turnback procedures

4.4.1.1 If a supersonic aircraft is unable to continue flight to its destination and a reversal of track is necessary, it should:

- a) when operating on an outer track of a multi-track system, turn away from the adjacent track;
- b) when operating on a random track or on an inner track of a multi-track system, turn either left or right as follows:
 - 1) if the turn is to be made to the right, the aircraft should attain a position 46 km (25 NM) to the left of the assigned track and then turn to the right into its reciprocal heading, at the greatest practical rate of turn;
 - 2) if the turn is to be made to the left, the aircraft should attain a position 46 km (25 NM) to the right of the assigned track and then turn to the left into its reciprocal heading, at the greatest practical rate of turn;
- c) while executing the turnback, the aircraft should lose height so that it will be at least 1 850 m (6 000 ft) below the level at which turnback was started, by the time the turnback is completed;
- d) when turnback is completed, heading should be adjusted to maintain a lateral displacement of 46 km (25 NM) from the original track in the reverse direction, if possible maintaining the flight level attained on completion of the turn.

Note.- for multi-track systems where the route spacing is greater than 93 km (50 NM), the

mid-point distance should be used instead of 46 km (25 NM).

4.5 Weather deviation procedures

4.5.1 General

4.5.1.1 The following procedures are intended to provide guidance. All possible circumstances cannot be covered. The pilot's judgement shall ultimately determine the sequence of actions to be taken. ATC shall render all possible assistance.

4.5.1.2 If the aircraft is required to deviate from track to avoid weather and prior clearance cannot be obtained, an ATC clearance shall be obtained at the earliest possible time. Until an ATC clearance is received, the aircraft shall follow the procedures detailed in 4.5.4 below.

4.5.1.3 The pilot shall advise ATC when weather deviation is no longer required, or when a weather deviation has been completed and the aircraft has returned to the center line of its cleared route.

4.5.2 Obtaining priority from ATC when weather deviation is required.

4.5.2.1 When the pilot initiates communications with ATC, rapid response may be obtained by stating "WEATHER DEVIATION REQUIRED" to indicate that priority is desired on the frequency and for ATC response.

4.5.2.2 The pilot still retains the option of initiating the communications using the urgency call "PAN PAN" (preferably spoken three times) to alert all listening parties to a special handling condition which will receive ATC priority for issuance of a clearance or assistance.

4.5.3 Actions to be taken when controller-pilot communications are established

4.5.3.1 The pilot notifies ATC and requests clearance to deviate from track, advising when possible, the extent of the deviation expected.

4.5.3.2 ATC takes one of the following actions:

- a) If there is no conflicting traffic in the horizontal plane, ATC will issue clearance to deviate from track; or
- b) If there is conflicting traffic in the horizontal plane, ATC separates aircraft by establishing appropriate separation; or
- c) If there is conflicting traffic in the horizontal plane and ATC is unable to establish appropriate separation, ATC shall:
 - 1) advise the pilot of inability to issue clearance for requested deviation;
 - 2) advise the pilot of confliction traffic; and
 - 3) request the pilot's intentions.

SAMPLE PHRASELOGY

"UNABLE (requested deviation), TRAFFIC IS (call sign, position, altitude, direction), ADVISE INTENTIONS".

4.5.3.3 The pilot will take the following actions:

- a) advise ATC of intentions **by the most expeditious means**; and
- b) comply with the ATC clearance issued; or
- c) execute the procedures detailed in 4.5.4 below. **ATC will issue essential traffic information to all aircraft and;**
- d) if necessary, establish voice communications with ATC to expedite dialogue on the situation.

4.5.4 Actions to be taken if a revised ATC clearance cannot be obtained

4.5.4.1 The provisions of this section apply to situations where a pilot has the need to exercise the authority of a pilot-in-command under the provisions of Annex 2, 2.3.1.

4.5.4.2 If a revised ATC clearance cannot be obtained and deviation from track is required to avoid weather, the pilot shall take the following actions:

- a) if possible, deviate away from the organized track or route system;
- b) establish communications with and alert nearby aircraft broadcasting, at suitable intervals: flight level, aircraft identification, aircraft position (including ATS route designator or the track code) and intentions, on the frequency in use and on frequency 121.5 MHz (or, as a back-up, on the inter-pilot air-to-air frequency 123.45 MHz);
- c) watch for conflicting traffic both visually and by reference to ACAS (if equipped);

Note.- if, as a result of actions taken under the provisions of 4.5.4.2 b) and c) above, the pilot determines that there is another aircraft at or near the same flight level with which a conflict may occur, then the pilot is expected to adjust the path of the aircraft, as necessary to avoid conflict.

- d) turn on all aircraft exterior lights (commensurate with appropriate operating limitations);
- e) for deviations of less than 19 km (10 NM), aircraft should remain at a level assigned by ATC;
- f) for deviation of greater than 19 km (10 NM), when the aircraft is approximately 19 km (10 NM) from

track, initiate a level change based on the following criteria in Table 1;

Table 1

Route center line track	Deviations >19 km (10 NM)	Level change
EAST 000 ⁰ – 179 ⁰ magnetic	LEFT RIGHT	DESCEND 90 m (300 ft) CLIMB 90 m (300 ft)
WEST 180 ⁰ – 359 ⁰ magnetic	LEFT RIGHT	CLIMB 90 m (300 ft) DESCEND 90 m (300 ft)

- g) when returning to track, be at its assigned level, when the aircraft is within approximately 19 km (10 NM) of the center line; and
- h) if contact was not established prior to deviating, continue to attempt to contact ATC to obtain a clearance. If contact was established, continue to keep ATC advised of intentions and obtain essential traffic information.

4.6 Special Procedures for in-flight contingencies involving a loss of vertical navigation performance required for flight within the AFI RVSM airspace

4.6.1 General

4.6.1.1 An in-flight contingency affecting flight in the AFI RVSM airspace pertains to unforeseen circumstances that directly impact on the ability of one or more aircraft to operate in accordance with the vertical navigation performance requirements of the AFI RVSM airspace, as specified in 2. Such in-flight contingencies can result from degradation of aircraft equipment associated with height-keeping, and from turbulent atmospheric conditions.

4.6.1.2 The pilot shall inform air traffic control as soon as possible of any circumstances where the vertical navigation performance requirements for the AFI RVSM airspace cannot be maintained. In such cases, the pilot shall obtain a revised air traffic control clearance prior to initiating any deviation from the cleared route and/or flight level, whenever possible. Where a revised air traffic control clearance could not be obtained prior to such a deviation, the pilot shall obtain a revised clearance as soon as possible thereafter.

4.6.1.3 Air traffic control shall render all possible assistance to a pilot experiencing an in-flight contingency. Subsequent air traffic control actions will be based on the intentions of the pilot, the over-all air traffic situation, and the real-time dynamics of the contingency.

4.6.2 Degradation of aircraft equipment — pilot reported

4.6.2.1 When informed by the pilot of an RVSM approved aircraft operating in the AFI RVSM airspace that the aircraft's equipment no longer meets the RVSM MASPS, as specified in 18, air traffic control shall consider the aircraft as non-RVSM approved.

4.6.2.2 Air traffic control shall take action immediately to provide a minimum vertical separation of 600 m (2 000 ft) or an appropriate horizontal separation from all other aircraft concerned operating in the AFI RVSM airspace. An aircraft rendered non-RVSM approved shall normally be cleared out of the AFI RVSM airspace by air traffic control, when it is possible to do so.

4.6.2.3 Pilots shall inform air traffic control, as soon as practicable, of any restoration of the proper functioning of equipment required to meet the RVSM MASPS.

4.6.2.4 The first ACC/UAC to become aware of a change in an aircraft's RVSM status shall coordinate with adjacent ACCs/UACs, as appropriate.

4.6.3 Severe turbulence — not forecast

4.6.3.1 When an aircraft operating in the AFI RVSM airspace encounters severe turbulence due to weather or wake vortex that the pilot believes will impact the aircraft's capability to maintain its cleared flight level, the pilot shall inform ATC. Air traffic control shall establish either an appropriate horizontal separation or an increased minimum vertical separation.

4.6.3.2 Air traffic control shall, to the extent possible, accommodate pilot requests for flight level and/or route changes, and pass traffic information, as required.

4.6.3.3 Air traffic control shall solicit reports from other aircraft to determine whether RVSM should be suspended entirely or within a specific flight level band and/or area.

4.6.3.4 The ACC/UAC suspending RVSM shall coordinate any such suspension(s), and any required adjustments to sector capacities with adjacent ACCs/UACs, as appropriate, to ensure an orderly progression to the transfer of traffic.

4.6.4 Severe turbulence — forecast

4.6.4.1 Where a meteorological forecast is predicting severe turbulence within the AFI RVSM airspace, air traffic control shall determine whether RVSM should be suspended and, if so, the period of time, and specific flight level(s) and/or area.

4.6.4.2 In cases where RVSM will be suspended, the ACC/UAC suspending RVSM shall coordinate with adjacent ACCs/UACs with regard to the flight levels appropriate for the transfer of traffic, unless a contingency flight level allocation scheme has been determined by letter of agreement. The ACC/UAC suspending RVSM shall also coordinate applicable sector capacities with adjacent ACCs/UACs, as appropriate.

5.0 AIR TRAFFIC CONTROL CLEARANCES

5.1 Adherence to ATC-approved Mach number (A2 – 3.6.2)

5.1.1 Air Traffic Control clearances

5.1.1 Turbojet aircraft operating at or above FL 250 within the Canarias FIR shall adhere to the Mach number approved by ATC and shall request ATC approval before making any change thereto. If it is essential to make an immediate change in the Mach number (eg. due to turbulence), ATC shall be notified as soon as possible that such a change has been made.

5.1.2 If it is not feasible, due to aircraft performance, to maintain the last assigned Mach number during en-route climbs and descents, pilots of aircraft concerned shall advise ATC at the time of the climb/descent request.

5.1.3 ATC clearance into the AFI RVSM airspace

5.1.3.1 Except for operations within the AFI RVSM transition airspace and within specifically designated airspace, only RVSM approved aircraft and non-RVSM approved State aircraft shall be issued an air traffic control clearance into the AFI RVSM airspace.

5.1.3.2 Air traffic control clearance into the AFI RVSM airspace shall not be issued to formation flights of aircraft.

6.0 SEPARATION OF AIRCRAFT

6.1 Lateral separation (A11 – Attachment B; P-ATM, 5.4.1 and 5.11)

6.1.1 Minimum lateral separation shall be 185 km (100 NM) except as provided for in 6.1.2 and 6.1.3 below.

6.1.2 Where aircraft are transiting into an airspace with a larger lateral minimum than the airspace being exited, lateral separation will continue to exist provided that:

- a) the smaller separation minimum exists;
- b) flight paths diverge by 15 degrees or more until the larger minimum is established; and
- c) it is possible to ensure, by means approved by the appropriate ATS authority, that the aircraft have navigation capability necessary to ensure accurate track guidance.

6.1.3 For flights on designated controlled oceanic routes or areas within the Canarias FIR (southern sector), Dakar Oceanic, Recife and Sal Oceanic FIRs, the minimum lateral separation that shall be applied between RNAV-equipped aircraft approved to RNP 10 or better shall be 93 km (50 NM).

6.1.3.1 The letter R shall be annotated in Item 10 (Equipment) of the flight plan to indicate that the aircraft meets the RNP type prescribed.

6.1.3.2 Operators shall establish programmes to mitigate the occurrence of large lateral track errors due to equipment malfunction or operational error, which:

- a) ensure that operating drills include mandatory navigation cross-checking procedures to identify navigation errors in sufficient time to prevent aircraft inadvertently deviating from an ATC-cleared route; and
- b) provide for the continued airworthiness of aircraft navigation systems necessary to navigate to the degree of accuracy required.

Note.- Detailed guidance material on RNP is contained in the Manual on Required Navigation Performance (RNP) (Doc 9613).

6.1.3.3 A target level of safety of 5×10^{-9} fatal accidents per flight hour per dimension shall be established for route systems operating a 93 km (50 NM) lateral separation minimum and the safety level of such airspace shall be determined by an appropriate safety assessment.

Note.- Detailed guidance on conducting safety assessments is contained in the Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689).

6.1.3.4 The following criteria are used in the operational assessment of airspace system safety:

- a) the proportion of the total flight time spent by aircraft 46 km (25 NM) or more off the cleared track shall be less than 7.0×10^{-4} ; and
- b) the proportion of the total flight time spent by aircraft between 74 km and 111 km (40 NM and 60NM) off the cleared track shall be less than 4.1×10^{-5} .

6.1.3.5 Adequate monitoring of flight operations shall be conducted to provide data to assist in the assessment of continuing compliance of aircraft with the lateral navigation performance capabilities of RNP 10 and 6.1.3.3 above. Such data shall include operational errors due to all causes. A safety assessment shall be carried out periodically, based on the data collected, to confirm that the safety level continues to be met.

Note.- Detailed guidance on monitoring is contained in the Air Traffic Services Planning Manual (Doc 9426) and the

Manual of Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689).

6.2 Longitudinal separation (P-ATM, 5.4.2 and 5.11)

6.2.1 Except as provided for in 6.2.2, the minimum longitudinal separation between turbo-jet aircraft shall be:

- a) 20 minutes, except as specified below;
- b) 15 minutes at or above FL 250 within the Canarias, Dakar Oceanic, Recife and Sal Oceanic FIRs, provided that the Mach number technique is applied, and, whether in level, climbing or descending flight, the aircraft have reported over the same entry point to the ATS routes or a common point into the oceanic-controlled airspace and follow the same track or continuously diverging tracks; or
- c) 10 minutes or 150 km (80 NM), derived by RNAV, when the Mach number technique is applied on designated controlled oceanic routes in the EUR/SAM corridor within the Dakar Oceanic, Recife and Sal Oceanic FIRs.

6.2.2 For flight in the EUR/SAM corridor (Canarias (southern sector), Dakar Oceanic, Recife and Sal Oceanic FIRs), the minimum longitudinal separation minima between RNAV-equipped aircraft approved to RNP 10 or better on the same track shall be 93 km (50 NM) provided that:

- a) the letter R shall be annotated in Item 10 (Equipment) of the flight plan to indicate that the aircraft meets the RNP type prescribed; and

- b) a target level of safety of 5×10^{-9} fatal accidents per flight hour per dimension shall be established and the safety level of such airspace shall be determined by an appropriate safety assessment.

6.2.2.1 Adequate monitoring of flight operations shall be conducted to provide data to assist in the assessment of continuing compliance of aircraft with the longitudinal navigation performance capabilities of RNP 10. Such data shall include operational errors due to all causes. A safety assessment shall be carried out periodically, based on the data collected, to confirm that the safety level continues to be met.

Note.- Detailed guidance on monitoring is contained in the Air Traffic Services Planning Manual (Doc 9426) and the Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689).

6.3 Vertical separation Minimum

6.3.1. Between FL 290 and FL 410 inclusive within the AFI RVSM airspace, the vertical separation minimum shall be:

- a) 300 m (1 000 ft) between RVSM approved aircraft;
- b) 600 m (2 000 ft) between:
 - non-RVSM approved State aircraft and any other aircraft operating within the AFI RVSM airspace; and
 - non-RVSM approved State aircraft and any other aircraft operating within the AFI RVSM transition airspace and within specifically designated airspace.

6.3.2 ATC shall provide a minimum vertical separation of 600 m (2 000 ft) between an aircraft experiencing a communications failure in flight and any

other aircraft, where both aircraft are operating within the AFI RVSM airspace.

~~The minimum vertical separation that shall be applied between FL 290 and FL 410 inclusive is 300 m (1 000 ft).~~

6.3.1 Area of applicability

~~The reduced vertical separation minimum (RVSM) shall be applied for flights between FL 290 and FL 410 inclusive, within the Canarias (Southern sector), Dakar Oceanic, Recife (oceanic portion) and Sal Oceanic FIRs.~~

~~————— Note. — Implementation will be carried out in phases and will be promulgated by appropriate AIP Supplements and included in the respective AIPs.~~

~~6.3.2 Establishment of RVSM transition areas (A2 Appendix 3; A6, Parts I and II, 7.2.3; A11 3.3.4; P-ATM, 5.3.2)~~

~~6.3.2.1 In order to allow for the transition of flights to and from EUR/SAM airspace, the ATS authorities responsible for Canarias, Dakar Oceanic, Recife and Sal Oceanic FIRs may establish designated RVSM transition areas. A 300 m (1 000 ft) vertical separation minimum can be applied between RVSM approved aircraft within these transition areas.~~

~~6.3.2.2 An RVSM transition area shall have a vertical extent of FL 290 to FL 410 inclusive, be contained within horizontal dimensions determined by the provider States, be overlapping with or contained within EUR/SAM RVSM airspace and should have direct controller-pilot communications.~~

6.3.3 RVSM approval

~~The minimum separation in 6.3 shall only be applied between aircraft and operators that have been approved by the State of Registry or the State of the Operator, as appropriate, to conduct flights in RVSM airspace and that are capable of meeting the minimum aircraft system~~

~~performance specification (MASPS) height-keeping requirements (or equivalent).~~

~~6.3.4 MASPS~~

~~The MASPS height-keeping requirements are as follows:~~

- ~~a) for all aircraft, the differences between cleared flight level and the pressure altitude actually flown shall be symmetric about a mean of 0 m (0 ft), shall have a standard deviation no greater than 13 m (43 ft) and shall be such that the error frequency decreases with increasing magnitude at a rate which is at least exponential;~~
- ~~b) for groups of aircraft that are nominally of identical design and built with respect to all details that could influence the accuracy of height-keeping performance in the RVSM flight envelope (FL 290 to FL 410 inclusive):~~
 - ~~4) the mean altimetry system error (ASE) of the group shall not exceed 25 m (80 ft) in magnitude; and~~
 - ~~5) the sum of the absolute value of the mean ASE and of three standard deviations of ASE shall not exceed 75 m (245 ft);~~
- ~~e) for non-group aircraft for which the characteristics of the airframe and altimetry system fit are unique and so cannot be classified as belonging to a group of aircraft: the ASE shall not exceed 61 m (200 ft) in magnitude in the RVSM flight envelope (FL 290 to FL 410 inclusive); and~~
- ~~f) the following criteria shall be used in the operational assessment of airspace system safety: the total vertical error (TVE), which is the difference between the geometric height of the aircraft and the geometric height of the flight level~~

~~to which it is assigned, is required to be such that:~~

- ~~1) the probability that TVE equal to or greater than 91 m (300 ft) in magnitude is equal to or less than 2.0×10^{-3} ;~~
- ~~2) the probability that TVE equal to or greater than 152 m (500 ft) in magnitude is equal to or less than 5.0×10^{-6} ;~~
- ~~3) the probability that TVE equal to or greater than 200 m (650 ft) in magnitude is equal to or less than 1.4×10^{-6} ;~~
- ~~4) the probability that TVE between 290 m and 320 m (950 ft and 1 050 ft), inclusive, in magnitude is equal to or less than 1.7×10^{-7} ; and~~
- ~~5) The proportion of time that aircraft spend at incorrect flight levels, 300 m (1 000 ft), or multiplies thereof, away from assigned flight levels is equal to or less than 7.1×10^{-7} .~~

~~*Note. Guidance material regarding the initial achievement and contained maintenance of the height-keeping performance in 6.3.4 is contained in the Guidance Material on the Implementation of a 300 m (1 000 ft) Vertical Separation Minimum (VSM) for Application in the EUR/SAM corridor.*~~

~~6.3.5 Target level of safety (TLS)~~

~~Application of RVSM in the airspace designated in 6.3.1 shall meet a TLS of 5×10^{-9} fatal accidents per aircraft flight hour due~~

~~to all causes of risk in the vertical dimension.~~

~~6.3.6 Approval status and aircraft registration~~

~~Item 10 of the flight plan (Equipment) shall be annotated with the letter W if the aircraft and operator have received RVSM State approval. Furthermore, the aircraft registration shall be indicated on Item 18 of the flight plan.~~

~~6.3.7 Operation of aircraft not approved for RVSM~~

~~6.3.7.1 Except for areas where transition areas have been established, aircraft not meeting the requirements of 6.3.4 shall not be allowed to operate in EUR/SAM RVSM airspace.~~

~~6.3.7.2 Exceptionally, aircraft that have not received RVSM State approval may be cleared to operate in airspace where RVSM may be applied in accordance with policy and procedures established by the State provided that 5=600 m (2 000 ft) vertical separation is applied.~~

~~Note. Transitions to and from EUR/SAM RVSM airspace will normally take place in the first FIR in EUR/SAM RVSM airspace.~~

~~6.3.8 Monitoring~~

~~Adequate monitoring of flight operations in the EUR/SAM RVSM airspace shall be conducted to assist in the assessment of continuing compliance of aircraft with the height-keeping capabilities in 6.3.4. Monitoring shall include assessment of other sources of risk to ensure that the TLS specified in 6.3.5 is not exceeded.~~

~~Note. Details of the policy and procedures for monitoring established by the South Atlantic Monitoring Agency (SATMA) are contained in the Guidance Material on the Implementation of a 300 m (1 000 ft) Vertical Separation Minimum~~

~~(VSM) for Application in the EUR/SAM Corridor.~~

~~6.3.9 Wake turbulence procedures~~

~~6.3.9.1 The following special procedures are applicable to mitigate wake turbulence encounters in the airspace where RVSM is applied.~~

~~6.3.9.2 An aircraft that encounters wake turbulence should notify ATC and request a revised clearance. However, in situations where a revised clearance is not possible or practicable:~~

~~a) the pilot should establish contact with other aircraft, if possible, on the air-to-air frequency 123.45 MHz; and~~

~~b) one (or both) aircraft may initiate lateral offset(s) not to exceed 3.7 km (2 NM) from the assigned route(s) or track(s), provided that:~~

~~1) as soon as it is practicable to do so, the offsetting aircraft notify ATC that temporary lateral offset action has been taken and specify the reason for doing so; and~~

~~2) the offsetting aircraft notify ATC when re-established on assigned routes(s) or track(s).~~

~~Note. In the contingency circumstances above, ATC will not issue clearances for lateral offsets and will not normally respond to action taken by pilots.~~

6.4 Information on application of separation minima

(A11 – 3.4; P-ATM, 5.4.1, 5.4.2 and 5.11)

6.4.1 Where, circumstances permitting, separation minima lower than those specified in 6.1 and 6.2 will be applied in accordance with

~~the PANS-ATM, appropriate information should be published in Aeronautical Information Publications so that users of the airspace are fully aware of the portions of airspace where the reduced separation minima will be applied and of the navigation aids on the use of which those minima are based.~~

**7.0 ALTIMETER SETTING
PROCEDURES APPLICABLE TO
AIR TRAFFIC SERVICES AND
MINIMUM LEVELS
(P-ATM, 4.10 AND 4.10.3)**

7.1 The lowest usable flight level for holding and approach manoeuvres shall be calculated from actual QNH, unless the pressure variation is so small that reference to climatological data is acceptable.

Note 1.- The lowest usable flight will provide a terrain clearance of at least 300 m (1 000 ft) and, for operation in the vicinity of an aerodrome will not be established below 450 m (1 500 ft) above aerodrome elevation.

Note 2.- MET Offices will inform ATS units when, in abnormal conditions, pressure goes below the minimum climatological value, in order that appropriate steps can be taken to cancel temporarily the use of the lowest flight level or levels that would not ensure the minimum terrain clearance.

7.2 Based on current and anticipated atmospheric pressure distribution, area control centers shall coordinate, where required, the lowest flight level to be used.

7.3 In determining the transition level, the table at Appendix A should be used when necessary. This table shows the transition level directly as a function of the transition altitude of the aerodrome and of the current QNH altimeter setting value.

8.0 FLIGHT INFORMATION SERVICE

8.1 Information on runway conditions
(A11 – 4.2.1; P-ATM, 6.6)

8.1.1 Unless otherwise provided, area control centers shall have available for transmission to aircraft on request immediately prior to descent, information on the prevailing runway conditions at the aerodrome of intended landing.

8.2 Transmission of SIGMET information
(P-ATM, 9.1.3.2)

8.2.1 Transmission of SIGMET information to aircraft shall be at the initiative of the appropriate ATS unit, by the preferred method of directed transmission followed by acknowledgement, or by a general call when the number of aircraft would render the preferred method impracticable.

8.2.2 SIGMET information passed to aircraft shall cover a portion of the route up to two hours' flying time ahead of the aircraft.

8.3 Transmission of amended aerodrome forecast
(P-ATM, 9.1.3.5)

8.3.1 Amended aerodrome forecasts shall be passed to aircraft within 60 minutes from the aerodrome of destination, unless the information would have been made available through other means.

8.4 Transmission of trend forecasts
(A11 – 4.2.2)

8.4.1 The latest trend forecasts available to the ATS unit, provided it is no more than one hour old, shall always be transmitted to an aircraft together with the latest report of routine or special observation, when the aircraft requests the latter information.

**9.0 AIR TRAFFIC SERVICES
COORDINATION**

9.1 Coordination between units providing area control service
(P-ATM, 10.3)

9.1.1 If a flight should enter an adjacent area information concerning any review of estimate of three minutes or more shall be forwarded to the adjacent area control center.

10.0 AIR TRAFFIC SERVICES MESSAGES

10.1 ~~Flight plan and departure~~ ~~messages~~

~~—— (P-ATM, 11.3.3 and 11.4.2.2)~~

~~10.1.1 Filed flight plan messages for flights intending to operate within the NAT Region at a distance of 60 NM or less from the northern and southern boundaries of Gander Oceanic and Shanwick Oceanic flight information regions shall be addressed to the area control centers in charge of the NAT flight information regions along the route and, in addition, to the area control centers in charge of the nearest adjacent NAT flight information regions.~~

~~10.1.2 For flights departing from points within the adjacent regions and entering the NAT Region without intermediate stops, filed flight plan message shall be transmitted to the appropriate area control centers immediately after the flight plan has been submitted.~~

10.1 Computer-assisted coordination process

10.1.1 Procedures

10.1.1.1 *Operational procedure*

10.1.1.1.1 The following basic rules shall apply for the use of EST and ACT messages:

- a) These messages shall be automatically generated, exchanged and processed to obviate human intervention to the extent practicable.
- b) A single message shall be sent in respect of each flight due to be transferred and any subsequent revision shall be the subject of verbal coordination.

c) The message shall provide the most recent information available on all transfer conditions at the time of transmission.

d) Acceptance by the receiving unit of the transfer conditions implied in the message shall be assumed, unless the receiving unit initiates verbal coordination to amend the transfer conditions.

Note.— Bilateral arrangement may be required to cover the event of failure of the ATS direct speech circuit.

e) There shall be bilateral agreement as to the boundary point and transmission times for each route. The normal transmission time shall be 15 minutes before the flight concerned is expected to cross the boundary.

f) In the event of data not being correlated by the receiving computer with an appropriate entry in its flight plan database, the computer shall originate a warning to the appropriate air traffic control sector to take necessary action for the acquisition of missing flight plan details. This shall normally involve a telephone inquiry.

g) In the event of incomprehensible or illogical data being detected within the message, the computer shall initiate an appropriate warning to the air traffic control sector involved, if this can be determined, for further action.

Note.— Any system-initiated warning shall require reversion to verbal coordination.

h) If the receiving unit has not received a flight plan, the sending air traffic control unit shall verbally inform the receiving unit of whether or not the aircraft is RVSM approved.

- i) When an automated message does not contain the information filed in Item 18 of the ICAO flight plan form relevant to RVSM operations, the sending air traffic control unit shall inform the receiving unit of that information by supplementing the ACT message verbally, using the term “NEGATIVE RVSM” or “NEGATIVE RVSM STATE AIRCRAFT”, as applicable.
- j) When a verbal coordination process is being used, the sending air traffic control unit shall include the information filed in Item 18 of the ICAO flight plan form relevant to RVSM operations at the end of the verbal estimate message, using the term “NEGATIVE RVSM” or “NEGATIVE RVSM STATE AIRCRAFT”, as applicable.
- k) When a single aircraft is experiencing an in-flight contingency which impacts on RVSM operations, the associated coordination message(s) shall be supplemented verbally by a description of the cause of the contingency.

11.0 ALERTING AND SEARCH AND RESCUE SERVICES

11.1 Routes and equipment of private aircraft (P-ATM, 11.3.3 and 11.4.2.2)

11.1.1 General aviation aircraft operating over designated areas, land or sea, where search and rescue operations would be difficult, should:

- a) carry appropriate survival equipment:
- b) follow the route or specified procedures if not equipped with two-way radio, except that under special circumstances, the appropriate authority may grant

specific exemptions from this requirement.

11.2 Alerting services (P-ATM, 9.2)

11.2.1 The procedures for “Alerting Service” detailed in the PANS-ATM, 9.2, are applicable to all flights except those conducted wholly in the vicinity of an aerodrome when exempted by the appropriate air traffic control unit.

12.0 IDENTIFICATION OF ATS ROUTES (A11, Appendix 1 – 2.4)

12.1 Composition of designators

12.1.1 The letter D to indicate that on a route or portion thereof advisory service only is provided and the letter F to indicate that on a route or portion thereof flight information service only is provided shall be added after the basic designators of the ATS route in question.

13.0 USE OF SECONDARY SURVEILLANCE RADAR (SSR) (P-ATM, Chapter 8)

13.1 Secondary surveillance radar information may be used alone for the provision of horizontal separation between properly equipped aircraft in the circumstances and under the conditions specified below:

- a) Within the coverage area of the associated primary radar, in order to overcome known deficiencies of that radar, eg. the fact that primary radar echoes of certain aircraft are not, or not continuously, presented on the radar display due to the reflecting characteristics of such aircraft, clutter, etc. In this case, SSR responses may be used for the separation of transponder-equipped aircraft and, additionally, for the separation of transponder-equipped aircraft from other known aircraft not using SSR but displayed clearly on the primary radar display,

provided that the SSR responses from any aircraft (not necessarily the one being provided separation) coincide with the primary radar echo of the same aircraft.

Note.-Where SSR accuracy cannot be verified by means of monitor equipment or by visual correlation of the SSR response with the primary radar echo from a given aircraft, SSR responses alone may be used only to provide identification.

- b) Outside the coverage area of the associated primary radar, or in certain areas (which shall be defined horizontally as well as vertically) and under circumstances specified by the appropriate authority in consultation with the operators, provided:

- 1) reliable SSR coverage exists within the area;
- 2) the area is designated as controlled airspace;
- 3) the control of the air traffic in the area is vested in one ATC unit unless adequate means of coordination exists between all ATC units concerned;
- 4) actual operating experience has shown that loss of SSR responses is not occurring at a rate affecting the safety of operations and adequate measures for earliest possible detection of such losses have been developed;
- 5) density and/or complexity of air traffic in the area and provision of navigational guidance allow a safe reversion to other forms of

separation in case of SSR failure;

- 6) the aircraft concerned have previously been identified and identification has been maintained;
- 7) procedural separation is applied between aircraft with functioning transponders and other aircraft; and
- 8) when primary radar fails and until procedural separation is established:
 - i) the positional accuracy of the SSR responses has been verified (see 13.1 a) and Note): and
 - ii) the pilots of the aircraft concerned have been advised.
- c) In the case of aircraft emergency.

~~13.2 Carriage and operation of pressure-altitude reporting SSR transponders~~

~~13.2.1 With effect from 1 January 2000, all aircraft operating as IFR flights in the AFI Region shall be equipped with a pressure-altitude reporting SSR transponder.~~

~~13.2.2 Unless otherwise directed by air traffic control, the last assigned identity (Mode A) code shall be retained. If no identity code has been assigned, Mode A code 2000 shall be selected and retained.~~

**14.0 USE OF AIRBORNE COLLISION
— AVOIDANCE SYSTEMS (ACAS)**

— (A2 3.2; A6, Part I 6.18; A10
— Vol. IV; A11 2.4.2; P OPS, Vol. I,
— Part VIII; P ATM, Chapter 4)

**14.1 — Carriage and operation of
ACAS II**

14.1.1 ACAS II shall be carried and operated in the AFI Region by all aircraft that meet the following criteria:

- a) With effect from 1 January 2000 all civil fixed-wing turbine-engined aircraft having a maximum take-off mass exceeding 15 000 kg or maximum approved passenger seating configuration of more than 30.
- b) With effect from 1 January 2005, all civil fixed-wing turbine-engined aircraft having a maximum take-off mass exceeding 5 700 kg or a maximum approved passenger seating configuration of more than 19.

14.2 — Responsibility for separation of aircraft during manoeuvres in compliance with a resolution advisory (RA)

14.2.1 The use of ACAS II does not alter the respective responsibilities of pilots and controllers for the safe operation of aircraft.

14.2.2 On being notified that an aircraft, under air traffic control, is manoeuvring in accordance with a resolution advisory (RA), a controller should not issue instructions to that aircraft which are contrary to the RA as communicated by the pilot. Once an aircraft departs from the current ATC clearance compliance with an RA, the controllers cease to be responsible for providing separation between that aircraft and other aircrafts affected as a direct consequence of the manoeuvre induced by the RA. However, when circumstances permit, the controller should endeavour to provide traffic information to aircraft affected by the manoeuvre. The controller's responsibility for providing

separation for all the affected aircraft resumes when:

- a) the controller acknowledges a report from the pilot that the aircraft has resumed the current clearance; or
- b) the controller acknowledges a report from the pilot that the aircraft is resuming the current clearance and issues an alternative clearance which is acknowledged by the flight crew.

14.3 — ACAS

14.3.1 ACAS can have a significant effect on air traffic control. Therefore there is a continuing need to monitor the performance of ACAS in the developing air traffic management environment.

14.3.2 Following an RA event, or other significant ACAS event, pilots and controllers should complete an ACAS RA report; aircraft operators and ATS authorities should forward the completed reports through established channels.

**15. Special procedures applicable to
designated airspace****15.1 Provisions for the transition of
aircraft to/from the AFI RVSM
airspace****15.1.1 Area of applicability**

15.1.1.1 Transition tasks associated with the application of a 300 m (1 000 ft) vertical separation minimum within the AFI RVSM airspace, shall be carried out in all or parts of the following FIRs/UIRs:

Abijan, Addis Ababa, Algiers, Asmara, Cairo, Canarias, Casablanca, Dakar, Johannesburg, Khartoum, Luanda, Mauritius, Mogadishu, Roberts, Sal, Seychelles, Tripoli, Tunis.

Note.— The volume of airspace referred to in 15.1.1.1 will be referred to as the “AFI RVSM transition airspace”.

15.1.1.2 RVSM approved aircraft and non-RVSM approved State aircraft entering the AFI RVSM airspace from a non-RVSM environment

15.1.1.3 RVSM approved aircraft and non-RVSM approved State aircraft entering the AFI RVSM airspace from a non-RVSM environment shall be established at a flight level in accordance with:

- a) the Tables of Cruising Levels, as published in ICAO Annex 2, Appendix 3, a); and/or
- b) a flight level allocation scheme, if applicable; and/or
- c) as specified in an inter area control centre (ACC) letter of agreement.

15.1.1.4 Any changes from non-RVSM levels to RVSM flight levels shall be initiated by the first ACC/upper area control centre (UAC) providing air traffic control service to the aircraft within the AFI VSM airspace, and shall be achieved before the aircraft passes the transfer of control point to the adjacent CC/UAC, unless otherwise specified in an inter ACC letter of agreement.

15.1.2. Aircraft entering a non-RVSM environment from the AFI RVSM airspace

15.1.2.1 Aircraft entering a non-RVSM environment from the AFI RVSM airspace shall be established with the applicable vertical separation minimum.

15.1.2.1.1 The applicable vertical separation minimum shall be established by the last ACC/UAC providing air traffic control service to the aircraft within the AFI RVSM airspace, and before the aircraft passes the transfer of control point to the adjacent ACC/UAC.

15.1.2.1.2 Such aircraft shall be established at a flight level in accordance with:

- a) the Tables of Cruising Levels, as published in ICAO Annex 2, Appendix 3, b); and/or
- b) a flight level allocation scheme, if applicable; and/or
- c) as specified in an inter ACC letter of agreement.

15.1.3 Non-RVSM approved civil operations

15.1.3.1 Non-RVSM approved State aircraft operating from a departure aerodrome outside the lateral limits of the AFI RVSM airspace with a destination aerodrome within the lateral limits of the AFI RVSM airspace:

- a) shall be cleared to a flight level below FL 290; and
- b) any such flight level changes shall be initiated by the first ACC/UAC providing air traffic control service to the aircraft within the AFI RVSM airspace, and shall be achieved before the aircraft passes the transfer of control point to the adjacent ACC/UAC.

15.1.3.2 Non-RVSM approved aircraft operating from a departure aerodrome to a destination aerodrome which are both within the lateral limits of the AFI RVSM airspace shall be cleared to a flight level below FL 290.

15.3.3.3 Non-RVSM approved aircraft operating from a departure aerodrome within the lateral limits of the AFI RVSM airspace to a destination aerodrome outside the lateral limits of the AFI RVSM airspace:

- a) shall be cleared to a flight level below FL 290; and
- b) may be cleared to FL 290 or above by the last ACC/UAC providing air traffic control service to the aircraft within the AFI RVSM airspace, and any such flight

level changes shall be achieved before the aircraft passes the transfer of control point to the adjacent ACC/UAC.

5.1.3.4 Non-RVSM approved aircraft operating from a departure aerodrome to a destination aerodrome which are both outside the lateral limits of the AFI RVSM airspace, with a portion of the route within the lateral limits of the AFI RVSM airspace:

- a) shall be cleared to a flight level below FL 290 or above FL 410 by the first ACC/UAC providing air traffic control service to the aircraft within the AFI RVSM airspace, and any such flight level changes shall be achieved before the aircraft passes the transfer of control point to the adjacent ACC/UAC, in accordance with the flight level allocation system (FLAS), if applicable, and/or as specified in an inter ACC letter of agreement; and
- b) may subsequently be cleared to a requested flight level within, or through, the AFI RVSM airspace by the last ACC/UAC providing air traffic control service to the aircraft within the AFI RVSM airspace, and any such flight level changes shall be achieved before the aircraft passes the transfer of control point to the adjacent ACC/UAC.

16. Air Traffic Services messages

16. Phraseology related to RVSM Operations in the AFI RVSM AIRSPACE

16.1 Controller/pilot RTF phraseology

Phrase Meaning	Phrase Meaning
(<i>call sign</i>) CONFIRM RVSM APPROVED	For a controller to ascertain the RVSM approval status of an aircraft.

NEGATIVE RVSM*	For a pilot to report non-RVSM approval status: a) on the initial call on any frequency within the AFI RVSM airspace (controllers shall provide read back with this same phrase); and b) in all requests for flight level changes pertaining to flight levels within the AFI RVSM airspace; and
	c) in all read backs to flight level clearances pertaining to flight levels within the AFI RVSM airspace. Additionally, except for State aircraft, pilots shall include this RTF phrase to read back flight level clearances involving the vertical transit through FL 290 or FL 410.
AFFIRM RVSM*	For a pilot to report RVSM approval status.
NEGATIVE RVSM STATE AIRCRAFT*	For a pilot of a non-RVSM approved State aircraft to report non-RVSM approval status, in response to the RTF phrase (<i>call sign</i>) CONFIRM RVSM APPROVED.
UNABLE RVSM DUE TURBULENCE*	Denial of air traffic control clearance into the AFI RVSM airspace.
UNABLE RVSM DUE EQUIPMENT*	For a pilot to report that the aircraft's equipment has degraded below the MASPS required for flight within the AFI RVSM airspace. This phrase is to be used to convey both the initial indication of the non-

	MASPS compliance, and henceforth, on initial contact on all frequencies within the lateral limits of the AFI RVSM airspace until such time as the problem ceases to exist, or the aircraft has exited RVSM airspace.
READY TO RESUME RVSM*	For a pilot to report the ability to resume operation within the AFI RVSM airspace after an equipment or weather-related contingency.

Phrase Meaning	Phrase Meaning
REPORT ABLE TO RESUME RVSM	For a controller to confirm that an aircraft has regained its RVSM approval status, or to confirm that the pilot is ready to resume RVSM operations.

*Note.-*indicates a pilot transmission*

16.2 Phraseology between ATS units

NEGATIVE RVSM or NEGATIVE RVSM STATE AIRCRAFT [<i>as applicable</i>]	To verbally supplement an automated estimate message exchange that does not automatically transfer Item 18 information. Also used to verbally supplement estimate messages of non-RVSM approved aircraft.
UNABLE RVSM DUE TURBULENCE [or EQUIPMENT, <i>as applicable</i>]	To communicate the cause of a contingency relating to an aircraft that is unable to conduct RVSM operations due to severe turbulence or other severe weather-related phenomenon [or equipment failure, <i>as applicable</i>]. End of new text.

17. RVSM Approval

17.1 Except for State aircraft, operators intending to conduct flights within the volume of airspace specified in 15.1.2 where RVSM is applied shall require an RVSM approval either from the State in which the operator is based or from the State in which the aircraft is registered. To obtain RVSM approval, operators shall satisfy the said State that:

- a) aircraft for which the RVSM approval is sought have the vertical navigation performance capability required for RVSM operations through compliance with criteria of the RVSM minimum aircraft systems performance specifications (MASPS);
- b) they have instituted procedures in respect of continued airworthiness (maintenance and repair) practices and programmes; and they have instituted flight crew procedures for operations in AFI RVSM airspace specified in 15.1.2

Note 1.— An RVSM approval is not restricted to a specific region. Instead, it is valid globally on the understanding that any operating procedures specific to a given region, in this case the AFI Region, should be stated in the operations manual or appropriate crew guidance.

Note 2.— Aircraft that have received State approval for RVSM operations will be referred to as “RVSM approved aircraft”.

Note 3.— Aircraft that have not received State approval for RVSM operations will be referred to as “non-RVSM approved aircraft”.

18. Minimum Aircraft Systems Performance (MASPS)

18.1 The characteristics of total vertical error (TVE) distribution form the basis of the MASPS which were developed to support the introduction of RVSM operations in accordance with agreed global safety standards. The MASPS were designed to ensure that:

- a) in respect of groups of aircraft that with respect to all details that could influence the accuracy of height-keeping performance, height-keeping capability shall be such that TVE for the group of aircraft shall have a mean no greater than 25 m (80ft) in magnitude and shall have standard deviation no greater than $92 - 0.004z$ for $0 < z < 0$ where z is the magnitude of the mean TVE in feet or $28 - 0.013z$ for $0 < z < 25$ when z is in metres. In addition, the components of TVE must have the following characteristics:

- 1) the mean altimetry system error (ASE) of the group shall not exceed 25 m (80ft) in magnitude;
- 2) the sum of the absolute value of the mean ASE and of three standard deviations of ASE shall not exceed 75 m (245 ft); and
- 3) the differences between cleared flight levels and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with standard deviation no greater than 13.3 m (43.7 ft), and in addition, the decrease in frequency of differences with increasing difference magnitude shall be at least exponential.

- b) in respect of a non-group aircraft for which the characteristics of the airframe and altimetry system fit are unique and so

cannot be classified as belonging to a group of aircraft, height-keeping performance capability shall be such that the components of the TVE of the aircraft have the following characteristics:

- 1) the ASE of non-group aircraft shall not exceed 60 m (200 ft) in magnitude under all flight conditions; and
- 2) the differences between the cleared flight level and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft), and in addition, the decrease in frequency of differences with increasing difference magnitude shall be at least exponential.

18.2 Guidance material of use to those involved in the initial achievement and continued maintenance of the height-keeping performance capability has been issued by ICAO under the title Manual on the Implementation of a 300 m (1,000 ft) Vertical Separation Minimum (VSM) between FL290 and FL410 Inclusive. Detailed technical guidance material on the airworthiness, continued airworthiness, and the operational practices and procedures for AFI airspace is provided in the Joint Aviation Authorities Administrative and Guidance Material, Section one: General, part 3: Leaflet No. 6

19. RVSM Monitoring

19.1 Adequate monitoring of flight operations in the AFI RVSM airspace shall be conducted to assist in the assessment of continuing compliance of aircraft with the height-keeping capabilities in 18. Monitoring shall include assessment of other sources of risk to ensure that the TLS specified in 20 is not exceeded.

Note.—Details of the policy and procedures for monitoring established by the AFI Monitoring Agency (South Africa) are contained in the Guidance Material on the Implementation of a 300 m (1000 ft) Vertical Separation Minimum (VSM) for Application in the AFI Region are contained in ICAO Doc 9574 and other appropriate documentations on the subject.

Note.—In the contingency circumstances above, ATC will not issue clearances for lateral offsets and will not normally respond to action taken by pilots.

20. Target level of safety (TLS)

20.1 Application of RVSM in the airspace designated in 6.3.1.1 shall meet a TLS of 5×10^{-9} fatal accidents per aircraft flight hour due to all causes of risk in the vertical dimension.

21. ~~Wake turbulence procedures~~

21.1 ~~The following special procedures are applicable to mitigate wake turbulence encounters in the airspace where RVSM is applied.~~

21.2 ~~An aircraft that encounters wake turbulence should notify air traffic control (ATC) and request a revised clearance. However, in situations where a revised clearance is not possible or practicable:~~

a) ~~the pilot should establish contact with other aircraft, if possible, on the appropriate VHF inter-pilot air-to-air frequency; and~~

b) ~~one (or both) aircraft may initiate lateral offset(s) not to exceed 2 NM from the assigned route(s) or track(s), provided that:~~

~~as soon as it is practicable to do so, the offsetting aircraft notify ATC that temporary lateral offset action has been taken and specify the reason for doing so; and the offsetting aircraft notify ATC when re-established on assigned route(s) or track(s).~~

c) Proposer's reason for amendment:

Implementation of Reduced Vertical Separation Minimum (RVSM) in the AFI Region. The reduction in vertical separation will improve the provision of air traffic services in the areas concerned and is in line with the implementation strategy adopted in the AFI CNS/ATM implementation plan. This will improve ATC efficiency and airspace capacity.

d) Proposed implementation date of the amendment:

Upon approval by Council.

e) Proposal has been circulated to the following States and International Organizations:

Afghanistan	Cape Verde	Ethiopia	Japan
Algeria	Central African Republic	Finland	Jordan
Angola	Chad	France	Kenya
Argentina	Chile	Gabon	Kuwait
Armenia	China	Gambia	Lebanon
Australia	Colombia	Germany	Lesotho
Austria	Congo	Ghana	Libyan Arab Jamahiriya
Bahrain	Comoros	Greece	Liberia
Bangladesh	Cote d'Ivoire	Guinea	Luxembourg
Belarus	Croatia	Guinea Bissau	Madagascar
Belgium	Cuba	Hungary	Malawi
Benin	Cyprus	Iceland	Malaysia
Bosnia and Herzegovina	Czech Republic	India	Maldives
Botswana	Democratic Republic of Congo	Indonesia	Mali
Brazil	Democratic Peoples' Republic of Korea	Iran, Islamic Republic of	Malta
Bulgaria	Denmark	Iraq	Mauritania
Burkina Faso	Djibouti	Ireland	Mauritius
Burundi	Egypt	Israel	Mexico
Cameroon	Equatorial Guinea	Italy	Morocco
Canada	Eritrea	Jamaica	Mozambique

Namibia	Sweden
Netherlands	Switzerland
New Zealand	Syrian Arab Republic
Niger	Thailand
Nigeria	The former Yugoslav Republic of Macedonia
Norway	Togo
Oman	Tunisia
Pakistan	Turkey
Philippines	Uganda
Poland	United Arab Emirates
Portugal	United Kingdom
Qatar	United Republic of Tanzania
Republic of Korea	United States
Romania	Uruguay
Rwanda	Viet Nam
Russian Federation	Yemen
Sao Tome and Principe	Zambia
Saudi Arabia	Zimbabwe
Senegal	ASECNA
Seychelles	IATA
Sierra Leone	IFALPA
Singapore	
Slovakia	
Slovenia	
Somalia	
South Africa	
Spain	
Sri Lanka	
Sudan	
Swaziland	

f) Secretariat comments

- a) This amendment proposal has been developed within the framework of the APIRG/12, 13 and 14 Meetings Conclusions/Decisions 12/66, 13/58 and 14/21 respectively concerning the planning and evolutionary implementation of RVSM in the AFI Region.
 - b) Implementation of RVSM in the AFI Region would enable aircraft operating in the AFI RVSM airspace to continue under RVSM in EUR/NAT, MID/ASIA, CAR/SAM and ASIA/PAC RVSM airspaces, thereby enhancing the efficiency of seamless flight operations.
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**ACTION PLAN FOR IMPLEMENTATION OF REDUCED
VERTICAL SEPARATION MINIMA IN THE AFRICA-
INDIAN OCEAN REGION**

23 April 2004

**Prepared by the AFI RVSM Program Office [ARPO]
Revision 23/04/04**

AFI STRATEGY/ACTION PLAN FOR RVSM IMPLEMENTATION

EXECUTIVE SUMMARY

1. INTRODUCTION

It will be recalled that the Air Navigation Commission in approving APIRG Conclusion 13/85 relating to initial implementation of RVSM in the AFI Region, recommended that the Commission, prior to determination of a Target implementation date, make an Implementation Strategy available for approval. APIRG 14 mandated the AFI RVSM Task Force to develop a strategy for the implementation of RVSM in the AFI Region.

2. OBJECTIVES

To implement RVSM in the AFI Region the following objectives must be achieved:

- Develop an AFI RVSM Implementation Plan;
- Develop an AFI RVSM Implementation Program

3. RVSM IMPLEMENTATION PLAN

An AFI RVSM Implementation Plan shall be developed to set out the scope of the work needed to safely implement RVSM at the earliest realistic date, in an efficient manner and taking into account RVSM plans in adjacent Regions. Work completed by the AFI RVSM Task Force (ARTF) will be incorporated in the AFI Plan (See Attachment A)

4. RVSM PROGRAM MANAGEMENT

Successful and timely implementation of RVSM will be dependent on the establishment of a Program Office to manage the RVSM Program and appointment of dedicated staff with the required expertise. The Program Office will act as the AFI RVSM Implementation focal point, report to the ARTF and provide guidance to National Program Managers, who will in-turn report to the Program Office. (*See Attachment B*).

5 RVSM Program Management Plan

The AFI RVSM Task Force (ARTF) should direct the development of an RVSM Program Plan to implement the RVSM Plan. This should be accomplished in consultation with National Program Managers and other RVSM stakeholders. The Program Office shall develop a detailed Program Management Plan, which will provide a baseline and communication tool against which to monitor the cost, schedule and performance aspects of the RVSM Program. (See *Attachment B*).

5.1 National RVSM Program Manager (NPM)

States shall appoint National RVSM Program Manager. These managers will be responsible for the day-to-day management of the National RVSM Program, coordinate RVSM activities at national level and provide required inputs to the Program Office.

5.2 RVSM Program Structure

The RVSM Program will include many stakeholder activities up to and including the implementation of RVSM, as well as activities following implementation. Identified activities should be developed into a Work Schedule. The Work Schedule can be summarized into five sub-programs (See Attachment B).

5.2.1 Sub-Program 1 - RVSM Program Management.

The main deliverable is the RVSM Plan and full Stakeholder commitment to the implementation of RVSM at the agreed date. It includes program management activities throughout the required period, in particular progress monitoring and progress/status reports to States and the ARTF.

5.2.2 Sub-Program 2 - Aircraft Operations and Airworthiness

To ensure timely RVSM approvals for Aircraft Operations and Airworthiness by States, technical, operational and regulatory directives shall be available for airspace users. It will also assist and monitor the approval process. Aircraft height-keeping accuracy must be verified through the operation of a

height-monitoring infrastructure system. The monitoring program will provide the technical data to confirm that safety objectives are met.

5.2.3 Sub-Program 3 – Air Traffic Management (ATM)

This sub-program will ensure that all ATS provider units are well prepared and ready for the introduction of RVSM on the agreed date. Tasks should be identified to allow States to make airspace restructuring, introduce RVSM Procedures. Modify ATC systems, provide ATC Training and resolve legislative issues, etc.

5.2.4 Sub-Program 4 - RVSM Safety Assurance

RVSM safety assurance constitutes the safety assessments necessary prior to implementation, just after implementation and at the end of the RVSM Program to ensure that the agreed safety objectives are met. This includes amongst others the development of an agreed RVSM safety policy, and identifies the possible need for States to prepare RVSM safety cases.

5.2.5 Sub-Program 5 - Regional Monitoring Agency (RMA)

It is recognized that there is a requirement for monitoring of aircraft height keeping performance as part of RVSM implementation program. An AFI Regional Monitoring Agency needs to be established by the AFI RVSM Task Force to provide Safety Oversight Services in connection with implementation and continued safe use of RVSM within the designated airspace.

6 RVSM Program Schedule

A schedule for all the activities must be developed in conjunction with the various stakeholders and, in particular, the RVSM National Program Managers (NPM). The schedule will serve as the benchmark against which the program progress will be assessed. (*See Attachment C*)

7. AFI RVSM COST

It is the responsibility of stakeholders to identify and gain approval for their own budget and resource requirements.

8. CONCLUSION

Implementation planning should be progressed as a priority item. A program for implementation in the earliest possible time frame should be actively pursued, with implementation planning being carried out by the ARTF under the direction of APIRG. The RVSM Program should be fully coordinated by the Program Office for the entire area of future application, and should take full account of the work carried out by the ARTF.

Attachment A:

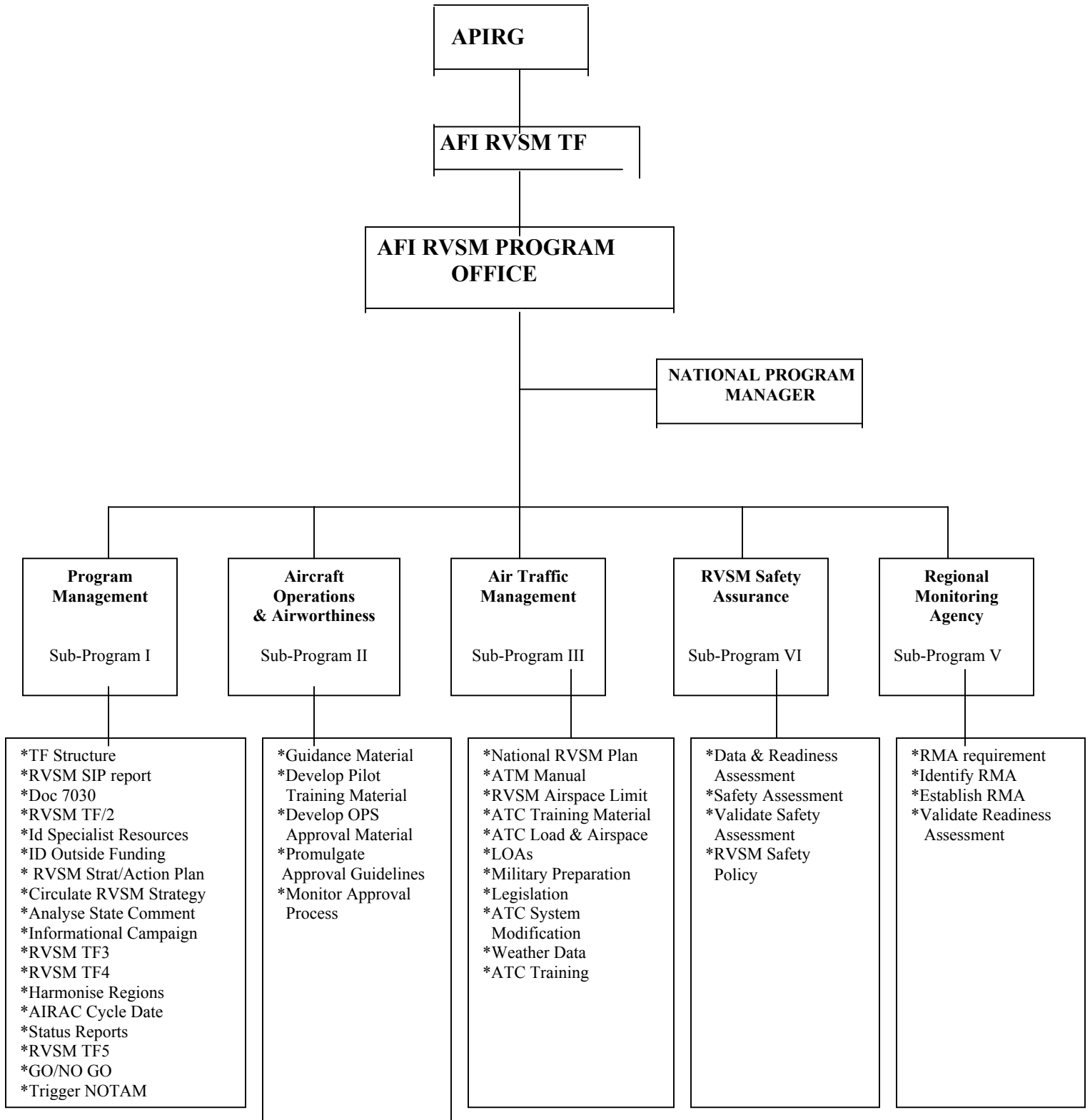
AFI RVSM IMPLEMENTATION ACTION PLAN				
ID	Description	Target Date	Status	Resources
	Program Management			
1	Agree on structure of TF to enable efficient handling of specialist technical tasks	21 November 2003	Completed	Secretariat Support Team: ASECNA South Africa, IATA, Nigeria, Tunisia
2	Consideration of the RVSM SIP Report	21 November 2003	Completed	RVSM/ITF2
3	RVSM/RNAV/RNP TF/2 Meeting	21 November 2003	Completed	RVSM/ITF2
4	Identify resources for performing specialist technical tasks	21 November 2003	Completed	RVSM/ITF2
5	Investigate methods of funding any outside assistance required	Ongoing	In progress.	ICAO/IATA
6	Finalize the RVSM Implementation Strategy/ Action Plan	31 December 2003	Completed	ICAO
7	Circulate RVSM Implementation Strategy/Action Plan for comments from States	5 January 2004	Completed 15 Dec '03	ICAO
8	Develop Doc 7030 amendment	31 March 2004	In Progress	ICAO
9	Obtain and analyze the comments from States on RVSM implementation Strategy/Action Plan	31 March 2004	In progress	States, ICAO RVSM/ITF3
10	Develop a regional RVSM informational Website	31 March 2004	In Progress	IACO/IATA/States
11	RVSM Seminar/Workshops/RVSM ITF3	19-22 April 2004	In Progress	ICAO
12	RVSM/ITF/4	June 2004	In progress	ICAO/RVSM ITF/4
13	Undertake coordination and harmonization of procedures with adjacent Regions	Ongoing	In progress	ICAO and AFI RMA
14	States to send AIC re RVSM Implementation intention	April 2004	In Progress	ICAO/States
15	Confirm target AIRAC implementation date (AIP Supplement to be published)	30 September 2004	In progress	Informal coordination Meeting/RVSM ITF/5
16	Prepare/maintain regional status report detailing RVSM implementation plans and circulate to States	Ongoing	In progress	ICAO
17	RVSM/ITF/5	Sept/October 2004	In progress	ICAO/RVSM ITF/5
18	Go/No-Go decision	30 September 2004	In Progress	Informal meeting of all Stakeholders/ ICAO/TF5
19	Publish Trigger NOTAM	25 November 2004	In progress	States

AFI RVSM IMPLEMENTATION ACTION PLAN				
ID	Description	Target Date	Status	Resources
	Aircraft Operations and Airworthiness			
20	Develop regional OPS & Airworthiness RVSM Guidance Material	21 November 2003	Completed	ICAO
21	Develop regional Pilot Training RVSM Guidance Material	31 March 2004	In Progress	States/ICAO/IATA
22	Develop AFI RVSM OPS Approval Process	30 July 2004	In progress	RMA/ ICAO/States
23	Promulgate on the guideline operational approval process	31 March 2004	In progress	States, ICAO
24	Monitor operator approval process	30 July 2004	In progress	RMA
	Air Traffic Management			
25	Develop National RVSM plan	31 March 2004	In progress	States, ICAO
26	Develop Regional ATC OPS Manual	31 March 2004	In progress	ICAO
27	Determine the limits of RVSM airspace	30 June 2004	In progress	States/ICAO
28	Develop Regional ATC Training Guidance Material	31 March 2004	In Progress	South Africa/ASECNA/ Nigeria
29	Evaluate the need for simulations to assess ATC workload and possible need for airspace/air route Sector changes	30 June 2004		Senegal/ASECNA/Nigeria South Africa
30	Identify issues to be addressed in Letters of Agreement	31 March 2004	In progress	Tunisia
31	Military aviation preparation	30 June 2004	In progress	States, ICAO
32	Develop National RVSM Legislation	30 June 2004	In progress	States, ICAO
33	States assess the impact of RVSM implementation on controller automation systems and plan for upgrades/ modifications	30 April 2004	In progress	States
34	Collect weather and turbulence data for analysis	31 June 2004	In progress	AFI RMA ICAO/States
35	States to conduct local RVSM training for air traffic controllers.	31 June 2004	In progress	States
	RVSM Safety Assurance			
36	Conduct preliminary data collection and readiness assessment	30 June 2004	In progress	RMA - ICAO
37	Complete RVSM Safety assessment	30 June 2004	In progress	AFI RMA/ICAO

AFI RVSM IMPLEMENTATION ACTION PLAN				
ID	Description	Target Date	Status	Resources
38	Validate safety assessment	30 June 2004	In progress	RVSM ITF/4
39	Develop AFI RVSM Safety Policy	30 June 2004	In progress	RVSM/ITF4
40	Evaluate options for setting up AFI RMA	21 November 2003	Completed	RVSM/ITF2
	Monitoring Agency			
41	Identify an AFI RMA	21 November 2003	Completed	RVSM/ITF/2
42	Establish an AFI RMA.	31 March 2004	In progress	South Africa/ICAO
43	Validate implementation readiness assessment	31 July 2004	In progress	ICAO, RMA

ATTACHMENT B

AFI RVSM PROGRAM



AFI RVSM IMPLEMENTATION SCHEDULE

DELIVERABLE						2004							2005	
	JAN	F	M	A	M	J	J	A	S	O	N	D	JAN	F
PROGRAM MANAGEMENT														
RVSM Program Office	C													
RVSM Implementation Program	C													
AFI RVSM Master Plan	C													
RVSM Web-Site	C													
RVSM Promotion	O													
Doc 7030														
State RVSM Implementation Intention AIC														
GO/NO-Go Decision														
Publish Trigger NOTAM														
AIRCRAFT OPS & AIRWORTHINESS														
Aircraft System Development														
Pilot Training Guidance Material														
RVSM Approval Achievement														
System Architecture														
System Development														
System Operation														
AIR TRAFFIC MANAGEMENT														
RVSM Airspace Structure														
ATC Procedures														
ATS Provider														
ATC Training														
Flight Planning														
ATFM														
ATS Systems														

AFI RVSM IMPLEMENTATION SCHEDULE

DELIVERABLE						2004							2005	
	JAN	F	M	A	M	J	J	A	S	O	N	D	JAN	F
Military Aviation														
Legislation														
OPS Data Collection														
Post Implementation														
RSMOPS Performance Review														
SAFETY ASSURANCE														
AFI Safety Policy														
Pre-Implementation Safety Assessment														
Post-Implementation Safety Assessment														
HEIGHT MONITORING														
Regional Monitoring Agency (RMA)														
RVSM Aircraft Database														
Height Deviation														
Readiness Assessment														

C = Completed

O = Ongoing

**Minimum information for each monitored aircraft
to be maintained in electronic form by an RMA**

**AIRCRAFT HEIGHT-KEEPING PERFORMANCE MONITORING DATA RECORD
FORMAT**

FIELD	FIELD IDENTIFIER	FIELD DATA TYPE	WIDTH	RANGE
1	Validity Indicator	Alphabetic	1	“C”: Compliant “A”: Aberrant “N”: Non-Compliant
2	Date of Measurement (dd/mm/yyyy)	Date	8	e.g. 01/01/1996
3	Time of Measurement (hh:mm:ss)	Time	8	e.g. 12:00:00
4	Measuring Instrument	Alphanumeric	4	e.g. “HYQX” “G123”
5	Aircraft Mode “A” Identity (octal)	Alphanumeric	4	
6	Aircraft Mode “S” Address (hexadecimal)	Alphanumeric	6	
7	Aircraft Registration Number	Alphanumeric	10	
8	Flight Call Sign	Alphanumeric	7	
9	Operator	Alphabetic	3	
10	Aircraft Type	Alphanumeric	4	
11	Aircraft Mark/Series	Alphanumeric	6	
12	Flight Origin	Alphabetic	4	
13	Flight Destination	Alphabetic	4	
14	Mean Mode “C” Altitude During Measurement ¹	Numeric	5	0-99999 This field may be Null for GMS
15	Assigned Altitude at Time of Measurement ¹	Numeric	5	0-99999
16	Mean Estimated Geometric Height of Aircraft	Numeric	5	0-99999
17	SD of Estimated Geometric Height of Aircraft	Numeric	5	0-99999
18	Mean Geometric Height of Assigned Altitude	Numeric	5	0-99999
19	Estimated TVE	Numeric	4	0-9999
20	Minimum Estimated TVE*	Numeric	4	0-9999
21	Maximum Estimated TVE*	Numeric	4	0-9999
22	SD of Estimated TVE*	Numeric	4	0-9999
23	Estimated AAD	Numeric	4	0-9999
24	Minimum Estimated AAD*	Numeric	4	0-9999
25	Maximum Estimated AAD*	Numeric	4	0-9999
26	SD of Estimated AAD*	Numeric	4	0-9999
27	Estimated ASE	Numeric	4	0-9999
28	Minimum Estimated ASE*	Numeric	4	0-9999
29	Maximum Estimated ASE*	Numeric	4	0-9999
30	SD of Estimated ASE*	Numeric	4	0-9999
31	Indicator for Reliability of Geometric Height Measurement	Numeric	3	HMU: 0.0-1.0 GMU: 0.0-9.9
32	Indicator of Reliability of Met Data	Numeric	1	0.1
33	Aircraft Serial/Construction Number	Alphanumeric	12	e.g. 550-0848

- only when more than one data point is available

Reference Documents on RVSM

Documents	Explanation	Language	Web site / URL
Reference Documents			
Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL N°6).	TGL N°6 Revision 1- Guidance material on the approval of aircraft and operators flight in airspace above flight level 290 where a 300m (1,000ft) vertical separation minimum is applied.	English	http://www.eur-rvsm.com/documents/TGL6rev1.pdf
<p>FAA documents RVSM Approval Checklist - US Operators (01 May 02)</p> <p>RVSM Approval Checklist - Non-US Operators (01 May 02)</p> <p>Example Operator RVSM Application (17 Feb 99)</p> <p>Interim Guidance Material on the Approval of Operators/Aircraft for RVSM Operations 91-RVSM with Change 1 (30 June 99)(Complete RVSM Guidance Material with updated changes).</p>	RVSM Aircraft and Operator Approval Documentation- documents and guidance related to RVSM aircraft and operator approval.	English	http://www.faa.gov/ats/ato/150_docs/91RVSM_CH1.doc

Documents	Explanation	Language	Web site / URL
ICAO Doc 7030/4 Regional Supplementary Procedures amendment for EUR RVSM (requirements and procedures).	This Doc 7030/4 amendment was approved by the ICAO Council on 23 November 2000.	English	http://www.eur-rvsm.com/documents/ApprovedE99-33Doc7030amendment.pdf
Master Plan-European Reduced Vertical Separation Minimum Programme	This EUR RVSM Master Plan has been endorsed in 1999 by all Programme participants. It describes the general programme history, organization, key dates and associated responsibilities.	English	http://www.eur-rvsm.com/documents/A041.pdf
ATC Manual for a Reduced Vertical Separation Minimum (RVSM) in Europe-Version 2.0.	Whilst the English version is the only official version, two language versions are also provided.	English French	http://www.eur-rvsm.com/documents/ATCManualV2_0.pdf
Safety			
EUR-RVSM Pre-Implementation Safety Case Edition 2.0 of 14 August 2001.	This document constitutes the EUROCONTROL Pre-Implementation Safety Case (PISC) for the RVSM Programme.	English	http://www.eur-rvsm.com/documents/safety/EURRVSMPISCV2014AUG2001.pdf
Functional Hazard Assessment Results of 12 February 2001.	This document contains the results of the Functional Hazard Assessment (FHA) for the EUR RVSM Programme conducted during the last quarter of 2000.	English	http://www.eur-rvsm.com/documents/safety/RVSMFHAV1012FEB2001.pdf
National Safety Plan	Guidance material to develop national safety plans.	English	http://www.eur-rvsm.com/documents/safety/GuidancetoStatesJune01.pdf

Documents	Explanation	Language	Web site / URL
EUR RVSM Safety Policy Document	The Reduced Vertical Separation Minimum (RVSM) operational concept, sets out the Safety Policy European RVSM programme, lists the safety objectives and provides a high-level description of the deliverables of the RVSM Safety Sub-Programme.	English	http://www.eur-rvsm.com/documents/safety/A573SafetyPolicyDocV1_0.pdf
Wake Vortices			
The Effect of RVSM on Wake	EUROCONTROL has sponsored a Vortex Turbulence study into the effects RVSM would have on the occurrence of turbulence due to wake vortex encounters. From that page, the full report including programme response is also available for download, as well as the Wake Turbulence Report Form.	English	http://www.eur-rvsm.com/documents/WakeVortexAugust2001.pdf
RVSM Approval Requirements – Training			
Flight Crew Training and Associated RVSM Operational considerations	This brief provides guidance for RVSM operational considerations.	English	http://www.eur-rvsm.com/documents/RVSMFlightCrewtraining&operational considerations.pdf

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