

## **Subpart D - Operations in airspace with reduced vertical separation minima (RVSM)**

### **AMC1 SPA.RVSM.105 RVSM operational approval**

#### CONTENT OF OPERATOR RVSM APPLICATION

The following material should be made available to the competent authority, in sufficient time to permit evaluation, before the intended start of RVSM operations:

(a) Airworthiness documents

Documentation that shows that the aircraft has RVSM airworthiness approval. This should include an aircraft flight manual (AFM) amendment or supplement.

(b) Description of aircraft equipment

A description of the aircraft appropriate to operations in an RVSM environment.

(c) Training programmes, operating practices and procedures

The operator should submit training syllabi for initial and recurrent training programmes together with other relevant material. The material should show that the operating practices, procedures and training items, related to RVSM operations in airspace that requires State operational approval, are incorporated.

(d) Operations manual and checklists

The appropriate manuals and checklists should be revised to include information/guidance on standard operating procedures. Manuals should contain a statement of the airspeeds, altitudes and weights considered in RVSM aircraft approval, including identification of any operating limitations or conditions established for that aircraft type. Manuals and checklists may need to be submitted for review by the competent authority as part of the application process.

(e) Past performance

Relevant operating history, where available, should be included in the application. The applicant should show that any required changes have been made in training, operating or maintenance practices to improve poor height-keeping performance.

(f) Minimum equipment list

Where applicable, a minimum equipment list (MEL), adapted from the master minimum equipment list (MMEL), should include items pertinent to operating in RVSM airspace.

(g) Plan for participation in verification/monitoring programmes

The operator should establish a plan for participation in any applicable verification/monitoring programme acceptable to the competent authority. This plan should include, as a minimum, a check on a sample of the operator's fleet by an regional monitoring agency (RMA)'s independent height-monitoring system.

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## OPERATING PROCEDURES

## (a) Flight planning

- (1) During flight planning the flight crew should pay particular attention to conditions that may affect operation in RVSM airspace. These include, but may not be limited to:
  - (i) verifying that the airframe is approved for RVSM operations;
  - (ii) reported and forecast weather on the route of flight;
  - (iii) minimum equipment requirements pertaining to height-keeping and alerting systems; and
  - (iv) any airframe or operating restriction related to RVSM operations.

## (b) Pre-flight procedures

- (1) The following actions should be accomplished during the pre-flight procedure:
  - (i) Review technical logs and forms to determine the condition of equipment required for flight in the RVSM airspace. Ensure that maintenance action has been taken to correct defects to required equipment.
  - (ii) During the external inspection of aircraft, particular attention should be paid to the condition of static sources and the condition of the fuselage skin near each static source and any other component that affects altimetry system accuracy. This check may be accomplished by a qualified and authorised person other than the pilot (e.g. a flight engineer or ground engineer).
  - (iii) Before take-off, the aircraft altimeters should be set to the QNH (atmospheric pressure at nautical height) of the airfield and should display a known altitude, within the limits specified in the aircraft operating manuals. The two primary altimeters should also agree within limits specified by the aircraft operating manual. An alternative procedure using QFE (atmospheric pressure at aerodrome elevation/runway threshold) may also be used. The maximum value of acceptable altimeter differences for these checks should not exceed 23 m (75 ft). Any required functioning checks of altitude indicating systems should be performed.
  - (iv) Before take-off, equipment required for flight in RVSM airspace should be operative and any indications of malfunction should be resolved.

## (c) Prior to RVSM airspace entry

- (1) The following equipment should be operating normally at entry into RVSM airspace:
  - (i) two primary altitude measurement systems. A cross-check between the primary altimeters should be made. A minimum of two will need to agree within  $\pm 60$  m ( $\pm 200$  ft). Failure to meet this condition will

require that the altimetry system be reported as defective and air traffic control (ATC) notified;

- (ii) one automatic altitude-control system;
  - (iii) one altitude-alerting device; and
  - (iv) operating transponder.
- (2) Should any of the required equipment fail prior to the aircraft entering RVSM airspace, the pilot should request a new clearance to avoid entering this airspace.
- (d) In-flight procedures
- (1) The following practices should be incorporated into flight crew training and procedures:
- (i) Flight crew should comply with any aircraft operating restrictions, if required for the specific aircraft type, e.g. limits on indicated Mach number, given in the RVSM airworthiness approval.
  - (ii) Emphasis should be placed on promptly setting the sub-scale on all primary and standby altimeters to 1013.2 hPa / 29.92 in Hg when passing the transition altitude, and rechecking for proper altimeter setting when reaching the initial cleared flight level.
  - (iii) In level cruise it is essential that the aircraft is flown at the cleared flight level. This requires that particular care is taken to ensure that ATC clearances are fully understood and followed. The aircraft should not intentionally depart from cleared flight level without a positive clearance from ATC unless the crew are conducting contingency or emergency manoeuvres.
  - (iv) When changing levels, the aircraft should not be allowed to overshoot or undershoot the cleared flight level by more than 45 m (150 ft). If installed, the level off should be accomplished using the altitude capture feature of the automatic altitude-control system.
  - (v) 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. Following loss of the automatic height-keeping function, any consequential restrictions will need to be observed.
  - (vi) Ensure that the altitude-alerting system is operative.
  - (vii) At intervals of approximately 1 hour, cross-checks between the primary altimeters should be made. A minimum of two will need to agree within  $\pm 60$  m ( $\pm 200$  ft). Failure to meet this condition will require that the altimetry system be reported as defective and ATC notified or contingency procedures applied:
    - (A) the usual scan of flight deck instruments should suffice for altimeter cross-checking on most flights; and

- (B) before entering RVSM airspace, the initial altimeter cross-check of primary and standby altimeters should be recorded.
  - (viii) In normal operations, the altimetry system being used to control the aircraft should be selected for the input to the altitude reporting transponder transmitting information to ATC.
  - (ix) If the pilot is notified by ATC of a deviation from an assigned altitude exceeding  $\pm 90$  m ( $\pm 300$  ft) then the pilot should take action to return to cleared flight level as quickly as possible.
- (2) Contingency procedures after entering RVSM airspace are as follows:
- (i) The pilot should notify ATC of contingencies (equipment failures, weather) that affect the ability to maintain the cleared flight level and coordinate a plan of action appropriate to the airspace concerned. The pilot should obtain the guidance on contingency procedures is contained in the relevant publications dealing with the airspace.
  - (ii) Examples of equipment failures that should be notified to ATC are:
    - (A) failure of all automatic altitude-control systems aboard the aircraft;
    - (B) loss of redundancy of altimetry systems;
    - (C) loss of thrust on an engine necessitating descent; or
    - (D) any other equipment failure affecting the ability to maintain cleared flight level.
  - (iii) The pilot should notify ATC when encountering greater than moderate turbulence.
  - (iv) If unable to notify ATC and obtain an ATC clearance prior to deviating from the cleared flight level, the pilot should follow any established contingency procedures for the region of operation and obtain ATC clearance as soon as possible.
- (e) Post-flight procedures
- (1) In making technical log entries against malfunctions in height-keeping systems, the pilot should provide sufficient detail to enable maintenance to effectively troubleshoot and repair the system. The pilot should detail the actual defect and the crew action taken to try to isolate and rectify the fault.
  - (2) The following information should be recorded when appropriate:
    - (i) primary and standby altimeter readings;
    - (ii) altitude selector setting;
    - (iii) subscale setting on altimeter;
    - (iv) autopilot used to control the aircraft and any differences when an alternative autopilot system was selected;
    - (v) differences in altimeter readings, if alternate static ports selected;
    - (vi) use of air data computer selector for fault diagnosis procedure; and

- (vii) the transponder selected to provide altitude information to ATC and any difference noted when an alternative transponder was selected.
- (f) Crew training
- (1) The following items should also be included in flight crew training programmes:
    - (i) knowledge and understanding of standard ATC phraseology used in each area of operations;
    - (ii) importance of crew members cross-checking to ensure that ATC clearances are promptly and correctly complied with;
    - (iii) use and limitations in terms of accuracy of standby altimeters in contingencies. Where applicable, the pilot should review the application of static source error correction/position error correction through the use of correction cards; such correction data should be available on the flight deck;
    - (iv) problems of visual perception of other aircraft at 300 m (1 000 ft) planned separation during darkness, when encountering local phenomena such as northern lights, for opposite and same direction traffic, and during turns;
    - (v) characteristics of aircraft altitude capture systems that may lead to overshoots;
    - (vi) relationship between the aircraft's altimetry, automatic altitude control and transponder systems in normal and abnormal conditions; and
    - (vii) any airframe operating restrictions, if required for the specific aircraft group, related to RVSM airworthiness approval.

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SPECIFIC REGIONAL PROCEDURES

- (a) The areas of applicability (by Flight Information Region) of RVSM airspace in identified ICAO regions is contained in the relevant sections of ICAO Document 7030/4. In addition, these sections contain operating and contingency procedures unique to the regional airspace concerned, specific flight planning requirements and the approval requirements for aircraft in the designated region.
- (b) Comprehensive guidance on operational matters for European RVSM airspace is contained in EUROCONTROL Document ASM ET1.ST.5000 entitled "The ATC Manual for a Reduced Vertical Separation (RVSM) in Europe" with further material included in the relevant State aeronautical publications.

**AMC1 SPA.RVSM.110(a) RVSM equipment requirements**

TWO INDEPENDENT ALTITUDE MEASUREMENT SYSTEMS

Each system should be composed of the following components:

- (a) cross-coupled static source/system, with ice protection if located in areas subject to ice accretion;
- (b) equipment for measuring static pressure sensed by the static source, converting it to pressure altitude and displaying the pressure altitude to the flight crew:
- (c) equipment for providing a digitally encoded signal corresponding to the displayed pressure altitude, for automatic altitude reporting purposes;
- (d) static source error correction (SSEC), if needed to meet the performance criteria for RVSM flight envelopes; and
- (e) signals referenced to a flight crew selected altitude for automatic control and alerting. These signals will need to be derived from an altitude measurement system meeting the performance criteria for RVSM flight envelopes.