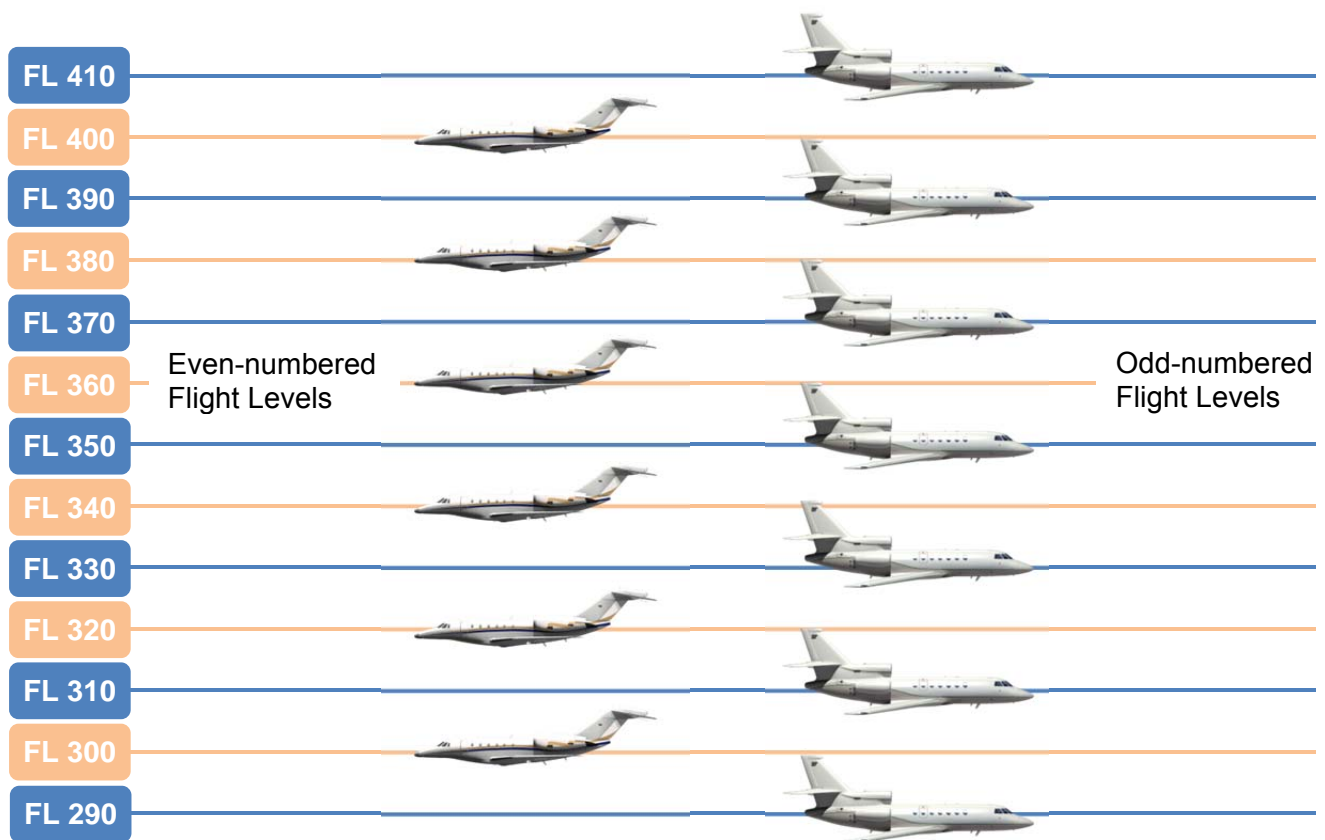


RVSM

Reduced Vertical Separation Minimum

RVSM Fundamentals

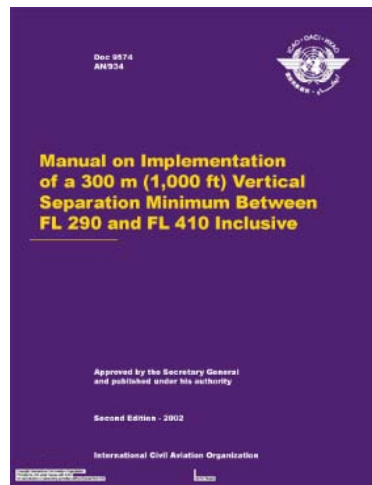
- RVSM airspace altitudes range from FL 290 to FL 410.
- FL 420 is NOT a usable altitude for Air Traffic Separation.



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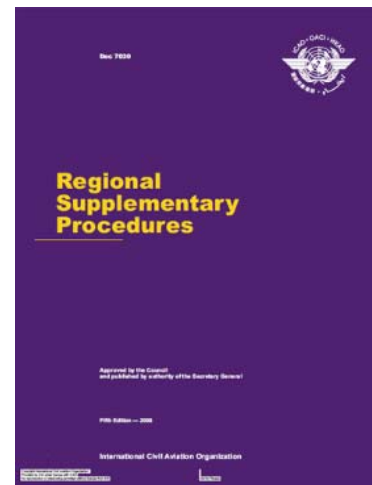
Reduced Vertical Separation Minimum (RVSM)

Source Documents



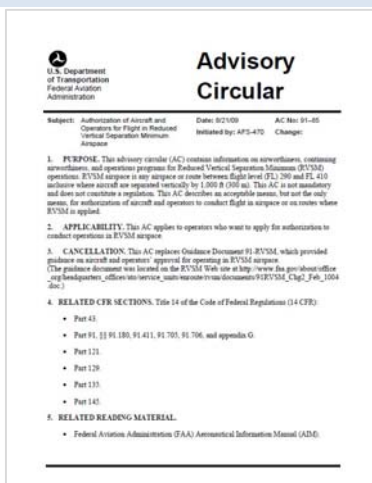
ICAO Document 9574

- Source document for RVSM source procedures.
- Describes the basics of RVSM as well as contingency procedures. It also specifies that RVSM approval granted by the appropriate approving authorities is valid in any RVSM airspace in the world.



ICAO Document 4444

Describes contingency procedures for any airspace.



FAA Advisory Circular 91-85

(Current Revision)

FAA guidance on RVSM procedures.



JAA Temporary Guidance Leaflet Number 6

(Current Revision)

EASA guidance on RVSM procedures.

Restrictions

ATC may allow the following categories of non-RVSM compliant aircraft to operate at RVSM flight levels:

- Military Aircraft
- State (government) Aircraft
- Active air ambulance aircraft utilizing a “Lifeguard” call sign (only while a “life critical patient” is onboard the aircraft)
- Flights conducted for aircraft certification and development flights for RVSM.
- Aircraft climbing or descending through RVSM airspace without leveling at RVSM altitudes. These aircraft are only accommodated as “File-and-Fly” flights.

These aircraft will be given Conventional Vertical Separation Minimums (CVSM) of 2,000-foot separation from other aircraft above FL 290.

Equipment Requirements

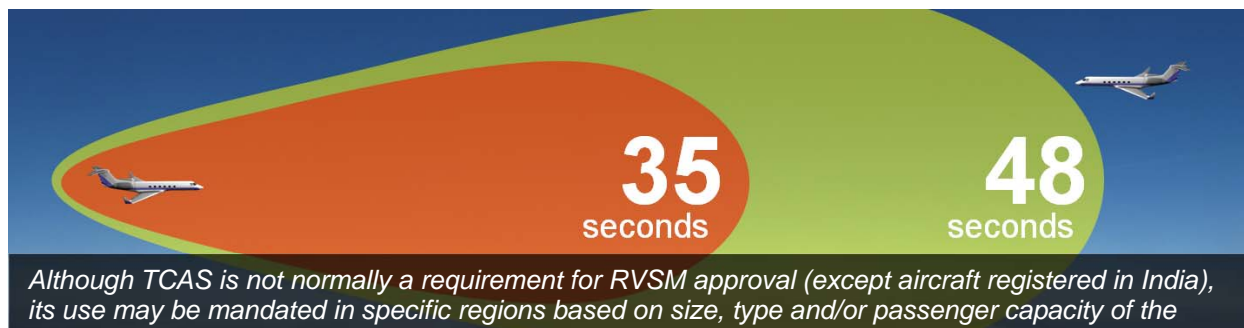
The following equipment must be operating normally before entering and while operating within RVSM airspace.

- Two independent altimetry systems for system cross-checking.
- One automatic altitude control system (the autopilot)
- An Altitude Alerting Device, and
- The Secondary Surveillance Radar altitude reporting transponder.

TCAS/ACAS Recommendations

Pilots should avoid actions that could cause a TCAS/ACAS event. It is recommended that crews should:

- Operate TCAS/ACAS II systems in the TA/RA mode during all operations with limited exceptions (engine failures, etc).
- Limit climb and descent rates to 1000 feet per minute (fpm) when in close proximity to other aircraft (5-6 nm, +/- 2000 feet).
- Use caution using a “Soft Hold” or “Turbulence Mode” of the autopilot.



Methods of Height Monitoring

All monitoring must be conducted at RVSM altitudes between FL's 290 thru 410 (FL's 291 thru 411 in China, Mongolia and North Korea).

Method	Passive	Transponder Mode	Areas of Operation
Height Monitoring Unit (HMU)	Yes	Requires Mode S	Strumble, UK; Nattenheim, Germany; Linz, Austria; Geneva, Switzerland; Setouchi, Japan.
Aircraft Geometric Height Measurement Element (AGHME)	Yes	Requires Mode S	Atlantic City, NJ; Cleveland, OH; Wichita, KS; Phoenix, AZ; Portland, OR; Lethbridge, Alberta; Ottawa, Ontario
ADS-B Based Height Monitoring System (AHMS)	Yes	Requires ADS-B	Australia; Thailand; Taiwan.
GPS Monitoring Unit (GMU)	Requires independent company representative and equipment, one hour flight time.		Can be done anywhere in the world.
Enhanced GPS Monitoring Unit (EGMU)	Requires independent company representative and equipment, one hour flight time.		Can be done anywhere in the world.
Trailing Cone	Requires independent company representative and equipment, done over the course of a flight.		Can be done anywhere in the world.

Monitoring Requirements

A defined procedure must be followed for monitoring a flight.

- Operators must submit a plan for height monitoring at the time of applying for RVSM approval.
- Approval for RVSM must be obtained prior to conducting the monitoring flight.
- You must also be listed with the appropriate height monitoring organization.
- Operators shall ensure that height-keeping performance will be monitored **at least once every two years or 1000 hours flight time, whichever is longer**. Results can be checked at a Regional Monitoring Agency (RMA) website.

Operations in RVSM Airspace

W	When filing ICAO flight plan, crews must add the letter "W" to item 10 in order to indicate that their aircraft is RVSM capable <u>and</u> that the operator has approval (Letter of Authorization) to operate in RVSM airspace.
STS/ non-RVSM	Note in item 18 on the ICAO Flight Plan to request operations in the RVSM airspace by a non-RVSM approved aircraft.
+/- 75	The difference between known elevation and elevation displayed on the altimeters should not exceed 75ft or the limits specified in aircraft operating manuals (whichever is more restrictive). The two primary altimeters should agree within limits specified by the aircraft operating manual (Maximum +/- 75 feet for European Operators).
150 ft	Using the autopilot for level-off is highly recommended. Leveling off within 150 feet of the cleared Flight Level is especially important because excessive overshoot might lead to conflict with other aircraft.
200 ft	Two primary altimeters must agree to within 200 feet when operating at RVSM altitudes.
SLOP	In remote/oceanic airspace where aircraft are not under radar surveillance, controllers may not be able to detect a loss of separation. The Strategic Lateral Offset Procedure helps to avoid these conflicts. Offsets are 1 or 2 nm to the right of the centerline for aircraft with automatic offset capability. Aircraft without automatic offset programming must fly centerline. SLOP is a Standard Operating Procedure and no ATC clearance is required. Position Reporting should be done as if on centerline when using SLOP.

Contingency Procedures

Severe Turbulence Crews experiencing an altitude deviation due to severe turbulence, should immediately contact ATC and report "*unable RVSM due turbulence.*" They should report location and magnitude of turbulence. Crews should follow ATC instructions and may request a change in Flight Level or vectors clear of traffic at adjacent Flight Levels.

Mountain Wave Mountain wave activity can induce altitude excursions and airspeed fluctuations with only light turbulence present. With sufficient amplitude, it can induce large altitude and airspeed fluctuations accompanied by turbulence. ATC could suspend RVSM operations if it affects enough aircraft operations.

Wake Turbulence Aircraft operating at RVSM flight levels routinely cross one another's flight paths with only 1,000 ft of vertical separation. A wake vortex sinks at a rate of 400 to 500 ft per minute. Unless weakened by air currents, a wake vortex can retain enough energy to seriously disrupt your height-keeping ability.

Equipment Failures Examples of equipment failures that require contingency procedures are:

- Transponder failure
- Autopilot failure
- Failure of one primary altimeter
- Failure of both primary altimeters
- Loss of communication

Special Emphasis Items

To note when operating in RVSM airspace include:

- Pilot and controller phraseology
- Crew resource management
- Standby altimeter limitations
- Visual perception problems
- Air data system relationships
- Lateral offset procedures
- Characteristics of altitude capture systems

Phraseology

For a pilot to report non-RVSM approval status.	“Negative RVSM”
For a pilot to report RVSM approval status.	“Affirm RVSM”
For a pilot of a non-RVSM approved State aircraft to report non - RVSM approval status in response to the phrase: <i>(call sign)</i> CONFIRM RVSM APPROVED.	“Negative RVSM State aircraft”
A pilot must report severe turbulence or other severe weather-related phenomenon affecting the aircraft’s ability to maintain the height-keeping requirements for RVSM.	“Unable RVSM due turbulence”
A pilot must report if aircraft’s equipment has degraded below standards required for flight within RVSM airspace. This should be repeated when making initial call on newly assigned frequency.	“Unable RVSM due equipment”
For a pilot to report the ability to resume operation within the RVSM Airspace after an equipment or weather-related contingency.	“Ready to resume RVSM”
For a controller to confirm that an aircraft has regained its RVSM compliant status, or to confirm that the pilot is ready to resume RVSM operations.	“Report able to resume RVSM”
For a controller to ascertain the RVSM approval status of an aircraft.	“(call sign) confirm RVSM approved”
Denial of clearance into the RVSM Airspace.	“(call sign) unable clearance into RVSM airspace, maintain (or descend to/climb to) flight level (number)”

Regional Differences

Some countries accommodate non-RVSM compliant air ambulances. However; crews should not plan on that happening in all cases.

Another regional difference in RVSM airspace is handling of transitions through RVSM airspace by non-RVSM compliant aircraft. Congested airspace such as in Europe and certain areas in North America, non-RVSM compliant aircraft will be held at FL 280 or below. Less congested areas may allow a continuous climb or descent through the RVSM airspace.

RVSM in Russia

RVSM will be applied to airspace between **FL 290-410 ft** (8,550m-12,500m) inclusive.

Above transition altitude Flight Levels will be assigned in feet, the same as other RVSM regions. Altitude assignments below transition level will be in meters based on QFE altimeter settings (QNH on request). Speeds will be in knots True Airspeed.

State aircraft operators shall insert “M” in item 8 of FPL. State aircraft operators who do not have RVSM approval shall not insert “W” in item 10 of FPL. If requesting FL290 or above, STS/NONRVSM shall be included in item 18 of FPL and shall insert entry/exit points and a requested flight level in item 15.

Aircraft operators who intend to operate formation flights such as general air traffic (GAT) regardless of their RVSM approval status should include “STS/NONRVSM” in item 18. The letter “W” should not be inserted into Item 10 regardless of the RVSM status of the aircraft in the formation.

RVSM in China, Mongolia, and North Korea

China, Mongolia and North Korea’s RVSM airspace maintains the same essential characteristics of RVSM seen in other parts of the world, but unlike other regions, these countries use the metric system for altitude assignments ranging from 8,900 meters (FL 291) to 12,500 meters (FL 411) with 300 meter separation between flight levels.

Use the China/Mongolian Flight Level Allocation Scheme (or FLAS) Conversion Table to convert the metric clearance into the equivalent standard flight level. Crews are reminded that although the altitudes will be assigned in meters, crews are required to fly the altitudes in FEET, even if the aircraft has the capability of a metric readout on their altimeter. This will assure the proper altitudes are being flown.

When completing a flight plan requesting a metric RVSM Flight Level (China and Mongolia) indicate with an S followed by a 4 digit Flight Level in meters.

Chinese/Mongolian/Russian Airspace if rapid descent is required:

If unable to contact ATC and rapid descent required:

Turn 30° right and track out 20 kilometers (i.e. deviate right of airway centerline by 10 km or 5 nm), then, turn left to track parallel the original route, then descend to the new level, and then return to the original route (when appropriate). *Note: when returning to the original route, be aware that there may be conflicting traffic on that route.*

Establish communications with and alert nearby aircraft by broadcasting, at suitable intervals: flight identification, flight level, aircraft position and intention on the frequency in use, as well as on frequency 121.5 MHz (or, as a backup, the VHF inter-pilot air-to-air frequency 123.45 MHz). Establish visual contact with conflicting traffic and turn on all aircraft exterior lights.

Oceanic Airspace:

If you lose RVSM capability:

1. Notify ATC of any equipment failure and intended course of action.
2. Maintain the CFL and route, provided that the aircraft can maintain level.
3. Requesting ATC clearance to climb above or descend below RVSM airspace if the aircraft cannot maintain CFL and ATC cannot establish lateral, longitudinal or conventional vertical separation.
4. Executing the Doc 4444 contingency maneuver to offset from the assigned track and FL, if ATC clearance cannot be obtained or the aircraft cannot maintain CFL.
5. Watch for conflicting traffic both visually and by reference to TCAS, if equipped.
6. Alert nearby aircraft by making maximum use of exterior lights.
7. Broadcast position, FL, and intentions on 121.5 MHz (as a back-up, the VHF inter-pilot air-to-air frequency (123.45 MHz) may be used.)

Turbulence – follow above guidance

ICAO Doc 4444 Procedure

