

International Civil Aviation Organization



SAMPLE AIR TRAFFIC CONTROL OPERATIONS MANUAL FOR IMPLEMENTATION OF REDUCED VERTICAL SEPARATION MINIMUM IN THE AFI REGION

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Abstract
This manual represents an operational reference document intended for the use of ATS personnel involved in the planning, implementation and application of a Reduced Vertical Separation Minimum (RVSM) in Africa - Indian Ocean

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LIST OF ABBREVIATIONS

ACAS	Airborne Collision Avoidance System
ATC	Air Traffic Control
ACC	Area Control Centre
ACT	Activation Message
AIC	Aeronautical Information Circular
AFI	Africa and Indian Ocean
AIP	Aeronautical Information Publication
APIRG	AFI Planning and Implementation Regional Group
ASE	Altimetry System Error
ATM	Air Traffic Management
ATS	Air Traffic Services
CDB	Central Data Base
CFL	Cleared Flight Level
CFMU	Central Flow Management Unit
CHG	Modification Message (IFPS)
CMA	Central Monitoring Agency (NAT)
CVSM	Conventional Vertical Separation Minimum
FAA	Federal Aviation Administration (USA)
FDPS	Flight Data Processing System
FIR	Flight Information Region
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FPL	Flight Plan
GA	General Air Traffic
GMU	GPS Height Monitoring Unit
GPS	Global Positioning System
HMU	Height Monitoring Unit
IFPS	Integrated Initial Flight Plan
IFR	Instrument Flight Rules
JAA	Joint Aviation Authorities
JAA AMC	JAA Acceptable Means of Compliance
JAR	Joint Aviation Requirements
LoA	Letter of Agreement
MASPS	Minimum Aircraft System Performance Specifications
MEL	Minimum Equipment List
MNPS	Minimum Navigation Performance Specifications
MTCDD	Medium Term Conflict Detection
NAT	North Atlantic

NAT CMA	North Atlantic Region Central Monitoring Agency
NATSPG	North Atlantic Systems Planning Group
NOTAM	Notice to Airmen
OAT	Operational Air Traffic
OLDI	On-Line Data Interchange
RA	Resolution Advisory (ACAS)
RFL	Requested Flight Level
RGCSF	Review of the General Concept of Separation Panel
RNAV	Area Navigation
RNP	Required Navigation Performance
RPL	Repetitive Flight Plan
RTF	Radiotelephony
RVSM	Reduced Vertical Separation Minimum of 1 000 ft between FL 290 and FL 410 Inclusive
SARPs	Standards and Recommended Practices
SDB	State Data Base
SSEC	Static Source Error Correction
SSR	Secondary Surveillance Radar
STCA	Short Term Conflict Alert
TA	Traffic Advisory (ACAS)
TGL	Temporary Guidance Leaflet (TGL-JAA)
TLS	Target Level of Safety (TLS)
TSE	Total System Error
TVE	Total Vertical Error
VFR	Visual Flight Rules
VSM	Vertical Separation Minimum
UAC	Upper Area Control Centre
UIR	Upper Flight Information Region

DEFINITIONS

Flight Level Allocation Scheme (FLAS)

The scheme whereby specific flight levels may be assigned to specific route segments within the network.

General Air Traffic (GAT)

Flight conducted in accordance with the rules and provisions of ICAO.

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 based or of the State in which the aircraft is registered. To obtain such RVSM approval, Operators shall satisfy the said State:

- 1) that aircraft for which the RVSM Approval is sought have the vertical navigation performance capability required for RVSM operations through compliance with the criteria of the RVSM Minimum Aircraft Systems Performance Specification (MASPS).
- 2) That they have instituted procedures in respect of continued airworthiness (maintenance and repair) practices and programmes.
- 3) That they have instituted flight crew procedures for operations in the AFI RVSM airspace.

Note: For the purposes of the application of RVSM, the term: “RVSM APPROVED” shall be used to indicate that an aircraft has been granted RVSM Approval.

RVSM Entry Point

The first reporting point over which an aircraft passes or is expected to pass immediately before, upon, or immediately after initial entry into AFI RVSM airspace, normally the first reference point for applying a reduced vertical separation minimum.

RVSM Exit Point

The last reporting point over which an aircraft passes or is expected to pass immediately before, upon, or immediately after leaving AFI RVSM airspace, normally the last reference point for applying a reduced vertical separation minimum.

State Aircraft

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

Ref: ICAO Convention on International Civil Aviation, Article 3 b

Strategic Flight Level

A flight level which is flight-plannable in accordance with the Table of Cruising Levels of ICAO Annex 2, Appendix 3 and the FLAS, as specified in the relevant Aeronautical Information Publications (AIPs).

Tactical Flight Level

A flight level which is not flight-plannable and which is reserved for tactical use by ATC.

RVSM REFERENCE DOCUMENTS

- ICAO Annexes; 2,3.2;A6,Part 1,6.18; A10 Vol. IV; A11, 2.4.2; P-OPS,Vol.1 Part VIII; P-ATM, CAP 4.
- EUROCONTROL - RVSM
- NAT RVSM
- FAA RVSM manuals

SAMPLE AIR TRAFFIC CONTROL OPERATIONS MANUAL FOR IMPLEMENTATION OF REDUCED VERTICAL SEPARATION MINIMUM

1 INTRODUCTION

In the late 1970s, the International Civil Aviation Organization (ICAO) initiated a comprehensive program of studies to examine the feasibility of reducing the 2000 ft vertical separation minimum (VSM) applied above flight level (FL) 290 to the 1000 ft VSM as used below FL 290. Throughout the 1980s, various studies were conducted under the auspices of ICAO in Canada, Europe, Japan and the United States.

The studies demonstrated that the global reduction of vertical separation was safe, feasible and without the imposition of unduly demanding technical requirements and would be cost-beneficial. The studies also showed that the North Atlantic (NAT) minimum navigation performance specification (MNPS) airspace was an ideal area for the introduction of a reduced vertical separation minimum (RVSM) because of the types of aircraft and the essentially unidirectional tidal flow of traffic. Planning for RVSM in the NAT Region commenced in 1990. The first stage of the Operational Evaluation phase, using the 1000 ft RVSM (between FL 330 and FL 370 inclusive), began in March 1997. A second stage extended RVSM to between FL 310 and FL 390 inclusive in October 1998.

NAT Region implementation involves the application of RVSM in the transition area of States within the European Region. In an early stage of the studies, it was determined that the introduction of RVSM in upper European airspace would have considerable benefits. However, from the outset, it was clear that the complex nature of the European air traffic services (ATS) route structure, its wide variety of aircraft types and high traffic density, as well as the high percentage of aircraft climbing and descending, would be a more demanding environment than the NAT Region. Therefore, the introduction of RVSM in the European environment addressed all aspects of en-route operations such as the safety implications of European traffic complexity, the mix of aircraft types, the many stakeholders involved (39 RVSM participating States, industry, aircraft operators), etc.

2 AFI RVSM IMPLEMENTATION BACKGROUND

ESTABLISHMENT OF APIRG RVSM/RNAV/RNP TASK FORCE

Pursuant to APIRG/13 Decision 13/58 which *inter alia* stated that:

DECISION 13/58 ESTABLISHMENT OF A TASK FORCE ON RVSM AND RNAV/RNP IMPLEMENTATION

THAT AN APIRG TASK FORCE DEDICATED TO RVSM AND RNAV/RNP IMPLEMENTATION BE ESTABLISHED, WITH THE FOLLOWING TERMS OF REFERENCE, WORK PROGRAMME AND COMPOSITION:

2.1 Terms of Reference of the ICAO RVSM/RNAV/RNP Implementation Task Force

The RVSM/RNAV/RNP Task Force was established within the framework of the ATS/AIS/SAR Sub-Group in order to explore ways and means for the implementation of RVSM/RNAV/RNP in the AFI Region.

2.2 Terms of Reference of RVSM and RNAV/RNP Task Force

- a) To develop a comprehensive implementation plan for RVSM, RNAV and RNP in the AFI Region, taking into account the requirements contained in the ICAO Doc.9574, Doc.9613, Doc.9689, Doc.4444 and other relevant reference documents.
- b) To identify any areas within the AFI Region where it may be feasible to introduce RVSM and RNAV/RNP in the initial implementation.
- c) To determine the extent to which a cost/benefit analysis is required prior to implementation of RVSM and RNAV/RNP.
- d) To coordinate with the bodies responsible for the implementation of RVSM and RNAV/RNP in adjacent regions in order to harmonize implementation plans.
- e) To develop guidance material for RVSM and RNAV/RNP implementation in the AFI Region, including taking due account of experience gained in the SAT Region and existing material developed by other ICAO Regions (CAR/SAM, EUR, MID, NAT, ASIA/PAC, etc.).
- f) To address any other matters, as appropriate, which are relevant to the implementation of RVSM and RNAV/RNP.

APIRG has endorsed the objectives of capacity and potential economy benefits associated with future implementation of a 1 000 ft reduced vertical separation minimum in the AFI Region and, therefore, concluded that such implementation planning should be progressed as a priority item. It is recognized that a number of complex issues need to be addressed, including meteorological and topographical considerations, aircraft equipment and air traffic control questions.

3 THE NEED FOR RVSM

It is accepted that major changes to the AFI ATM systems will be necessary in order to cope with the continued traffic growth. The implementation of RVSM is considered to be the most cost effective means of meeting this need through the provision of **six (6)** additional flight levels for use in the AFI airspace from **FL 290 to FL 410** inclusive.

3.1 The AFI RVSM Implementation Programme

The programme consists of a series of co-ordinated activities, performed within the AFI Region ICAO, Participating States and User Organisations.

The programme has followed the general strategy set out in the ICAO Doc.9574 (First Edition) – “ Manual on Implementation of a 300 m (1000 ft) Vertical Separation Minimum between **FL 290 and FL 410** inclusive” which proposed a multi-step approach within four distinct phases :

- | | |
|---------|--------------------------------------|
| Phase 1 | Initial Planning |
| Phase 2 | Advanced Planning and Preparation |
| Phase 3 | Verification of Aircraft Performance |
| Phase 4 | Introduction of RVSM. |

3.2 Supporting Documentation

The following reference documents shall be used the introduction of RVSM in the AFI airspace :

- ICAO Doc. 7030 – Africa-Indian Ocean (AFI) Regional Supplementary procedures (As amended to incorporate RVSM- June 2006)
- ICAO Doc. 9574 – Manual on Implementation of a 300 m (1000 ft) Vertical Separation Minimum between FL 290 and FL 410 inclusive.

- JAA Temporary Guidance Leaflet on Approval of Aircraft and Operators for Flight in RVSM Airspace – TGL No.6.
- National AICs and/or. AIP SUPPs.

4 AFI RVSM AIRSPACE DESCRIPTION

4.1 AFI RVSM Airspace

4.1.1 RVSM shall be applicable in that volume of airspace between FL 290 and FL 410 inclusive in the following AFI Flight Information Regions (FIRs)/Upper Information Regions (UIRs):Accra, Addis Ababa, Algiers, Antananarivo, Asmara, Beira, Brazzaville, Cairo, Canarias, Cape Town, Casablanca, Dakar, Dakar Oceanic, Dar-es-Salaam, Entebbe, Gaborone, Harare, Johannesburg, Johannesburg Oceanic, Kano, Khartoum, Kinshasa, Lilongwe, Luanda, Lusaka, Mauritius, Mogadishu, Nairobi, N'Djamena, Niamey, Roberts, Sal Oceanic, Seychelles, Tripoli, Tunis, Windhoek.

4.1.2 There is NO transition airspace in entire AFI RVSM airspace.

4.2 AFI RVSM Transition Airspace

Transition tasks associated with the application of a 1 000 ft vertical separation minimum within the AFI RVSM Airspace shall be carried out in all, the adjacent FIRs/UIRs to the AFI RVSM airspace.

ATC units on the interface of AFI RVSM Airspace shall:

- establish RVSM approved & non-RVSM approved State aircraft entering RVSM Airspace at the appropriate RVSM FL
- apply 1,000 ft VSM between RVSM approved aircraft, otherwise apply 2,000 ft RVSM;
- establish non-RVSM approved civil aircraft below FL 290 if landing at an aerodrome below the RVSM Airspace;
- establish non-RVSM approved civil aircraft above FL 410 if transiting above the RVSM Airspace & landing at an aerodrome outside AFI RVSM Airspace;
- for aircraft leaving AFI RVSM Airspace, apply 2,000ft VSM and establish them at the appropriate non-RVSM levels.

4.3 AFI Interface with Adjacent Regions (ATSP_1-7)

ACCs/UACs providing air traffic control service within the airspace designated for the purpose of transitioning non-RVSM approved civil aircraft operating to/from the adjacent Regions (ie. Europe) may clear such non-RVSM approved civil aircraft to climb/descend through RVSM Airspace. Such climbs/descents through RVSM Airspace shall be achieved before the aircraft passes the transfer of control point to the adjacent ACC/UAC, if applicable, unless otherwise specified in the ATS Letter of Agreement.

4.4 ICAO Table of Cruising Levels for AFI RVSM Airspace(ATSP_1-2)

With the implementation of AFI RVSM, cruising levels within AFI Airspace will be organized in accordance with the Table of Cruising Levels contained in ICAO Annex 2, Appendix 3, a). The cruising levels appropriate to direction of flight within the AFI Region with the implementation of RVSM. As illustrated below:

Cruising levels as per direction of flight – FL280 to FL430	
Route from 180 degrees to 359 degrees*	Route from 000 degrees to 179 degrees *
← FL 430 (non RVSM level above RVSM airspace)	
	FL410 →
← FL400	FL390 →
← FL380	FL370 →
← FL360	FL350 →
← FL340	FL330 →
← FL320	FL310 →
← FL300	FL290 →
← FL280 (non RVSM level below RVSM airspace)	

4.5 Flight Operations Within the AFI RVSM Airspace (ATSP_1-2)

Except for State aircraft as defined in Article 2 to the Chicago Convention (Doc 7333) ONLY RVSM approved aircraft shall be permitted to operate within the AFI RVSM airspace. It should be noted that within the AFI RVSM Airspace all cruising levels are equally assignable by ATC to all RVSM approved and State aircraft, provided that the applicable vertical separation minimum is applied.

ATC shall:

- Only clear IFR RVSM approved aircraft & State aircraft into AFI RVSM Airspace;
- provide a 1,000 ft vertical separation minimum (VSM) between RVSM approved aircraft;
- provide 2,000 ft VSM between all military formation flights and any other aircraft.

5. RVSM PROCEDURES

Detailed RVSM procedures are contained the Regional Supplementary Procedures DOC 7030/4 AFI Region

5.1 General (ATSP_1-1)

- Only approved State aircraft shall be entitled to operate within the AFI RVSM Airspace, regardless of the RVSM status of the aircraft. (ATSP_1-1)
- The Integrated Initial Flight Plan Processing System (IFPS) shall disseminate Item 8 flight plan information to the flight data processing systems (FDPS) concerned for the purpose of providing a clear indication to ATC that where such non-RVSM approved flights are “State aircraft”, they are permitted to operate
- All operators filing Repetitive Flight Plans (RPLs) shall include in Item Q of the RPL all equipment and capability information in conformity with Item 10 of the ICAO Flight Plan.
- 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.

-
- Operators of RVSM approved aircraft shall indicate the approval status by inserting the letter “**W**” in Item 10 of the ICAO Flight Plan, and in Item Q of the Repetitive Flight Plan (RPL), regardless of the requested flight level.
 - Operators of non-RVSM approved State aircraft with a requested flight level of FL 290 or above shall insert “**STS/NONRVSM**” in Item 18 of the ICAO Flight Plan.
 - Operators of RVSM approved aircraft and non-RVSM approved State aircraft intending to operate within the AFI RVSM Airspace shall include the following in Item 15 of the ICAO Flight Plan:
 - (i) 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
 - (ii) 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.
 - Operators of non-RVSM approved civil aircraft shall flight plan to operate outside of the AFI RVSM Airspace.

5.2 State Aircraft operating Within AFI RVSM Airspace (ATSP_1-1)

All State aircraft operating in AFI RVSM Airspace will be considered as non-RVSM MASPS compliant and therefore non- RVSM approved. Therefore, the VSM required between State and other traffic shall be 2,000 ft. State aircraft, i.e. military aircraft, might be exempted from AFI RVSM requirements and where applicable, the indication that a non-RVSM approved aircraft is a State aircraft should be displayed. The requirement for ATC to accommodate non-RVSM approved State aircraft within the AFI RVSM Airspace imposes significant increases in controller workload result from the requirement of having to selectively apply two distinct vertical separation minima (VSM) within the same volume of airspace.

5.3 Cruising Levels Appropriate to Direction of Flight (ATSP_1-2)

The cruising levels appropriate to direction of flight for RVSM and non-RVSM environments are contained in ICAO Annex 2, Appendix 3.

5.4 In-Flight Contingency Procedures (ATSP_2-1)

An in-flight contingency affecting flight in the AFI RVSM Airspace pertains to unforeseen circumstances, which 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.

- The pilot shall inform ATC as soon as possible of any circumstances where the vertical navigation performance requirements for the AFI RVSM Airspace cannot be maintained.
- In above mentioned case, 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 ATC clearance could not be obtained prior to such a deviation, the pilot shall obtain a revised clearance as soon as possible thereafter.
- Air traffic control actions will be based on the intentions of the pilot, the overall air traffic situation, and the real-time dynamics.
- Suspension of RVSM refers to a discontinuance of the use of a vertical separation minimum of 1 000 ft between RVSM approved aircraft operating within the AFI RVSM Airspace.
- A vertical separation minimum of 2 000 ft shall be applied between all aircraft operating within the portion of the AFI RVSM Airspace where RVSM has been suspended, regardless of the RVSM approval status of the aircraft.

5.4.1 Degradation of Aircraft Equipment (ATSP_2-2); (ATSP_2-3); (ATSP_2-4)

- The failure in flight of any component of the Minimum Equipment List (MEL) required for RVSM operations shall render the aircraft non-RVSM approved.
- Where an aircraft's Mode C displayed level differs from the cleared flight level by 300 ft (the allowable tolerance for Mode C readout) or more, the controller shall inform the pilot accordingly and the pilot shall be requested to check the pressure setting and confirm the aircraft's level.
- When the pilot of an RVSM approved aircraft confirms that the aircraft's equipment no longer meets the RVSM MASPS, the controller shall consider the aircraft as non-RVSM approved and take action immediately to provide a minimum vertical separation of 2 000 ft, or an appropriate horizontal separation minimum, from all other aircraft concerned.

- An aircraft rendered non-RVSM approved shall be cleared out of the AFI RVSM Airspace by air traffic control and the ACC/UAC to co-ordinate with adjacent ACCs/UACs.
- ATC shall manually apply the display of the a RVSM approved aircraft's associated radar label and/or radar position symbol, in accordance with established local radar display features applicable to non-RVSM approved aircraft in case of required RVSM equipment failure.

5.4.2 Severe Turbulence – Not Forecast (single aircraft) (ATSP_1-11)

When an aircraft operating in the AFI RVSM Airspace encounters severe turbulence due to weather or wake vortex which the pilot believes will impact the aircraft's capability to maintain its cleared flight level, the pilot shall inform ATC. ATC is required to establish either an appropriate horizontal separation minimum, or an increased vertical separation minimum of 2 000 ft. **(ATSP_1-12)**

- ATC shall co-ordinate the circumstances of an RVSM approved aircraft that is unable to maintain its cleared flight level due to severe turbulence by verbally supplementing the estimate message with: “**UNABLE RVSM DUE TURBULENCE**”.
- ATC shall manually apply the distinguishing feature of the radar label associated with non-RVSM approved aircraft and/or the radar position symbol to such an aircraft until such time as the pilot reports ready to resume RVSM. (ATSP_2-9)
- An aircraft experiencing severe turbulence while operating within the AFI RVSM Airspace need not be cleared out of RVSM airspace. If the pilot has informed ATC that the severe turbulence will impact the aircraft's capability to maintain the cleared flight level, the establishment of an appropriate horizontal separation minimum, or an increased vertical separation minimum may be accomplished within the AFI RVSM Airspace, traffic permitting.

5.4.3 Severe Turbulence – Not Forecast (multiple aircraft) (ATSP_2-9)

- When a controller receives pilot reports of severe turbulence which had not been forecast, and which could impact multiple aircraft with regards to their ability to maintain cleared flight level within the AFI RVSM Airspace, the controller shall provide for an increased vertical separation minimum or an appropriate horizontal separation minimum. (ATSP_2-5)

5.4.4 Severe Turbulence – Forecast (ATSP_2-10)

- Where a meteorological forecast is predicting severe turbulence within the AFI RVSM Airspace, ATC shall determine whether RVSM should be suspended, and, if so, the period of time, and specific flight level(s) and/or area.
- Consideration should be given to the development of a contingency FLAS to supplement any existing FLAS between ACCs/UACs.
- The importance of obtaining timely accurate forecasts of severe turbulence should be stressed within agreements with the appropriate meteorological services office responsible for the dissemination of such information for the area

6. PHRASEOLOGY

RVSM R/T Phraseology must be developed. A few examples are:

- ATC wish to know RVSM status of flight - **CONFIRM RVSM APPROVED**
- Pilot indication that flight is RVSM approved - **AFFIRM RVSM**
- Pilot indication that flight is NON RVSM approved - **NEGATIVE RVSM**
- Pilot of State aircraft indicating that flight id NON RVSM approved - **NEGATIVE RVSM STATE AIRCRAFT**
- ATC refuse clearance into RVSM Airspace - **UNABLE CLEARANCE INTO RVSM AIRSPACE, MAINTAIN [or DESCEND TO, or CLIMB TO] FL ...**
- Pilot reporting severe turbulence / weather affecting ability to maintain RVSM height keeping requirements - **UNABLE RVSM DUE TURBULENCE**
- Pilot reporting equipment degraded below RVSM requirements - **UNABLE RVSM DUE EQUIPMENT**
- ATC requesting pilot to report when able to resume RVSM - **REPORT ABLE TO RESUME RVSM**
- Pilot ready to resume RVSM after equipment/weather contingency - **READY TO RESUME RVSM**

7. VERTICAL SEPARATION

Reduced Vertical separation

- 7.1 Between FL 290 and FL 410 inclusive within the AFI RVSM airspace, the vertical separation minimum shall be;
- a) 300M (1000 ft) between RVSM approved aircraft;
 - b) 600m (2000 ft) between
-non-RVSM approved State aircraft and any other aircraft operating within the AFI RVSM airspace in accordance with FLAS.
- 7.2 ATC shall provide a minimum vertical separation of 600M (2000ft between an aircraft experiencing a communication failure in flight and any other aircraft, where both aircraft are operating within the AFI RVSM airspace in accordance with FLAS.
- 7.3 Within the designated airspace where RVSM transition tasks are carried out, the applicable vertical separation minimum shall be 1 000 ft between RVSM approved aircraft, and 2 000 ft between any non-RVSM approved aircraft and any other aircraft.
- 7.4 The applicable vertical separation minimum between all formation flights of State aircraft and any other aircraft operating within the AFI RVSM Airspace shall be 2 000 ft.
- 7.5 The applicable vertical separation minimum between an aircraft experiencing a communication failure in flight and any other aircraft, where both aircraft are operating within the AFI RVSM Airspace, shall be 2 000 ft, unless an appropriate horizontal separation minimum exists.
- 7.6 All activities occurring within restricted or danger airspaces are to be considered as being non-RVSM approved. Consequently, the minimum vertical spacing required between the vertical limits of the activities contained within such airspaces non-participating aircraft operating within the RVSM airspace is 2,000 ft, above the upper and below the lower limits of such airspaces.

8. COMMUNICATION FAILURE

8.1 Communication Failure Procedures (ATSP_2-6)

The ICAO Regional Supplementary Procedures for AFI will specify that the applicable vertical separation minimum between an aircraft experiencing a communication failure in flight and any other aircraft, where both aircraft are operating within the AFI RVSM Airspace, shall be 2 000 ft, unless an appropriate horizontal separation minimum exists.

8.2 Compulsory Reporting Points

- One means used to determine that two-way communication between an aircraft and ATC has failed is the aircraft's failure to report its position over a compulsory reporting point. These points should be strategically located so as to enhance ATC's ability to detect air-ground communication failures on a timely basis, taking into account ATC separation and co-ordination requirements.
- There is a requirement to establish RVSM entry/exit points at or near the boundaries between the AFI RVSM Airspace and adjacent Regions for all ATS routes which cross the lateral limits of the AFI RVSM Airspace. The
- designation of these points as compulsory reporting points could also enhance ATC's ability to detect air-ground communication failures.

8.3 Laterally-Spaced, Uni-Directional ATS Routes

The use of laterally-spaced, uni-directional ATS routes as a means of strategically separating opposite-direction traffic operating to/from the AFIRVSM Airspace should be addressed.. In the context of air-ground communication failure procedures, laterally-spaced, uni-directional ATS routes between AFI RVSM Airspace and adjacent Regions could help mitigate the differences between cruising levels appropriate for direction of flight within the AFI RVSM Airspace versus the cruising levels applicable within adjacent Regions.

8.4 Flight Level Allocation Schemes (FLAS)

The strategic use of Flight Level Allocation Schemes should be considered and could also be used in the context of air-ground communication failure procedures.

9. ATS SYSTEMS SUPPORT

It is essential that ATC be aware as to the RVSM approval status of all aircraft operating within, outside of and in close proximity to the AFI RVSM Airspace if they are required to accommodate non-RVSM approved State aircraft.

9.1 Flight Data Processing Systems (FDPS).

In order to ensure RVSM separation between approved aircraft, it is important that ACCs/UACs receive the support of IFPS for the purpose of rejecting flight plans filed with for aircraft which do not qualify for operation within the AFI RVSM Airspace.

9.2 Radar Display Systems.

Radar display systems must provide controllers with continuous and unambiguous information on the RVSM approval status of all flights under their responsibility;

- In a radar environment, the radar position symbols and/or radar labels associated with aircraft operating within the AFI RVSM Airspace **shall** provide a clear indication of the current non-RVSM approval status.
- Where radar is used as the primary tool for applying separation, the radar position symbols and/or radar labels **should** provide a clear indication of the current non-RVSM approval status of aircraft operating within such level bands above and below the AFI RVSM Airspace.
- The means by which the distinguishing feature is applied to the radar position symbols and/or radar labels of the aircraft concerned **shall** be automatic.
- The possibility for the manual manipulation of the radar position symbols and/or radar labels of aircraft **shall** be available.

9.3 Flight Strips

Flight strips must display the non-RVSM approved status of all civil and State aircraft to controllers.

- Local FDPS shall indicate on all flight strips (paper, electronic or, in the absence of either, extended label) for non-RVSM approved aircraft the information filed by operators in respect of both their RVSM approval status and their status as that of a State aircraft (if applicable).
- Information regarding a State or civil aircraft's current non-RVSM approval status **shall** be displayed on the flight strip. Message example:
(**NON RVSM**).

- Where applicable, the indication that a non-RVSM approved aircraft is a State aircraft **shall** be displayed on the flight strip. Message example: (**STATE AIRCRAFT**)

9.4 On-Line Data Interchange (OLDI)

OLDI should:

- include the current RVSM approval status of an aircraft, as well as the information regarding an aircraft's status as being a "State" aircraft, where applicable.
- support the systematic transfer of information related to requests for "Special Handling" in the AFI RVSM Airspace, in Item 18 of the ICAO Flight Plan (Item 18 message: **STS/NON RVSM**).

9.5 Short Term Conflict Alert (STCA), and Medium Term Conflict Detection (MTCD)

Automatic conflict alert systems should be modified to use the RVSM approval or non-approval status of aircraft and apply the appropriate VSM of 1,000/2,000 ft.

- STCA systems of ACCs/UACs applying RVSM **should** be able to selectively assess the applicable vertical separation minimum of either 1 000 ft or 2 000 ft, as determined by the current RVSM approval or non-approval status of the aircraft concerned, operating in the level band between FL 290 to FL 410 inclusive.
- Medium Term Conflict Detection (MTCD) systems of ACCs/UACs applying RVSM **shall** be able to assess the selective application of a vertical separation minimum of either 1 000 ft or 600 m 2 000 ft, as determined by the current RVSM approval or non-approval status of the aircraft concerned operating in the level band between FL 290 to FL 410 inclusive.

9.6 Flight Planning Requirements

Specific Flight Planning procedures are contained in the AFI RVSM in ICAO Doc 7030/4 AFI Regional Supplementary Procedures. The flight plan (FPL) shall include:

- the entry point at the lateral limit of AFI RVSM airspace and requested flight level after the entry point;
- the exit point at the lateral limit of the RVSM airspace and the requested flight level after the exit point;
- operators of RVSM approved aircraft shall insert "W" in Item 10 of the FPL regardless of requested FL;

- operators of non-RVSM approved State aircraft with a requested flight level of 290 or above shall insert “STS/NONRVSM” in Item 18 of the FPL;
- operators of formation flights of RVSM-approved State aircraft shall NOT insert “W” in Item 10 of the FPL;
- operators filing Repetitive Flight Plans (RPLs) shall include in Item Q of the RPL the RVSM approval status “EQPT/W” for RVSM approved aircraft, & “EQPT/ ” for non-RVSM approved aircraft;
- if a change of aircraft on an RPL results in a modification of the RVSM approval status in Item Q, the operator shall submit a modification message (CHG).

10. AIR TRAFFIC MANAGEMENT CONSIDERATIONS (ATST_1-1); (ATST_1-2)

The introduction of RVSM will require that individual ACCs/UACs undertake a critical evaluation of operating practices so as to identify areas where adjustments and/or changes are required. Individual ACCs/UACs may wish to take the opportunity to maximize the operational benefits to be gained from the introduction of RVSM by undertaking an extensive critical operational analysis and the training of air traffic controllers in the following activities:-

10.1 The ATS Route Network

- It is expected that the existing ATS route network will be through a combination of Flight Level Allocation Schemes, sectorisation, and, to a lesser extent, changes to the ATS route network itself.
- On bi-directional ATS routes, climbing and descending aircraft will cross more cruising levels in an RVSM environment than in a non-RVSM environment. Therefore, consideration should be given to the potential benefit of expanding the use of uni-directional ATS routes.
- The introduction of AFI RVSM will permit Flight Level Allocation Schemes (FLAS) through the designation of new flight levels for specified ATS route segments. Strategic de-confliction at major crossing points will be facilitated through the availability of the additional cruising levels.
- The implementation of AFI RVSM may require an analysis of the optimal levels to be used for delineating the vertical limits of control sectors within ACCs/UACs.
- States shall ensure that the vertical limits of control sectors within ACCs/UACs also facilitate the requirement to provide a vertical separation minimum of 2,000 ft between a. non-RVSM approved aircraft and any other aircraft operating within the AFI RVSM Airspace;

- Consideration should be given to the impact on ATC co-ordination workload resulting from the requirement to provide a 2,000 ft vertical separation minimum for such aircraft operating at levels immediately above or below vertical sector boundaries within the AFI RVSM Airspace.

10.2 ATC Sectorisation

- The implementation of AFI RVSM will require an analysis of the optimal levels to be used for delineating the vertical limits of control sectors within ACCs/UACs. Operational experts should evaluate the requirement to re-define such vertical limits as a function of adaptations to FLAS, or predicted changes in the vertical profiles of major traffic flows expected from the implementation of RVSM.
- The vertical limits of control sectors within the AFI RVSM Airspace should also facilitate the requirement to provide a vertical separation minimum of 2 000 ft between RVSM approved and non-approved aircraft.
- The impact on ATC co-ordination workload resulting from the requirement to provide a 2,000 ft vertical separation minimum, for such aircraft operating at levels immediately above or below vertical sector boundaries within the AFI RVSM Airspace should be determined.
- Inter-Centre Letters of Agreement must be amended to reflect any changes to sector boundaries, where applicable. (ATSP_1-5)

10.3 Special Procedures applicable to designated airspaces

Such special procedures are contained in the Regional SUPPs (Doc. 7030) for the AFI regional

10.4 Flight Level Allocation Schemes (FLAS) (ATSP_1-2)

States should consider a Flight Level Allocation Scheme whereby specific flight levels are applied to specific segments within the ATS route network.

Organizing the use and non-use of flight levels on specific route segments could avoid potential traffic conflicts.

A Strategy could therefore be developed as to when to discontinue the use of FL 310, FL 350, and FL 390 as eastbound cruising levels taking into account different traffic scenarios at these flight levels.

10.5 ATC Clearances (ATSP_1-1) (ATSP_1-3)

- only RVSM approved aircraft and non-RVSM approved State aircraft shall, subject to ATC capacity be issued an air traffic control clearance to join and operate within the AFI RVSM Airspace.
- Non-RVSM aircraft intending to climb or descend through the AFI RVSM airspace shall be given appropriate ATC clearance.
- ATC clearance into the AFI RVSM airspace shall **not** be issued to formation flights in the AFI RVSM controlled airspace.
- ATC shall assign flight levels to non-RVSM approved aircraft in accordance with a published table.
- All ATC clearances must be read back and acknowledged.

10.6 ATS Letters of Agreement (ATSP_1-5) (ATSP_1-6) (ATSP_2-13)

- 10.6.1 ACCs/UACs should review existing Inter-Centre Letters of Agreement for the purpose of updating the content to include RVSM-related changes prior to the implementation of AFI RVSM.
- 10.6.2 ACCs/UACs should review existing Civil/Military LOAs and/or develop new LOAs defining ATS coordination procedures in RVSM environment.

10.7 Inter-Centre Co-ordination

10.7.1 Flight Plans (ATSP_1-4) (ATSP_2-8)

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.

10.7.2 Computer-assisted Co-ordination of Estimate Messages (ATSP_1-1) (ATSP_1-6)

The On-Line Data Interchange (OLDI) System should support the co-ordination of requests for special handling (i.e. STS) as filed in Item 18 of the ICAO Flight Plan. When an automated message does not contain the information filed in Item 18 of the ICAO flight plan relevant to RVSM operations, the sending ATC unit shall inform the receiving ATC unit of that information by supplementing the ACT message verbally, using the term “**Negative RVSM**” or “**Negative RVSM State Aircraft**”, as applicable.

10.7.3 Verbal Co-ordination of Estimate Messages (ATSP_1-6)

- When a verbal co-ordination process is being used, the sending ATC unit shall include the information filed in Item 18 of the ICAO flight plan relevant to RVSM operations at the end of the verbal estimate message, using the term “**Negative RVSM**” or “**Negative RVSM State Aircraft**”, as applicable.
- When a single aircraft is experiencing an in-flight contingency which impacts on RVSM operations, the associated co-ordination messages shall be supplemented verbally by a description of the cause of the contingency.

10.7.4 Training for air traffic controllers and ATC maintenance personnel (Civil and Military) for RVSM. (ATST_1-1 to ATST_1-11); (ATST_2-1 to ATST 2-10); (ATST_3-1)

- The safety requirement associated with the ATS training is to show that all relevant staff have been appropriately trained in RVSM Procedures and are competent to operate within an RVSM environment. It is therefore essential that ATS providers recognize its responsibility for the competence of Air Traffic Controllers (ATC) in the provision of ATS in RVSM airspace.
- States must ensure that Air Traffic controllers and ATS Equipment personnel undergo full training and orientation in all the activities concerning the ATM Safety Elements Required for the safe implementation of RVSM in the AFI Continental airspace.

11 AIRCRAFT COLLISION AVOIDANCE SYSTEM

11.1 Carriage and Operation of Airborne Collision Avoidance System (ACAS) and Pressure-Altitude Reporting Transponder

The ICAO Standards relating to ACAS II as contained in the ICAO Annex 6, Part I paragraph 6.18 *inter alia* require that:

6.18.1 “From **1 January 2003**, all turbine-engined aeroplanes of a maximum certified take-off mass in excess of 15 000 kg or authorized to carry more than 30 passengers shall be equipped with an airborne collision avoidance system (ACAS II)”.

6.18.2 “From **1 January 2005**, all turbine-engined aeroplanes of a maximum certified take-off mass in excess of 5 700 kg or authorized to carry more than 19 passengers shall be equipped with an airborne collision avoidance system (ACAS II)”.

6.18.3 “An airborne collision avoidance system (ACAS) shall operate in accordance with the relevant provisions of ICAO Annex 10, Volume IV”.

The ICAO Standards relating to pressure-altitude reporting transponders as contained in Annex 6, Part I paragraph 6.19 *inter alia* require that:

6.19 “All aeroplanes shall be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provisions of Annex 10, Volume IV” and; The ICAO Standards relating to pressure-altitude transponders as contained in Annex 6, Part II paragraph 6.13.1 *inter alia* require as follows:

6.13.1 “**From January 2003**, unless exempted by the appropriate authorities, all aeroplanes shall be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provisions of Annex 10, Volume IV”.

Furthermore, other relevant ICAO provisions are contained in Annex 2, paragraph 3.2, Annex 11, paragraph 2.4.2, PANS/OPS Doc.8168, Volume I, Part VIII and PANS/ATM, Doc.4444 Chapter 8, paragraph 8.5.

It is relevant to note that TCAS II, Version 6.04A (or earlier), is **not** ICAO ACAS II SARPs compliant, and, as such, will require upgrading to TCAS II, Version 7. TCAS II, Version 6.04A (or earlier) models, were designed for an operating environment where a minimum vertical separation of 2 000 ft is applied above FL 290. TCAS II, Version 7, includes modifications intended to address operational issues, including its compatibility for operations within RVSM Airspace.

RVSM REFERENCE DOCUMENTS

ICAO The material is covered in the following documents:

Annex 2; chapter 3, para.2
Annex 6; part 1, paragraph 6.18
Annex 10;vol.iv
Annex 11; Para. 2.4.2
PANS-OPS; vol.1, part viii
PANS- ATM; chapter 4.

- EUROCONTROL - RVSM
- NAT RVSM
- FAA RVSM manuals
