

(COMPANY NAME)

(AIRCRAFT MODEL)

FAA Registration (XXXX)

Manufacturers Serial Number (XXXXXX)

FAR Part 91

RVSM Operations and Maintenance  
Procedures Manual

Revision: *Original*

FAA ACCEPTANCE



# RSVM Operations and Maintenance Procedures Manual

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### RVSM INTRODUCTION AND BACKGROUND

#### **Background**

In 1982 the International Civil Aviation Organization (ICAO) initiated a series of worldwide studies to assess the feasibility of a reduction of the Vertical Separation Minimum (VSM) above FL 290 from 2000 ft. to 1000 ft. The studies were co-coordinated by the Review of the General Concept of Separation Panel (RGCSP) which included representation from the International Air Transport Association (IATA), International Federation of Airline Pilots (IFALPA) and the International Federation of Air Traffic Controllers Associations (IFATCA). The principal benefits of which the implementations of the reduced VSM were expected to provide here:

- (a) A theoretical doubling of the airspace capacity between FL 290 and FL 410 and;
- (b) The opportunity for aircraft to operate at/close to their optimum flight levels, with resulting fuel economy.

#### **Airspace Designation**

Domestic RVSM (DRVSM) may be applied in the airspace for the 48 contiguous states, District of Columbia, and Alaska, including the airspace overlying the waters within 12 nautical miles of the coast.

#### **Notice posted in Jan 22, 2004 Issue of the FAA Domestic/International NOTAM Book Under Part 4 (Graphic Notices)**

#### **Reduced Vertical Separation Minimum (RVSM) Implementation in North America**

**RVSM Implementation Plan** The FAA implemented a Reduced Vertical Separation Minimum (RVSM) at 0901 UTC on January 20, 2005, between flight levels (FL) 290-410 (inclusive). Implementation is planned for the airspace of the lower 48 states of the United States, Alaska, Atlantic and Gulf of Mexico High Offshore Airspace (including Scottsdale and Miami Oceanic airspace), and the San Juan ICAO FIR.

On the same date and time and at the same flight levels, Canada and Mexico are planning RVSM implementation. Canada implemented RVSM in its Northern Domestic Airspace in April 2002 and plans to expand RVSM into Canadian Southern Domestic Airspace in January 2005.

The RVSM program enables vertical separation to be reduced between flight levels (FL) 290-410 (inclusive) from 2,000 ft. to 1,000 ft. RVSM was first implemented in North Atlantic Airspace in 1997. It is now implemented in other major airspaces such as Europe, the Pacific Ocean, and Australia.

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### RVSM INTRODUCTION AND BACKGROUND (continued)

**RVSM Authorization** In accordance with Title 14 of the code of Federal Regulations (14 CFR), Part 91, Section 91.180, with only limited exceptions, prior to operating in RVSM airspace, operators and aircraft must have received RVSM authorization from the responsible civil aviation authority. Aircraft must be equipped with altimeters, altitude control systems (auto-pilots), and altitude alerters that meet RVSM performance tolerances, and operator maintenance and operations programs must incorporate RVSM policies and practices. The RVSM Documentation Website provides guidance on the aircraft and operator approval process. See paragraph below:

**TCAS Equipage** TCAS equipage requirements are contained in 14 CFR Sections 121.356, 125.224, 129.18 and 135.189. Part 91 Appendix G does not contain TCAS equipage requirements specific to RVSM; however, Appendix G does require that aircraft equipped with TCAS II and flown in RVSM airspace be modified to incorporate TCAS II Version 7.0 or a later version.

Operators should start the RVSM authorization process as soon as possible. Operators that do not obtain RVSM authority by January 20, 2005, can continue to operate at/below FL 280.

**Exceptions** After RVSM implementation, if either the operator or the aircraft or both have not received RVSM authorization (Non-RSVM aircraft), the pilot can neither request nor accept a clearance into RVSM airspace unless:

The flight is conducted in accordance with FAA policy by a Non-RVSM Department of Defense, Foreign State, Lifeguard, or certification/development aircraft: or

The pilot intends to climb to and descend from FL430 or above in accordance with ICAO policy; or

An emergency situation exists.

**Sources of Information** Policy, procedures, and guidance on operator and aircraft compliance with RVSM standards can be found on the FAA RVSM Website Homepage at:

[www.faa.gov/ats/ato/rvsm1.htm](http://www.faa.gov/ats/ato/rvsm1.htm) . The "RVSM Documentation" and "Domestic RVSM" WebPages are linked to the RVSM Homepage. "RVSM Documentation" contains guidance and direction for an operator to obtain RVSM authorization for aircraft and programs.



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### RVSM INTRODUCTION AND BACKGROUND (continued)

**ATC and Operational Policy** The Area of Operations Specific section of the RVSM Documentation Web page contains an outline of Aeronautical Information Manual (AIM) material that will constitute Domestic US RVSM air traffic and operational policy.

**Flight Planning** Starting at 0901 UTC, January 20, 2005, ATC will use the flight plan equipment block information to either issue or deny clearance into RVSM airspace. Operators annotate the equipment block of the ATC flight plan with a designated letter to inform ATC when the operator and its aircraft have received RVSM authorization. Other letters may be used on FAA flight plans in the future, but currently, for both FAA and ICAO flight plans the letter W indicated the operator has received RVSM authorization. In accordance with Part 91 Appendix G, Section 4, the operator will not annotate the ATC flight plan with the designated RVSM letter unless the operator has been granted RVSM authority and the aircraft complies with Appendix G, Section 2 standards.

#### **Acronyms**

ACT-520	Aviation System Analysis and Modeling Branch (FAA Technical Center, Atlantic City, New Jersey)
CAA	Civil Aviation Authority
CMA	Central Monitoring Agency
CHDO	Certificated Holding District Office: For certain large operations, the responsible Certificate Management Office and for other operators, the responsible Flight Standards District Office (FSDO).
GMU	GPS-based Monitoring Unit
HMU	Height Monitoring Unit
IG	Interim Guidance
IMG	Implementation Manager Group
NAT	North Atlantic
MNPSA	Minimum Navigation Performance Specifications Airspace
PTRS	Program Tracking and Reporting Sub-system
RVSM	Reduced Vertical Separation Minimum

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### RVSM INTRODUCTION AND BACKGROUND (continued)

#### **Removal of Amendment of Authority**

The (INSERT FSDO OFFICE LOCATION) may revoke or restrict an RVSM letter of authorization if the (INSERT FSDO OFFICE LOCATION) determines that (COMPANY NAME) is not complying or is unable to comply with Part 91 Appendix G. Examples of reasons for amendment, revocation, or restriction include, but are not limited to, an operator's:

- (a) Committing one or more altitude-keeping errors in RVSM airspace;
- (b) Failing to make an effective and timely response to identify and correct an altitude-keeping error; or
- (c) Failing to report an altitude-keeping error.

This manual meets the requirements of FAA Inspectors Handbook 8300.10, Change 16, Vol. 2, Chapter 5 that enhanced Advisory Circular (AC) 91.70, Appendix G. Both documents may be found in the Appendix section of this manual.

## OPERATIONS SECTION 1 – NORMAL OPERATIONS

### **1) LEON LEGACY RVSM REPRESENTATIVE**

The Chief Pilot for (COMPANY NAME) is (INSERT NAME) and he is designated the RVSM Representative for the company. (INSERT NAME) is also the Chief Pilot and will be responsible for distribution, control, and revision of this manual. (COMPANY NAME) Chief Pilot and RVSM Representative can be contacted at (INSERT PHONE NUMBER). In the event the RVSM representative is unable to personally ensure that the compliance with the requirements of this RVSM maintenance program are being accomplished, a qualified aircrew member and/or aircraft mechanic employed by (COMPANY NAME) may act as a delegate.

### **2) CREWMEMBER TRAINING**

(COMPANY NAME) crewmembers have completed an initial RVSM training program. RVSM crewmembers will attend a refresher course every two years. Training records will be maintained with the Chief Pilot of (COMPANY NAME) who is the RVSM Representative. Flight Safety International, CAE SimuFlite, or any other FAA approved training facility will conduct flight crewmembers RVSM training.

### **3) PREFLIGHT PLANNING**

Prior to commencing a flight planned for RVSM airspace, it is the responsibility of the Pilot in Command (PIC) to:

- a) Ensure all international NOTAMS, Track Messages and information pertinent to the RVSM airspace is reviewed and a copy is kept in the cockpit.
- b) Review Tropopause charts for performance capability and wind charts for turbulent conditions, to determine if either could exceed altitude keeping equipment parameters.
- c) Ensure the ICAO flight plan is correct and that the proper designations of “Q” or “W” are included in the Equipment designation box (Field 10) to denote MNPS / RVSM approval.
- d) No person may show, on the flight plan filed with air traffic control, an operator or aircraft as approved for RVSM operations, or operated on a route or in an area where RVSM approval is required unless:
  - (1) The operator is authorized by the Administrator to perform such operations; and
  - (2) The aircraft has been approved and complies with the requirements of [Part 91 Appendix G](#) (this document is located in Appendix “C” to this Manual and may be accessed using this hyperlink)

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### OPERATIONS SECTION 1 – NORMAL OPERATIONS (continued)

#### 4) **PREFLIGHT PROCEDURES**

The pre-flight inspection of the aircraft shall include the following:

- a) Aircraft Maintenance Log
  - i A review of deferred discrepancies with particular attention to height keeping equipment, altitude alerting and altitude reporting equipment.
  - ii Any deferred discrepancies of equipment falling within the categories referred to in paragraph 5.a.1 shall be evaluated under the restrictions of the Master Minimum Equipment List to ensure compliance for flight within RVSM airspace.
  - iii A cross check of the RVSM Status Log and the aircraft technical log to ensure that the aircraft remains RVSM compliant following any possible maintenance action and the authorizing signature column has been completed.
  
- b) Altimeter Checks
  - i During cockpit pre-flight checks set both altimeters to local altimeter setting. This must be carried out at a position of known elevation.
  - ii The difference between altimeter readings, at airport elevation MUST NOT EXCEED 75 feet.
  - iii The altimeter pre-flight check will be recorded in the altimetry log including Time, Location, No. 1 Altimeter reading, No. 2 Altimeter reading, Standby Altimeter reading, and Standby Altimeter Setting.
  
- c) Static Sources
  - i During exterior inspection pay particular attention to the static sources and the condition of the skin in the vicinity of the source.
  - ii This check shall be performed by a qualified crewmember who is in
    - Compliance with training requirements of this manual.

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### OPERATIONS SECTION 1 – NORMAL OPERATIONS (continued)

#### 5) PILOT/CONTROLLER PHRASEOLOGY

The following figure shows standard phraseology that pilots and controllers will use to communicate in DRVSM operations.

#### STANDARD PHRASEOLOGY FOR DRVSM OPERATIONS

Message	Phraseology
For a controller to ascertain the RVSM approval status of an aircraft:	(call sign) confirm RVSM approved
Pilot indication that flight is RVSM approved	Affirm RVSM
Pilot will report lack of RVSM approval (Non-RVSM status):  1. On the initial call on any frequency in the RVSM airspace and ... 2. In all requests for flight level changes pertaining to flight levels within the RVSM airspace and ... 3. In all read-backs to flight level clearances pertaining to flight levels within the RVSM airspace and ... 4. In read back of flight level clearances involving climb and descent through RVSM airspace (FL290-410)	Negative RVSM, (supplementary information, e.g., "Certification flight".
Pilot report of one of the following after entry into RVSM airspace: all primary altimeters, automatic altitude control systems or altitude alerter systems have failed  <i>(This phrase is to be used to convey both the initial indication of RVSM aircraft system failure and on initial contact on all frequencies in RVSM airspace until the problem ceases to exist or the aircraft has exited RVSM airspace.)</i>	Unable RVSM Due to Equipment
ATC denial of clearance into RVSM airspace	Unable to issue clearance into RVSM airspace, maintain FL ____.
Pilot reporting severe turbulence affecting ability to maintain level	Unable RVSM due to turbulence
ATC requesting pilot to confirm that an aircraft has regained RVSM-approved status or a pilot is ready to resume RVSM	Confirm able to resume RVSM
Pilot ready to resume RVSM after aircraft system or weather contingency	Ready to resume RVSM

OPERATIONS SECTION 1 – NORMAL OPERATIONS (continued)

**6) ENTERING RVSM AIRSPACE**

- a) System Requirements
- i The following must be fully operational PRIOR to entering RVSM airspace:
    - Two Primary Altitude Measurement Systems
    - Two Air Data Computers
    - One Altitude reporting System
    - One Automatic Altitude Control System
    - One Altitude Alerting System
  - ii If TCAS II is installed, select mode TA/RA or Normal position.
  - iii Should any of the systems mentioned above fail prior to entering RVSM airspace; the pilot will request a new clearance to avoid flight in RVSM airspace.
- b) Recording / Reporting Requirements
- i In order to ensure system accuracy, provide for contingencies in the event of system errors and facilitate error tracking, the following altimetry logs should be made during flights that will enter or are flying within RVSM airspace:
    - At an appropriate point prior to entering RVSM airspace, the readings of the primary and standby altimeters should be recorded and made available for use in contingency situations. A minimum of two must agree within 200 feet.
    - For extended over-water operations, prior to the coast out point (the point where class II navigation begins), the readings from each altimeter should be recorded. A minimum of two altimeters must agree within 200 feet.
    - At each reporting point, but not to exceed one hour intervals, a crosscheck of altimeters should be made and recorded. A minimum of two altimeters must agree within 200 feet.
    - The information gathered from the two sub-paragraphs above, should be recorded on the [RVSM Altimeter Log Form](#) (using this hyperlink) as required for enroute operations.
    - The active transponder should be selected to the altimetry system being used to control the aircraft.
  - ii Failure of the altimeters to agree within 200 feet mandates a report to ATC declaring the altimetry system is discrepant.

*Note. Future systems may make use of automatic altimeter comparators in lieu of cross-checks by the crew.*

OPERATIONS SECTION 1 – NORMAL OPERATIONS (continued)

**6) ENTERING RVSM AIRSPACE** (continued)

- c) Recommended Operating Practices
  - i TCAS II (if installed) should be operated in the TA/RA mode during all operations in the RVSM airspace and Transition Areas.
  - ii Climb and descent rates in the RVSM airspace and Transition Areas should be limited to 1000 fpm when operating within five (5) NM and  $\pm 2000$  feet of other aircraft to minimize the generation of TAs and RAs.

**7) IN-FLIGHT PROCEDURES**

- a) Altimeters / Cleared Flight Level
  - i Emphasis should be placed on promptly setting the sub-scale on all primary and standby altimeters to 29.92 in. Hg/1013.2 (hPa) when passing the transition altitude and rechecking for proper altimeter setting when reaching the initial cleared flight level (CFL).
  - ii In level cruise it is essential that the aircraft is flown at the CFL. This requires that particular care is taken to ensure that ATC clearances are fully understood and followed. Except in contingency or emergency situations, the aircraft should not intentionally depart from CFL without a positive clearance from ATC.
  - iii During cleared transition between levels, the aircraft should not be allowed to overshoot or undershoot the cleared flight level by more than 150 ft (45 m).  
**Note: It is recommended that the level off be accomplished using the altitude capture feature of the automatic altitude-control system, if installed.**
  - iv 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.
  - v The altitude-alerting system should be operational.
  - vi Normally, the altimetry system being used to control the aircraft should be selected to provide the input to the altitude-reporting transponder transmitting information to ATC.
  - vii If the pilot is notified by ATC of an AAD error which exceeds 300 ft (90 m), then the pilot should take action to return to CFL as quickly as possible.
  - viii Contingency procedures after entering RVSM airspace. The pilot should notify ATC of contingencies (aircraft system failures, weather conditions), which affect the ability to maintain the CFL and co-ordinate a plan of action.

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## OPERATIONS SECTION 1 – NORMAL OPERATIONS (continued)

<b>RVSM ALTIMETER LOG</b>									
Prior to aircraft departure, record altimeter readings and known elevation. The readings must be within 50 feet of each other below 5000 feet and 75 feet above 5001 feet elevation.									
Flight No: _____ Date: _____ From: _____ To: _____									
Registration: N 865LS		CREW - PIC: _____			SIC: _____		Page: _____		
<b>Pre-Flight Altimeter Check</b>									
Time (UTC)	Position	Known Elevation	Barometric Pressure	Pilot Altimeter	Copilot Altimeter	ISIS	ISIS Setting		
<b>Prior to Entering RVSM Airspace Altimeter Check</b>									
Time (UTC)	Position	Wind (T)	Temp@	TAS	GS	Fuel Used	Fuel Remaining	Total Fuel Flow	TTG
		Pilot Altimeter		Co-pilot Altimeter		ISIS		ISIS Setting	
	FL:								
<b>Additional Enroute Altimeter Checks</b>									
Time (UTC)	Position	Wind (T)	Temp@	TAS	GS	Fuel Used	Fuel Remaining	Total Fuel Flow	TTG
		No. 1 Altimeter		No. 2 Altimeter		Standby Altimeter		Standby. Alt. Setting	
	FL:								
Time (UTC)	Position	Wind (T)	Temp@	TAS	GS	Fuel Used	Fuel Remaining	Total Fuel Flow	TTG
		Pilot Altimeter		Co-pilot Altimeter		ISIS		ISIS Setting	
	FL:								
Time (UTC)	Position	Wind (T)	Temp@	TAS	GS	Fuel Used	Fuel Remaining	Total Fuel Flow	TTG
		Pilot Altimeter		Co-pilot Altimeter		ISIS		ISIS Setting	
	FL:								

- 1) Primary and ISIS (Integrated Standby Instrument System) Altimeters are recorded in feet with QNE settings
- 2) ISIS setting is the hectapascal / inches of Mercury setting required to bring the altitude in feet to same reading as the primary altimeters.

Note: - In flight - Primary altimeters are to be within 200 ft of each other. The Standby Altimeter is noted and then set for zero difference from the primary altimeter for use in case of contingencies.

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OPERATIONS SECTION 1 – NORMAL OPERATIONS (continued)

**8) POST FLIGHT PROCEDURES**

a) FAA Reports

All incidents of height keeping error must be reported to the FAA within 72 hours of the occurrence. Errors, which must be reported, are:

- i Total Vertical Error (TVE) equal to or greater than +/- 300 feet.
  - Total Vertical Error is the vertical geometric difference between the actual pressure flown by the aircraft and its assigned pressure altitude (Flight Level)
- ii Altimetry System Error (ASE) equal to or greater than +/- 245 feet.
  - Altimetry System Error is the difference between the pressure altitude displayed to the flight crew when referenced to ISA standard ground pressure setting (29.92 in. Hg / 1013.25 hPa) and free stream pressure altitude.
- iii Assigned Altitude Deviation (AAD) equal to or greater than +/- 300 feet.
  - Assigned Altitude Deviation is the difference between the transponder Mode C altitude and the assigned altitude/flight level.

b) Flight Log Write-ups

- i Upon arrival at the aircrafts destination, the pilot shall make a clear, concise Log Book write-up of all defects in height keeping aircraft systems. The Height Keeping Error Report (Page 11) and the RVSM Status Report (Page 12) must be completed if errors are noted or as required for enroute operations. The following information should be noted when appropriate:
  - Primary and Standby Altimeter readings
  - Altitude selector setting
  - Sub-scale setting on altimeter
  - Autopilot used to control the aircraft and any differences when the alternate system was selected.
  - Transponder selected to provide altitude information to ATC and any differences in reported altitude if alternate transponder or altitude service is manually selected.

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## OPERATIONS SECTION 1 - NORMAL OPERATIONS (continued)

### HEIGHT KEEPING ERROR REPORT

AIRCRAFT: Embraer Legacy EMB-135BJ      REGISTRATION: N865LS      SERIAL No: 14501080

DATE: \_\_\_\_\_ TIME (UTC): \_\_\_\_\_ LOCATION: \_\_\_\_\_

CREW: (PIC) \_\_\_\_\_ (SIC.) \_\_\_\_\_

DISCREPANCY / ERROR: \_\_\_\_\_

ALTIMETER: \_\_\_\_\_

CREW	ADC 1	ADC 2	ALTERNATE	SETTING
PILOT				
CO-PILOT				
ISIS				

ALTITUDE SELECTOR SETTING: \_\_\_\_\_

AUTOPILOT USED: \_\_\_\_\_

ALTITUDE DIFFERENCE WITH AUTOPILOT ALT SELECTED: \_\_\_\_\_

TRANSPONDER/ADC: \_\_\_\_\_ / \_\_\_\_\_ REPORTED ALTITUDE: \_\_\_\_\_

TRANSPONDER/ADC: \_\_\_\_\_ / \_\_\_\_\_ REPORTED ALTITUDE: \_\_\_\_\_

REMARKS / FLIGHTSUMMARY: \_\_\_\_\_

CAPTAIN'S SIGNATURE: \_\_\_\_\_