

# Appendix G to Part 91—Operations in Reduced Vertical Separation Minimum (RVSM) Airspace

## Section 1. Definitions

Reduced Vertical Separation Minimum (RVSM) Airspace. Within RVSM airspace, air traffic control (ATC) separates aircraft by a minimum of 1,000 feet vertically between flight level (FL) 290 and FL 410 inclusive. RVSM airspace is special qualification airspace; the operator and the aircraft used by the operator must be approved by the Administrator. Air-traffic control notifies operators of RVSM by providing route planning information. Section 8 of this appendix identifies airspace where RVSM may be applied.

RVSM Group Aircraft. Aircraft within a group of aircraft, approved as a group by the Administrator, in which each of the aircraft satisfy each of the following:

- (a) The aircraft have been manufactured to the same design, and have been approved under the same type certificate, amended type certificate, or supplemental type certificate.
- (b) The static system of each aircraft is installed in a manner and position that is the same as those of the other aircraft in the group. The same static source error correction is incorporated in each aircraft of the group.
- (c) The avionics units installed in each aircraft to meet the minimum RVSM equipment requirements of this appendix are:
  - (1) Manufactured to the same manufacturer specification and have the same part number; or
  - (2) Of a different manufacturer or part number, if the applicant demonstrates that the equipment provides equivalent system performance.

RVSM Nongroup Aircraft. An aircraft that is approved for RVSM operations as an individual aircraft.

RVSM Flight envelope. An RVSM flight envelope includes the range of Mach number, weight divided by atmospheric pressure ratio, and altitudes over which an aircraft is approved to be operated in cruising flight within RVSM airspace. RVSM flight envelopes are defined as follows:

- (a) The full RVSM flight envelope is bounded as follows:
  - (1) The altitude flight envelope extends from FL 290 upward to the lowest altitude of the following:
    - (i) FL 410 (the RVSM altitude limit);
    - (ii) The maximum certificated altitude for the aircraft; or
    - (iii) The altitude limited by cruise thrust, buffet, or other flight limitations.
  - (2) The airspeed flight envelope extends:
    - (i) From the airspeed of the slats/flaps-up maximum endurance (holding) airspeed, or the maneuvering airspeed, whichever is lower;
    - (ii) To the maximum operating airspeed (V<sub>mo</sub>/M<sub>mo</sub>), or airspeed limited by cruise thrust buffet, or other flight limitations, whichever is lower.
  - (3) All permissible gross weights within the flight envelopes defined in paragraphs (1) and (2) of this definition.
- (b) The basic RVSM flight envelope is the same as the full RVSM flight envelope except that the airspeed flight envelope extends:
  - (1) From the airspeed of the slats/flaps-up maximum endurance (holding) airspeed, or the maneuver airspeed, whichever is lower;

(2) To the upper Mach/airspeed boundary defined for the full RVSM flight envelope, or a specified lower value not less than the long-range cruise Mach number plus .04 Mach, unless further limited by available cruise thrust, buffet, or other flight limitations.

## Section 2. Aircraft Approval

(a) An operator may be authorized to conduct RVSM operations if the Administrator finds that its aircraft comply with this section.

(b) The applicant for authorization shall submit the appropriate data package for aircraft approval. The package must consist of at least the following:

- (1) An identification of the RVSM aircraft group or the nongroup aircraft;
- (2) A definition of the RVSM flight envelopes applicable to the subject aircraft;
- (3) Documentation that establishes compliance with the applicable RVSM aircraft requirements of this section; and
- (4) The conformity tests used to ensure that aircraft approved with the data package meet the RVSM aircraft requirements.

(c) Altitude-keeping equipment: All aircraft. To approve an aircraft group or a nongroup aircraft, the Administrator must find that the aircraft meets the following requirements:

- (1) The aircraft must be equipped with two operational independent altitude measurement systems.
- (2) The aircraft must be equipped with at least one automatic altitude control system that controls the aircraft altitude—
  - (i) Within a tolerance band of  $\pm 65$  feet about an acquired altitude when the aircraft is operated in straight and level flight under nonturbulent, nongust conditions; or
  - (ii) Within a tolerance band of  $\pm 130$  feet under nonturbulent, nongust conditions for aircraft for which application for type certification occurred on or before April 9, 1997 that are equipped with an automatic altitude control system with flight management/performance system inputs.
- (3) The aircraft must be equipped with an altitude alert system that signals an alert when the altitude displayed to the flight crew deviates from the selected altitude by more than:
  - (i)  $\pm 300$  feet for aircraft for which application for type certification was made on or before April 9, 1997; or
  - (ii)  $\pm 200$  feet for aircraft for which application for type certification is made after April 9, 1997.

(d) Altimetry system error containment: Group aircraft for which application for type certification was made on or before April 9, 1997. To approve group aircraft for which application for type certification was made on or before April 9, 1997, the Administrator must find that the altimetry system error (ASE) is contained as follows:

- (1) At the point in the basic RVSM flight envelope where mean ASE reaches its largest absolute value, the absolute value may not exceed 80 feet.
- (2) At the point in the basic RVSM flight envelope where mean ASE plus three standard deviations reaches its largest absolute value, the absolute value may not exceed 200 feet.
- (3) At the point in the full RVSM flight envelope where mean ASE reaches its largest absolute value, the absolute value may not exceed 120 feet.
- (4) At the point in the full RVSM flight envelope where mean ASE plus three standard deviations reaches its largest absolute value, the absolute value may not exceed 245 feet.
- (5) Necessary operating restrictions. If the applicant demonstrates that its aircraft otherwise comply with the ASE containment requirements, the Administrator may establish an operating restriction on that applicant's aircraft to restrict the aircraft from operating in areas of the basic RVSM flight envelope where the absolute value of mean ASE exceeds 80 feet, and/or the absolute value of mean ASE plus three standard deviations exceeds 200 feet; or from operating in areas of the full RVSM flight envelope where the absolute value of the mean ASE exceeds 120 feet and/or the absolute value of the mean ASE plus three standard deviations exceeds 245 feet.

(e) Altimetry system error containment: Group aircraft for which application for type certification is made after April 9, 1997. To approve group aircraft for which application for type certification is made after April 9, 1997, the Administrator must find that the altimetry system error (ASE) is contained as follows:

- (1) At the point in the full RVSM flight envelope where mean ASE reaches its largest absolute value, the absolute value may not exceed 80 feet.
- (2) At the point in the full RVSM flight envelope where mean ASE plus three standard deviations reaches its largest absolute value, the absolute value may not exceed 200 feet.

(f) Altimetry system error containment: Nongroup aircraft. To approve a nongroup aircraft, the Administrator must find that the altimetry system error (ASE) is contained as follows:

- (1) For each condition in the basic RVSM flight envelope, the largest combined absolute value for residual static source error plus the avionics error may not exceed 160 feet.
- (2) For each condition in the full RVSM flight envelope, the largest combined absolute value for residual static source error plus the avionics error may not exceed 200 feet.

(g) Traffic Alert and Collision Avoidance System (TCAS) Compatibility With RVSM Operations: All aircraft. After March 31, 2002, unless otherwise authorized by the Administrator, if you operate an aircraft that is equipped with TCAS II in RVSM airspace, it must be a TCAS II that meets TSO C-119b (Version 7.0), or a later version.

(h) If the Administrator finds that the applicant's aircraft comply with this section, the Administrator notifies the applicant in writing.

### **Section 3. Operator Authorization**

(a) Authority for an operator to conduct flight in airspace where RVSM is applied is issued in operations specifications, a Letter of Authorization, or management specifications issued under subpart K of this part, as appropriate. To issue an RVSM authorization, the Administrator must find that the operator's aircraft have been approved in accordance with Section 2 of this appendix and the operator complies with this section.

(b) An applicant for authorization to operate within RVSM airspace shall apply in a form and manner prescribed by the Administrator. The application must include the following:

- (1) An approved RVSM maintenance program outlining procedures to maintain RVSM aircraft in accordance with the requirements of this appendix. Each program must contain the following:
  - (i) Periodic inspections, functional flight tests, and maintenance and inspection procedures, with acceptable maintenance practices, for ensuring continued compliance with the RVSM aircraft requirements.
  - (ii) A quality assurance program for ensuring continuing accuracy and reliability of test equipment used for testing aircraft to determine compliance with the RVSM aircraft requirements.
  - (iii) Procedures for returning noncompliant aircraft to service.
- (2) For an applicant who operates under part 121 or 135 of this chapter or under subpart K of this part, initial and recurring pilot training requirements.
- (3) Policies and procedures: An applicant who operates under part 121 or 135 of this chapter or under subpart K of this part must submit RVSM policies and procedures that will enable it to conduct RVSM operations safely.

(c) Validation and Demonstration. In a manner prescribed by the Administrator, the operator must provide evidence that:

- (1) It is capable to operate and maintain each aircraft or aircraft group for which it applies for approval to operate in RVSM airspace; and
- (2) Each pilot has an adequate knowledge of RVSM requirements, policies, and procedures.

## **Section 4. RVSM Operations**

(a) Each person requesting a clearance to operate within RVSM airspace shall correctly annotate the flight plan filed with air traffic control with the status of the operator and aircraft with regard to RVSM approval. Each operator shall verify RVSM applicability for the flight planned route through the appropriate flight planning information sources.

(b) No person may show, on the flight plan filed with air traffic control, an operator or aircraft as approved for RVSM operations, or operate 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 Section 2 of this appendix.

## **Section 5. Deviation Authority Approval**

The Administrator may authorize an aircraft operator to deviate from the requirements of §91.180 or §91.706 for a specific flight in RVSM airspace if that operator has not been approved in accordance with section 3 of this appendix if:

(a) The operator submits a request in a time and manner acceptable to the Administrator; and

(b) At the time of filing the flight plan for that flight, ATC determines that the aircraft may be provided appropriate separation and that the flight will not interfere with, or impose a burden on, the operations of operators who have been approved for RVSM operations in accordance with Section 3 of this appendix.

## **Section 6. Reporting Altitude-Keeping Errors**

Each operator shall report to the Administrator each event in which the operator's aircraft has exhibited the following altitude-keeping performance:

- (a) Total vertical error of 300 feet or more;
- (b) Altimetry system error of 245 feet or more; or
- (c) Assigned altitude deviation of 300 feet or more.

## **Section 7. Removal or Amendment of Authority**

The Administrator may amend operations specifications or management specifications issued under subpart K of this part to revoke or restrict an RVSM authorization, or may revoke or restrict an RVSM letter of authorization, if the Administrator determines that the operator is not complying, or is unable to comply, with this appendix or subpart H of this part. 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.

## Section 8. Airspace Designation

(a) RVSM in the North Atlantic.

(1) RVSM may be applied in the NAT in the following ICAO Flight Information Regions (FIRs): New York Oceanic, Gander Oceanic, Sondrestrom FIR, Reykjavik Oceanic, Shanwick Oceanic, and Santa Maria Oceanic.

(2) RVSM may be effective in the Minimum Navigation Performance Specification (MNPS) airspace within the NAT. The MNPS airspace within the NAT is defined by the volume of airspace between FL 285 and FL 420 (inclusive) extending between latitude 27 degrees north and the North Pole, bounded in the east by the eastern boundaries of control areas Santa Maria Oceanic, Shanwick Oceanic, and Reykjavik Oceanic and in the west by the western boundaries of control areas Reykjavik Oceanic, Gander Oceanic, and New York Oceanic, excluding the areas west of 60 degrees west and south of 38 degrees 30 minutes north.

(b) RVSM in the Pacific.

(1) RVSM may be applied in the Pacific in the following ICAO Flight Information Regions (FIRs): Anchorage Arctic, Anchorage Continental, Anchorage Oceanic, Auckland Oceanic, Brisbane, Edmonton, Honiara, Los Angeles, Melbourne, Nadi, Naha, Nauru, New Zealand, Oakland, Oakland Oceanic, Port Moresby, Seattle, Tahiti, Tokyo, Ujung Pandang and Vancouver.

(c) RVSM in the West Atlantic Route System (WATRS). RVSM may be applied in the New York FIR portion of the West Atlantic Route System (WATRS). The area is defined as beginning at a point 38°30' N/60°00' W direct to 38°30' N/69°15' W direct to 38°20' N/69°57' W direct to 37°31' N/71°41' W direct to 37°13' N/72°40' W direct to 35°05' N/72°40' W direct to 34°54' N/72°57' W direct to 34°29' N/73°34' W direct to 34°33' N/73°41' W direct to 34°19' N/74°02' W direct to 34°14' N/73°57' W direct to 32°12' N/76°49' W direct to 32°20' N/77°00' W direct to 28°08' N/77°00' W direct to 27°50' N/76°32' W direct to 27°50' N/74°50' W direct to 25°00' N/73°21' W direct to 25°00'05' N/69°13'06' W direct to 25°00' N/69°07' W direct to 23°30' N/68°40' W direct to 23°30' N/60°00' W to the point of beginning.

(d) RVSM in the United States. RVSM may be applied in the airspace of the 48 contiguous states, District of Columbia, and Alaska, including that airspace overlying the waters within 12 nautical miles of the coast.

(e) RVSM in the gulf of Mexico. RVSM may be applied in the Gulf of Mexico in the following areas: Gulf of Mexico High Offshore Airspace, Houston Oceanic ICAO FIR and Miami Oceanic ICAO FIR.

(f) RVSM in Atlantic High Offshore Airspace and the San Juan FIR. RVSM may be applied in Atlantic High Offshore Airspace and in the San Juan ICAO FIR.

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