

Caribbean/South America ICAO Regions

Reduced Vertical Separation Minimum (RVSM)

Training Manual/Controller Briefing Guide

DRAFT

CAR/SAM RVSM Implementation Reduced Vertical Separation Minimum (RVSM) Controller Briefing Package

*** Note...Although the Caribbean region and the South American region are different ICAO regions, for the purposes of this document, they are referred to as one region, the CAR/SAM region.

1.0 Background

1.1 RVSM is the reduction in vertical separation from the current 2000ft minimum to a 1000ft minimum between FL 290 and FL 410 inclusive. The benefits of RVSM allow operators to gain fuel savings and ATC to realize operational efficiencies. The States of the CAR/SAM ICAO regions, in a conclusion reached at the GREPECAS meeting of December 2002, have directed the implementation of RVSM in parallel with the North American ICAO region, currently scheduled for early 2005. RVSM was first used operationally in the North Atlantic in 1997. Prior to its implementation, the concept of RVSM was studied for many years and subjected to numerous safety assessments. Due to the high levels of accuracy and reliability built into today's avionics, the safety of RVSM has been proven by over 1,000,000 flights conducted to date using RVSM separation standards. Financially, RVSM has proven to be a great success, providing a positive cost benefit to aircraft operators in terms of increased capacity, fuel savings, and system efficiency. RVSM has also proven to be a very important tool for ATC, providing controllers with one more tool to manage their traffic. Numerous studies have demonstrated that global reduction of vertical separation is safe, feasible, and cost beneficial and can be implemented without imposing complex technical requirements on either the users or the service providers, namely you, the controller.

1.2 The currently RVSM project is not the first one for the CAR/SAM region. A portion of SAM airspace, the corridor between Brazil and Europe, is already making use of RVSM operations. A portion of CAR airspace, the Miami-San Juan Corridor, is currently designated as transition airspace, while the Caribbean portion of the WATRS (West Atlantic Route System) is exclusionary RVSM airspace. Almost all of the oceanic FIRs of the North Atlantic and the Pacific are exclusionary RVSM airspace between FL290-FL410. European domestic airspace was approved for RVSM operations in 2002. The North American/Caribbean/South American RVSM implementation will be one of the last, and one of the largest, in history. If you currently work flights that are going to Europe or Asia, you are working an RVSM approved flight.

1.3 GREPECAS has directed that all FIRs of the CAR/SAM regions implement RVSM according to an implementation plan developed by the RVSM Task Force. The current plan calls for all FIRs in the regions to be designated as RVSM airspace. While some previous implementations of RVSM globally have involved "exclusionary airspace (only RVSM

approved aircraft can flight plan into this airspace) this will not be the case in the CAR/SAM regions. While long haul international flights will be RVSM exclusionary between FL290 and FL410, States will be able to develop procedures to accommodate their domestic flights that are not RVSM approved within this altitude stratum. States will be allowed to modify the use of RVSM within airspace under their control, in keeping with ICAO directives and regional agreements. This will lessen the impact on domestic carriers that, for whatever reason, are finding it difficult to prepare their fleet for RVSM. Sometime after 2005, it is expected that the GREPECAS will provide further direction as to whether or not more airspace should become exclusionary.

2.0 RVSM Airspace

2.1 RVSM airspace is airspace where the use of 1000 feet vertical separation is approved. While much attention has been given to the airspace above FL290, the altitudes below FL290 have been RVSM for many, many years. Whether you are an en route controller or a terminal controller, you have been using 1000 feet between airplanes. Now you will simply be using the same standard above FL290 (up to FL410). While this may seem a bit strange at first, you will very quickly become used to RVSM, and the many efficiencies it will offer you as you manage your airspace. Controllers in Europe, the United States, and the Pacific report that RVSM has proven to be very easy to use, and has provided great benefit to them as they manage their airspace. The safety of RVSM has been proven many, many times by its extensive use around the world.

2.2 There have been some statements that the recent mid-air collision over Europe was linked to the use of RVSM. This is not correct. This accident is still under investigation, but RVSM was not a factor.

3.0 RVSM Transition Areas

3.1 RVSM transition airspace was designed to provide a buffer zone between airspace where RVSM operations are allowed and airspace where RVSM is not allowed. Because current plans call for all airspace in the CAR/SAM regions to be designated as RVSM airspace, the use of transition airspace should be limited to those areas where CAR/SAM airspace is adjacent to other ICAO regions that currently do not allow RVSM operations, such as Africa. It is possible that in these areas operational procedures will be covered by a letter of agreement, eliminating the need for transition airspace.

3.1 Under ICAO guidelines, when possible, transition to/from RVSM exclusionary airspace should be conducted under radar surveillance. Because current plans do not call for the use of exclusionary airspace across most of the CAR/SAM region, it is unlikely that controllers will be required to make this transition. If the use of exclusionary airspace does become an issue at a later time, each State can make the necessary changes, using ICAO documentation as guidance.

- 3.2 Aircraft do not have to be approved for RVSM operations to operate in transition airspace. Unless otherwise coordinated all RVSM operations must be terminated before aircraft enter non-RVSM airspace. This does not mean that controllers cannot coordinate an aircraft operating at a non-traditional altitude with the next controller, even if that controller's airspace is not approved for RVSM operations. Since the entire CAR/SAM region is scheduled to begin RVSM operations at the same time, this situation should rarely happen.

4.0 Document Changes/Safety Studies

4.1 The ICAO document that describes RVSM operations and requirements is ICAO Doc. 9674. Both the CAR and the SAM regional supplemental documents, the CAR 7030 and the SAM 7030, have been amended to allow for RVSM in the region. Each State will amend its regulations and documents governing Air Traffic Control procedures to include language allowing the use of RVSM procedures. Below is sample language:

Section XXXX. VERTICAL SEPERATION

Within airspace approved for RVSM operations:

- 1. Apply 1,000 feet/300m between RVSM approved aircraft, or:*
- 2. Apply 2000 feet/600m between an RVSM approved aircraft and a non-approved aircraft, or between two non-approved aircraft*

- 4.2 Remember, RVSM airspace can be defined vertically and horizontally. For example, the airspace in the Kingston FIR between FL290 and FL410 is designated "RVSM airspace". This does not mean the airspace is exclusionary, it just means that RVSM operations are allowed in the airspace because the necessary safety analysis and traffic studies have been completed.
- 4.3 Before RVSM can be implemented in any airspace, a safety analysis must be completed. The safety analysis for CAR/SAM airspace is being conducted by the States of the region, in partnership with the CAR/SAM Regional Monitoring Agency, or CARSAMMA. Each State is gathering traffic data about operational deviations, large height deviations (where flights do not stay at their assigned altitudes for some reason) and is sending this data to CARSAMMA. CARSAMMA will then analysis this data and determine whether or not if is safe to implement RVSM in the region. The safety analysis will include data about many types of incidents, including turbulence, mountain wave activity, weather, and controller/pilot errors. There is a high level of confidence that the safety analysis results will be positive.

- 4.4 CARSAMMA will also do ongoing monitoring to make sure RVSM operations stay safe. As a controller, you might be asked to provide input at some point in the future to give your opinion about how RVSM operations are going in your facility or area.

5.0 Aircraft/Pilot Requirements

5.1 Aircraft certification is probably the most complex, and expensive part of RVSM implementation. Depending on the age of the aircraft and its equipment, it can cost many thousands of dollars to certify the aircraft. By now, most operators have become very familiar with Interim Guidance 91-RVSM (www.faa.gov/ats/ato/rvsm1.htm) and 14 CFR Part 91 Appendix G FAR 91 Appendix G as primary references for the approval criteria and process for US registered aircraft. For operators flying under Part 91, the approval is granted in the form of a "Letter of Authorization" and for Part 135 operators, it's a change in the operations specifications.

5.2 Fortunately the CAR/SAM region has many factors working in its favor:

- Most of the long haul international fleet of the CAR/SAM region is already approved for RVSM
- New commercial aircraft that enter service in the region are approved for RVSM right at the factory
- Aircraft on domestic flights do not have to be RVSM approved
- Many thousands of aircraft have already been approved, which means there is a substantial amount of experience for the CAR/SAM region to use to make our job easier

5.2 Pilot Requirements:

- The pilot must notify ATC whenever the aircraft:
 - 1) is no longer RVSM compliant due to equipment failure; or
 - 2) experiences loss of redundancy of altimetry systems; or
 - 3) encounters turbulence that affects the capability to maintain assigned flight level.
- In a non-radar environment, pilots shall report reaching any altitude assigned within RVSM airspace.

- The aircraft crew must be certified to conduct RVSM operations. To become certified the crew must learn the various contingency procedures for use in unusual situations, such as equipment failures. This certification is done by the aircraft operator.

6.0 Accommodation of Certain Unapproved Operators

6.1 Civil Aircraft not approved for RVSM;

6.1.1 Accommodations have been made for humanitarian flights and certain ferry or maintenance flights that do not have RVSM approval.

In all cases below for both civil and military flights not approved for RVSM, those aircraft operating in the RVSM stratum will be separated from all other aircraft by a minimum 2000-ft. vertical separation.

Civil aircraft that are not approved for RVSM, and are unable to flight plan at or below FL 280 or above FL 410 may flight plan at RVSM flight levels in the RVSM stratum with prior coordination provided that:

- the aircraft is being initially delivered to the State of registry or operator; or
- the aircraft is RVSM approved but has experienced an equipment failure which disables RVSM capabilities and is being flown to a maintenance facility for repair in order to meet RVSM requirements and/or obtain approval; or
- the aircraft is being utilized for mercy or humanitarian purposes.
- The aircraft is on a domestic flight within a State and has complied with that State's procedures for the accommodation of non-approved aircraft in RVSM airspace

Aircraft operators requesting approval as above shall include the remarks "NON-RVSM" in field 18 of the ICAO flight plan.

6.1.2 State (Military) Aircraft

State (Military) aircraft not approved for RVSM may operate at RVSM flight levels provided prior coordination has been completed with ATC. This coordination shall consist of filing a flight plan and including the remarks "APVD NON-RVSM" in field 18 of the ICAO flight plan.

***It is extremely important that controllers know when they have non-approved aircraft operating in RVSM airspace. Controllers must be absolutely sure the next controller knows that these aircraft must be separated by 2000 feet.

7.0 Identification of RVSM-Approved Aircraft

7.1 Aircraft Equipment Suffixes

7.1.1 RVSM approval is indicated by the equipment suffix **/W**. This suffix has been approved by ICAO for international use.

7.1.2 The implementation of RVSM in the Pacific Oceanic airspace created a challenge with regard to equipment suffix information. This airspace is already designated as Required Navigation Performance-10 (RNP-10) airspace, with reduced longitudinal and lateral separation minima based on navigational performance. The equipment suffix for RVSM is **/W**, and for RNP is **/R**.

7.1.3 Some States with automated system may also chose to place some type of visual cue in the electronic data block of RVSM approved aircraft.

7.1.4 Controllers should insure that every aircraft that is operating under RVSM procedures has an equipment suffix designating it as RVSM approved.

8.0 Procedures for Aircraft that are unable to continue RVSM operations

8.1 When a pilot informs controllers that the flight will no longer be able to continue RVSM operations, the controller should take the following actions:

- Take steps, if necessary, to separate the aircraft by some other method, such as
 - 2000 feet vertical separation
 - Climbing/descending the aircraft out of RVSM airspace
 - longitudinal separation
 - lateral separation, including offsets
 - assigning the aircraft to another route

8.2 If the aircraft was unable to continue RVSM operations due to equipment failure, insure that the aircraft's equipment suffix is changed to show that it is no longer RVSM approved. Insure that this information is passed to the next controller.

8.3 It is important to note that when a pilot informs ATC that they have lost their ability to continue RVSM operations, and that aircraft is operating with less than standard lateral or longitudinal separation with another aircraft, it does not mean that separation has been lost. Rather, the controller must take immediate action to establish some other form of separation.

9.0 RVSM Website

If you would like to find more information about the RVSM process, you can go to the following website, which is maintained by the United States Federal Aviation Administration:

www.faa.gov/ats/ato/rvsm1.htm)

10.0

Space for additional information

11.0 Altitude Assignment

11.1 Assign altitudes within RVSM airspace using the following flight level allocation system:

*****This is a draft flight level allocation system and is subject to change by the RVSM Task Force**

Aircraft within RVSM or RVSM transition airspace	Assigned route, track, course, or vector is between 001 degrees and 180 degrees magnetic	Assign any the following cardinal altitudes	FL 290 FL 310 FL 330 FL 350 FL370 FL390 FL410
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Aircraft within RVSM or RVSM transition airspace	Assigned route, track, course, or vector is between 181 degrees and 360 degrees magnetic	Assign any of the following cardinal altitudes	FL 300 FL 320 FL 340 FL 360 FL 380 FL400
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11.2 It is important to remember that any aircraft, approved or non-approved, can be assigned any cardinal altitude in compliance with the above system. However, standard 2000' vertical separation **must** be applied to all non-RVSM approved aircraft within RVSM or RVSM transition airspace. This provides a significant benefit for non-approved aircraft on domestic flights as they can achieve the same fuel economy benefits as approved aircraft.

11.3 Aircraft not in compliance with the above system must be coordinated and approved by each receiving controller.

12.0 Operation of non-RVSM aircraft within RVSM airspace

12.1 RVSM approved aircraft will be given priority for level allocation over non-RVSM approved aircraft. The vertical separation minimum between non-RVSM aircraft operating in the RVSM stratum and all other aircraft is 2,000 ft.

12.2 ATC may clear non-RVSM aircraft to climb or descend *through* RVSM airspace, provided they do not climb or descend at less than standard rate, or level off while passing through the RVSM stratum.

13.0 Procedures for the suspension of RVSM due to reports of turbulence

13.1 ATC service providers will consider suspending RVSM procedures within RVSM airspace 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. within the RVSM stratum. However, any altitude is usable

13.2 The following procedures will apply in the event of a need to suspend RVSM:

- If a SIGMET indicating reports of severe turbulence is received, RVSM operations shall be terminated in the affected SIGMET area. ATC may amend the area of suspension as operationally necessary

- Adjacent facilities shall be advised of any planned or active suspension of RVSM.
- If RVSM is suspended, 2000-foot separation must be used in the RVSM stratum. However, there is no requirement that aircraft must be changed to “conventional” altitudes. If it is operational advantageous, aircraft may utilize RVSM levels so long as they are separated by 2000 feet – for example, Flight Level 320 and Flight Level 340.
- Determining the “affected area” is a judgement call based on pilot reports and current weather data. It should be made in consultation with the a State’s weather reporting services and any regional traffic management facility.
- If a decision is made to terminate RVSM, after determining the area affected and, if possible, any projected times for resumption of RVSM, prepare a NOTAM/AIC with the appropriate information for immediate distribution.

14.0 Wake Turbulence Contingency Procedures

The following weather deviation procedures will be proposed for addition to the CAR/SAM regional supplemental document.

- 14.1 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 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 track, provided that:
 - i) as soon as 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
 - ii) the offsetting aircraft notify ATC when re-established on assigned route(s) or track(s).
- 14.2 In this contingency circumstance, ATC will not issue clearances for lateral offsets and will not normally respond.

15.0 ICAO Oceanic/Remote Area Weather Deviation Procedures (CAR/SAM Region)

Use of this procedure will be contingent on communications and surveillance studies of the region. This procedure will only be used if it is determined that sufficient areas exist that lack direct pilot/controller communications.

15.1 General

15.1.1 The following procedures are intended to provide guidance for deviations around thunderstorms. All possible circumstances cannot be covered. The pilot's judgment shall ultimately determine the sequence of actions taken and ATC shall render all possible assistance.

15.1.2 If the aircraft is required to deviate from track to avoid weather and prior clearance cannot be obtained, an air traffic control clearance shall be obtained at the earliest possible time. In the meantime, the aircraft shall follow the procedures detailed in paragraph 13.3 below.

15.1.2 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 centerline of its cleared route.

15.2 Obtaining priority from ATC when weather deviation is required.

15.2.1 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.

15.2.2 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.

15.2.3 Actions to be taken when controller-pilot communications are established:

- a) The pilot notifies ATC and requests clearance to deviate from track, advising, when possible, the extent of the deviation expected.
- b) ATC takes one of the following actions:
 - 1) if there is no conflicting traffic in the horizontal dimension, ATC will issue clearance to deviate from track; or
 - 2) if there is conflicting traffic in the horizontal dimension, ATC separates aircraft by establishing vertical separation; or

- 3) if there is conflicting traffic in the horizontal dimension and ATC is unable to establish vertical separation, ATC shall:
 - i) advise the pilot unable to issue clearance for requested deviation;
 - ii) advise pilot of essential traffic; and
 - iii) request pilot's intentions.

SAMPLE PHRASEOLOGY:

“Unable to clear (requested deviation), traffic is (call sign, position, altitude, direction), advise intentions.”

- c) The pilot will take the following actions:
 - 1) Advise ATC of intentions; and
 - 2) Comply with air traffic control clearance issued; or
 - 3) Execute the procedures detailed in 13.3 below. (ATC will issue essential traffic information to all affected aircraft).
 - 4) If necessary, establish voice communications with ATC to expedite dialogue on the situation

15.3 Actions to be taken if a revised air traffic control clearance cannot be obtained

15.3.1 The pilot shall take the actions listed below under the provision that the pilot may deviate from rules of the air, when it is absolutely necessary in the interests of safety to do so.

15.3.2 If a revised air traffic control clearance cannot be obtained and deviation from track is required to avoid weather, the pilot should take the following actions:

- a) if possible, deviate **away** from the closest track or route system;
- b) establish communication with and alert nearby aircraft by broadcasting, at suitable intervals: flight identification, flight level, aircraft position (including the ATS route designator or the track code) and intentions (including the magnitude of the deviation expected) on the frequency in use, as well as on frequency 121.5 MHz (or, as a back-up, the VHF 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) for deviations of less than 10 NM, aircraft should remain at the level assigned by ATC;
- f) for deviations of greater than 10NM, when the aircraft is approximately 10 NM from track, initiate a level change based on the following criteria:

Route center line track	Deviations >10 NM	Level change
EAST (001-180 magnetic)	LEFT RIGHT	DESCEND 300 ft CLIMB 300 ft
WEST (181-360 magnetic)	LEFT RIGHT	CLIMB 300 ft DESCEND 300 ft

Note: - 14.3.2 b) c) above call for the pilot to: broadcast aircraft position and pilot's intentions, identify conflicting traffic and communicate air-to-air with near-by aircraft. If the pilot determines that there is another aircraft at or near the same FL with which his aircraft might conflict, then the pilot is expected to adjust the path of the aircraft, as necessary, to avoid conflict.

- g) 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.
- h) when returning to track, be at its assigned flight level, when the aircraft is within approximately 10 NM of centerline.