

Chapter 3

AIRCRAFT REQUIREMENTS AND APPROVAL

3.1 RVSM HEIGHT-KEEPING PERFORMANCE

3.1.1 Altimetry system and altitude-keeping characteristics were developed to satisfy the global height-keeping performance specification as described in 2.3. They describe the performance level that aircraft need to be capable of achieving in service, exclusive of Human Factors and extreme environmental influences, if the airspace system TVE requirements are to be satisfied.

3.1.2 The aforementioned characteristics were translated by technical bodies into airworthiness standards through the assessment of the characteristics of ASE and automatic altitude control. These standards comprise the in-service aircraft height-keeping requirements for RVSM operations and form part of the RVSM MASPS. The RVSM MASPS includes specifications and procedures for the separate aspects of type approval, release from production, and continued airworthiness and is included in the following documents for global application:

- a) Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL) No. 6 — *Guidance Material on the Approval of Aircraft and Operators for Flight in Airspace above Flight Level 290 where a 300 m (1 000 ft) Vertical Separation Minimum is Applied* — or any subsequent version thereof; or
- b) Federal Aviation Administration (FAA) Document 91-RVSM, *Guidance Material on the Approval of Operators/Aircraft for RVSM Operations*.

These documents are an acceptable means for RVSM approval and were developed in compliance with the guidance material in this manual.

3.2 AIRWORTHINESS APPROVAL

Introduction

3.2.1 Airworthiness approval must in all cases be in accordance with the requirements of the RVSM MASPS. As stated in 3.1.2, the RVSM MASPS, in addition to characterizing the ASE and automatic height-keeping capability requirements, also contains specifications and procedures for type approval and continued airworthiness.

3.2.2 All approvals will be applicable to an individual aircraft or to a group of aircraft, as defined in 3.2.3, that are nominally identical in aerodynamic design and items of equipment contributing to height-keeping accuracy.

Definition of aircraft type groupings

3.2.3 For aircraft to be considered as part of a group for the purposes of airworthiness approval, the following conditions should be satisfied:

- a) the aircraft should have been constructed to a nominally identical design and should be approved on the same Type Certificate (TC), TC amendment, or Supplemental TC, as applicable;

Note.— For derivative aircraft, it may be possible to use the data from the parent configuration to minimize the amount of additional data required to show compliance. The extent of additional data required will depend on the nature of the differences between the parent aircraft and the derivative aircraft.

- b) the static system of each aircraft should be nominally identical. The static source error (SSE) corrections should be the same for all aircraft of the group; and
- c) the avionics units installed on each aircraft to meet the minimum RVSM equipment criteria should comply with the manufacturer's same specification and have the same part number.

Note.— Aircraft that have avionics units which are of a different manufacturer or part number may be considered part of the group if it can be demonstrated that this standard of avionics equipment provides equivalent system performance.

3.2.4 If an airframe does not meet the conditions of 3.2.3 a) to c) to qualify as a part of a group, and is presented as an individual airframe for approval, it will be considered to be a non-group aircraft. The significance of this is that the certification processes for group and non-group aircraft are different.

Continued airworthiness

3.2.5 It is imperative that all aircraft continue, during their service life, to satisfy the requirements of the RVSM MASPS. While height-monitoring data from independent sources, as recommended by ICAO, should help to detect any long-term deterioration in altimetry system performance, it is nevertheless essential that certifying authorities ensure that, as part of the approval process, operator maintenance and inspection practices are reviewed and updated to reflect the specific airworthiness requirements applicable to RVSM operations.

3.3 STATE RVSM APPROVAL

Approval process

3.3.1 Where RVSM is applied, the specific aircraft type or types that the operator intends to use will need to be approved by the State of Registry of the aircraft or of the aircraft operator. RVSM approval will encompass the following elements:

- a) *Airworthiness approval (including continued airworthiness).* The aircraft will be approved as meeting the requirements of the appropriate State airworthiness document derived from the height-keeping capability requirements as defined by the RVSM MASPS. Furthermore, the aircraft altimetry and height-keeping equipment must be maintained in accordance with approved procedures and servicing schedules; and
- b) *Operational approval.* As defined by ICAO regional air navigation agreements, it may be necessary for an operator to hold a separate RVSM-specific operational approval in addition to an RVSM airworthiness approval to operate in RVSM airspace. Section 4.2 contains guidance on operational procedures that an operator may need to adopt for such airspace where RVSM is applied, including advice on the material that may need to be submitted for review by the authority responsible.

Validity of approval

3.3.2 RVSM approval issued for one region will always be valid for RVSM operations in another region provided specific restrictions have not been imposed on the operator by the State of the Operator or State of Registry.

Confirmation of approval status

3.3.3 Continuity of RVSM operations is dependent on the establishment of an aircraft approval confirmation process, which is intended to exclude unqualified aircraft and operators from operating in RVSM airspace unless the appropriate separation is applied. The process may have regional variations, but the primary responsibility for confirmation of the approval status of an aircraft/operator must rest with the State of the Operator/State of Registry. The confirmation process will be facilitated by the application of the following measures:

- a) maintaining a comprehensive record of all approvals granted for operations in RVSM airspace;
- b) providing the approvals records in 3.3.3 a) to the regional monitoring agency (RMA) for inclusion in its regional RVSM-approvals database; and
- c) including a check of the approval status of aircraft/operators in the schedule of routine in-flight inspections.

3.3.4 At the appropriate level, a secondary responsibility should rest with the air traffic services (ATS) provider States to institute routine checks of the approval status of aircraft operating within their area of authority and intending to operate in RVSM airspace. Apart from the scrutiny activities conducted by the relevant RMA, this responsibility could be met by:

- a) scrutinizing ATS flight plans;
- b) conducting cross-checks against the regional RVSM-approvals database, taking into account the currency of its contents; and
- c) querying operators that are suspected of not being in compliance with the airspace requirements.

3.3.5 Depending on State regulations, ATC clearances may be withheld for operations that are not in compliance with the airspace requirements.

3.3.6 In conjunction with the ATS provider, a further level of confirmation of approval can be affected by the RMA of a region in which RVSM applies. This can be achieved by the RMA taking action, following a query by a controlling authority, to obtain confirmation of approval status from the State of the Operator/State of Registry of aircraft which are not listed in an RVSM-approvals database.

Note.— The role of the RMA is covered in detail in 5.4.4.

3.3.7 The State of the Operator/State of Registry should formulate policies and courses of action with respect to aircraft/operators that are found to be operating in RVSM airspace without approval, which could jeopardize the safety of other users of the airspace.

Chapter 4

PROCEDURES

4.1 GENERAL PROCEDURES

Cruising levels

4.1.1 The table of cruising levels specified in Appendix 3 of Annex 2 to the Convention on International Civil Aviation, for use in RVSM airspace, shall be used.

4.2 FLIGHT CREW OPERATING PROCEDURES

In-flight procedures

4.2.1 Generally, flight crew operating procedures in RVSM airspace are no different from those in any other airspace; however, the continuity of RVSM operations will require periodic review of procedures specific to a region, e.g. contingency procedures, and should be reflected in regional documentation. Given the safety requirements and the effect large height deviations could have on the risk levels, crews should be reminded to exercise vigilance to minimize the occurrence of deviations from the cleared flight level. To this end, during routine training, flight crews should be reminded of the importance of adhering to the following in-flight procedures:

- a) in level cruise it is essential that the aircraft be flown at the cleared flight level (CFL). This requires that particular care be taken to ensure that ATC clearances are fully understood and complied with. Except in the event of an emergency, the aircraft should not intentionally depart from CFL without a clearance from ATC;
- b) during cleared transition between levels, the aircraft should not be allowed to overshoot or undershoot the new flight level by more than 45 m (150 ft);

Note.—The transition should be accomplished using the altitude capture feature of the automatic altitude-keeping device, if installed.

- c) an automatic altitude-keeping device should be operative and engaged during level cruise, except when circumstances such as turbulence or the need to re-trim the aircraft require its disengagement. In any event, adherence to cruise altitude should be done by reference to one of the two altimeters required by the RVSM MASPS;
- d) the altitude-alerting device should be operating and engaged;
- e) regular (hourly) cross-checks between the altimeters should be made, and a minimum of two RVSM MASPS-compliant systems must agree within 60 m (200 ft). Failure to meet this condition will require that the system be reported as defective and notified to ATC;

- f) the operating altitude-reporting transponder should be connected to the RVSM MASPS-compliant altimetry system being used to control the aircraft;
- g) before entering RVSM airspace, the pilot should review the status of equipment required. The following equipment should be operating normally:
 - 1) two altitude measurement systems, as defined by the RVSM MASPS;
 - 2) automatic altitude-keeping device(s);

Note.— Redundancy requirements for altitude-keeping devices should be established by regional agreement after an evaluation of such criteria as mean time between failures, length of flight segments and availability of direct pilot controller communications and radar surveillance.

- 3) at least one altitude-reporting transponder (if required for operation in that specific RVSM airspace) capable of being switched to operate from either of the two altimetry systems required by the RVSM MASPS; and
- 4) one altitude-alerting device;

Should any of this equipment fail prior to the aircraft entering RVSM airspace, the pilot should request a new clearance so as to avoid flight in this airspace;

- h) the following contingency procedures should be adhered to after entering RVSM airspace:
 - 1) the pilot should notify ATC of contingencies (equipment failures, weather conditions) in which the ability to maintain CFL is affected and coordinate a plan of action (see 4.3.2);
 - 2) equipment failures should be notified to ATC. Some examples are:
 - i) failure of all automatic altitude-keeping devices on board the aircraft;
 - ii) loss of redundancy of altimetry systems, or any part of these, on board the aircraft;
 - iii) failure of all altitude-reporting transponders;
 - iv) loss of thrust on an engine necessitating descent; and
 - v) any other equipment failure affecting the ability to maintain CFL;
 - 3) the pilot should notify ATC when encountering severe turbulence; and
 - 4) if unable to notify ATC and obtain an ATC clearance prior to deviating from the assigned CFL, the pilot should follow established contingency procedures as defined by the region of operation and obtain ATC clearance as soon as possible.

Operations manual

4.2.2 Where applicable, aircraft operators should revise their operations manuals to reflect any differences in standard operating procedures that result from operation in RVSM airspace.

4.3 ATC PROCEDURES

General

4.3.1 The continuity of RVSM operations safely in relation to the provision of air navigation services requires that ATC procedures be periodically reviewed and appropriate recurrent training provided. As a basis for the periodic review of regional procedures, consideration should be given to the appropriate action to be taken by controllers in the following situations, as applicable:

- a) aircraft known not to be suitably equipped are flight planned into RVSM airspace;
- b) an aircraft informs ATC that the capability to maintain a CFL appropriate to RVSM requirements has been lost;
- c) the pilot advises that the automatic altitude-keeping device has been turned off; and
- d) the displayed altitude differs from the CFL by 90 m (300 ft) or more.

Note 1.— While not necessary to support RVSM operations, the availability of altitude display is beneficial.

Note 2.— Surveillance systems should be capable of supporting RVSM operations.

ATC contingency procedures

4.3.2 In addition to emergency conditions that require immediate descent, such as loss of thrust or pressurization, ATC shall be made aware of any conditions that may make it impossible for an aircraft to maintain its CFL. Controllers should be trained regarding the appropriate action to take in the event that they are notified by the pilot of any such condition, as described in 4.2.1 h). Suggested actions in the event of such an occurrence are:

- a) obtain the pilot's intentions;
- b) assess the traffic situation to determine if the aircraft can be accommodated through the provision of lateral, longitudinal or increased vertical separation and, if so, apply the appropriate minimum;
- c) when the aircraft cannot be accommodated in accordance with b), ascertain if the aircraft can maintain altitude in accordance with the requirements applicable below RVSM airspace. If so, and if the pilot confirms it to be operationally feasible, the controller should issue a revised clearance to a level outside RVSM airspace when traffic permits; and
- d) handle aircraft that cannot be accommodated in accordance with either b) or c) as an emergency and take whatever action is necessary to provide the appropriate separation.

Military operations

4.3.3 States are reminded of the recognized responsibility in regard to military traffic as specified in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), Chapter 16. In this regard, procedures must be developed and periodically reviewed in order to accommodate military flight operations that do not meet the equipment requirements of RVSM MASPS (see Chapter 3, 3.1 to 3.2). These procedures must specify how

military flight operations in RVSM airspace are to be accommodated, but segregated from air traffic being provided with a 300 m (1 000 ft) VSM above FL 290. Suggested methods of accomplishing this are:

- a) providing temporary airspace reservations;
- b) providing block altitudes; and
- c) providing special routes applicable only to the mass movement of military aircraft on a temporary basis.

Meteorological conditions

4.3.4 Meteorological conditions that can cause turbulence which can be detrimental to accurate height-keeping include:

- a) gravity shear waves;
- b) thunderstorms;
- c) orographic flow.

4.3.5 Orographic flow, more commonly known as mountain wave activity, has been identified as being particularly detrimental to accurate height-keeping. Prior to implementation of RVSM, States known to have airspace susceptible to orographic flow should:

- a) assign responsibility for forecasting such conditions; and
- b) detail the action required by ATC on receipt of such forecasts.

4.3.6 When reports of severe turbulence are received, ATC must ascertain the capability of the aircraft to maintain CFL. Upon confirmation that meteorological conditions are affecting, or are likely to affect, height-keeping accuracy, ATC should be required to provide alternative separation as soon as possible. Additionally, when any of the meteorological conditions listed in 4.3.4 are expected to prevail over an area for an extended time period, the appropriate ATC authority should consider:

- a) issuing a NOTAM specifying the routes or area affected; and
 - b) temporarily suspending the use of 300 m (1 000 ft) VSM in the affected area.
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