EAC No.91_9

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Approval of Egyptian Operators and Aircraft to operate in Airspace above flight level FL 290 where a 1000 foot vertical separation minimum is applied

EAC 91-9.1 Purpose.

This circular provides the Egyptian requirements regarding the approval of aircraft and operators to conduct flight in airspace where reduced vertical separation minimum (RVSM) is applied. It contains guidance on airworthiness, continuing airworthiness, and operations programs for RVSM operations. RVSM airspace is any airspace or route between FL 290 and FL 410 inclusive where aircraft are separated vertically by 1,000-ft (300 m).

EAC 91-9.3 Related ECAR sections

(a) ECAR91.703 and 91.706
(b) ECAR91 Appendix G.

EAC 91.5 Definitions

The following definitions are intended to clarify certain specialized terms used in this circular:

(a) Aircraft group. A group of aircraft that are of nominally identical design and build with respect to all details that could influence the accuracy of height keeping performance.
(b) Altimetry System Error (ASE): The difference between the pressure altitude displayed to the cockpit crew when referenced to ISA standard ground pressure setting (2992 in. Hg/1013.25 hPa) and free stream pressure altitude.
(c) Assigned Altitude Deviation (AAD). The difference between the transponder Mode C altitude and the assigned altitude/flight level.
(d) Automatic altitude control system. Any system which is designed to automatically control the aircraft to a referenced pressure altitude.
(e) Avionics Error (AVE): The error in the processes of converting the sensed pressure into an electrical output, of applying any static source error correction (SSEC) as appropriate, and of displaying the corresponding altitude.
(f) Basic RVSM envelop: The range of Mach numbers and gross weights within the altitude ranges FL 290 to FL 410 (or max available altitude) where an aircraft can reasonably be expected to operate most frequently.
(g) Full RVSM Envelope. The entire range of operational Mach numbers, w/d, and altitude values over which the aircraft can be operated within RVSM airspace.
(h) Height-keeping capability: Aircraft height-keeping performance which can be expected under nominal environmental operating conditions with proper aircraft operating practices and maintenance.
(i) Height-keeping performance: The observed performance of an aircraft with respect to adherence to a flight level.
(j) Non-group aircraft. An aircraft for which the operator applies for approval on the characteristics of the unique airframe rather than on a group basis.
(k) Residual static source error. The amount by which static source error (SSE) remains undercorrected or overcorrected after the application of SSEC.
(l) Static source error. The difference between the pressure sensed by the static system at the static port and the undisturbed ambient pressure.
(m) Static Source Error Correction (SSEC): A correction for static source error.
(n) Total Vertical Error (TVE). Vertical geometric difference between the actual pressure altitude flown by an aircraft and its assigned pressure altitude (flight level).
(o) (w/d) aircraft weight, w, divided by the atmospheric pressure ratio, d.

EAC 91-9.7 Related reading material.

(a) International Civil Aviation Organization (ICAO) Doc. 9574, Manual on the Implementation of a 300 m (1,000 ft) Vertical Separation Minimum between FL 290 - FL 410 Inclusive.
(b) ICAO Doc. 9536, Review of the General Concept of Separation Panel (RGCSP), Sixth Meeting, Montreal, 28 November - 15 December 1988.

(c) ICAO Doc. 9572, RGCSP, Seventh Meeting, Montreal, 30 October: 20 November 1990.
(d) FAA AC 91-RVSM approval of aircraft and operators for flight in airspace above flight level (FL) 290 where a 1000 foot vertical separation minimum is applied.
(e) FAA AC 91-70 oceanic operations dated September 6, 1994.
(f) JAA leaflet No.6

EAC 91-9.9 Background.

(a) In 1987, the FAA concentrated its resources for the development of RVSM programs in the ICAO RGCSP. The U.S. delegation to RGCSP used the material developed by SC 150 in developing U.S. positions and proposals on RVSM criteria and programs.
(b) The ICAO RGCSP published two major reports which have provided the basis for the development of RVSM implementation documents. The Report of RGCSP/6 (Montreal, 28 November-15 December 1988) was published in two volumes. Volume 1 summarized the major conclusions reached by the panel and by individual States. Volume 2 presented the complete RVSM study reports of Eurocontrol, the U.S., Japan, Canada, and the USSR. The major conclusions of this report are that:
  (1) RVSM is "technically feasible without imposing unreasonably demanding technical requirements on the equipment."
  (2) RVSM would provide "significant benefits in terms of economy and en route airspace capacity."
(c) The second major report published by RGCSP was the report of RGCSP/7 (Montreal, 30 October - 20 November 1990). This report contains the draft "Manual on Implementation of a 300 M (1000 ft) Vertical Separation Minimum (VSM) Between FL 290 and FL 410 Inclusive." This material was approved by the ICAO Air Navigation Commission in February 1991 and published as ICAO Document 9574. This manual provides guidance for RVSM implementation planning, airworthiness requirements, crew procedures, ATC considerations, and system performance monitoring.

EAC 91-9.11The approval process for (RVSM) operations: -

(a) Approval of aircraft: Each aircraft type that an operator intends to use in RVSM airspace should have received an approval from the manufacturer authority.
  (1) In-service aircraft ECAR Part 121 operations: An individual operator seeking approval for its aircraft should contact the manufacturer of the specific aircraft type and the ECAA to determine/coordinate the process for RVSM approval. Final approval will require coordination between the operator and the aircraft manufacturer or design organization.
  (2) In-service aircraft ECAR Part 91 operations: An individual operator seeking approval for its aircraft should contact the manufacturer of the specific aircraft type and the ECAA to determine/coordinate the process for RVSM approval.
  (3) For newly purchased type of aircraft. The operator which desires to operate his aircraft within the RVSM airspace should contact the manufacturer to have the specific type approval for RVSM systems equipped on the aircraft before getting an operational approval from ECAA.
(b) Operator approval: Paragraph 9 contains details on the continuous airworthiness (maintenance) programs for RVSM operations. Paragraph 10 contains details on the operational procedures and programs which an operator should adopt for RVSM operation. Each individual operator should plan on presenting these programs to the ECAA at least 60 days prior to proposed operation.
  (1) ECAR Part 121 operators. The operator should notify ECAA of its intent to obtain approval for RVSM operations
  (2) ECAR Part 91 operators. The operator should contact ECAA to start the process to receive a letter of authorization (LOA) which will grant authorization for RVSM operations.

EAC 91-9.13 Aircraft systems

(a) Equipment for RVSM Operations: The minimum equipment should be as follows:
  (1) Two independent altitude measurement systems conforming with FAA AC 91-RVSM or equivalent.

(2) One SSR altitude reporting transponder. If only one is fitted, it should have the capability for switching to operate from either altitude measurement system.
(3) An altitude alert system.
(4) An automatic altitude control system.

(b) Altimetry. The altimetry system of an aircraft comprises all those elements involved in the process of free stream static pressure and converting it to a pressure altitude output according to specified tolerances in FAA AC 91-RVSM or equivalent.

(c) Altitude alert. The altitude deviation warning system should signal an alert when the altitude displayed to the cockpit crew deviates from selected altitude by more than a nominal value as specified tolerances in FAA AC 91-RVSM or equivalent.

(d) Automatic altitude control system. As a minimum a single automatic altitude control system should be installed which is capable of controlling aircraft height within specified tolerances in FAA AC 91-RVSM or equivalent.

EAC 91-9.15 Airworthiness approval. Reserved

EAC91-9.17 Continued airworthiness (maintenance requirements).

(a) General:
(1) The integrity of the design features necessary to ensure that altimetry systems continue to meet RVSM standards should be verified by scheduled tests and/or inspections in conjunction with an approved maintenance program. The operator should review its maintenance procedures and address all aspects of continuing airworthiness which are affected by RVSM requirements.
(2) Each person or operator should demonstrate that adequate maintenance procedures are available to ensure continued compliance with the RVSM maintenance requirements.

(b) Maintenance program approval requirements. Each operator requesting RVSM operational approval should submit a maintenance and inspection program which includes any maintenance requirements defined in the approved data package as part of a continuous airworthiness maintenance program approval or an equivalent program approved by the ECAA. Although air carries operating aircraft subject to a continuous airworthiness maintenance program do not have to comply with the provisions of ECAR Section 91.411 pertaining to altimeter system and altitude reporting equipment test and inspections, an effective maintenance and inspection program will typically incorporate these provisions as a requirement for maintenance program approval.

(c) Maintenance documents requirements. The following items should be reviewed as appropriate for RVSM maintenance approval:
(1) Maintenance manuals;
(2) Structural repair manuals;
(3) Standards practice manuals;
(4) Illustrated parts catalogs;
(5) Maintenance schedule; and
(6) MMEL/MEL.

(d) Maintenance practices

If the operator is subject to an ongoing approved maintenance program, that program should contain the maintenance practices outlined in the applicable aircraft and component manufacturer's maintenance manuals for each aircraft type. The following items should be reviewed before RVSM approval and if the operator is not subject to an approved maintenance program the following items should be followed:
(1) All RVSM equipment should be maintained in accordance with the component manufacturer's maintenance requirements and the performance requirements outlined in the approved documents.
(2) Any modification, repair, or design change, which in any way alters the initial RVSM approval, should be subject to a design review by persons approved by the approving authority.
(3) Any maintenance practices which may affect the continuing RVSM approval integrity, e.g., the alignment of pitot/static probes, dent, or deformation around

static plates, should be referred to the approving authority or persons delegated by the authority.

(4) Built-in Test Equipment (BITE) testing is not an acceptable basis for system calibrations, (unless it is shown to be acceptable by the airframe manufacturer with the approval authority agreement) and should only be used for fault isolation and troubleshooting purposes.

(5) A system leak check or visual inspection should be accomplished any time a quick disconnect static line is broken.

(6) Airframe and static systems should be maintained in accordance with the airframe manufacturer's inspection standards and procedures.

(7) To ensure the proper maintenance of airframe geometry for proper surface contours and the mitigation of altimetry system error, surface measurements or skin waviness checks should be made if needed to ensure adherence to the airframe manufacturer's RVSM tolerances. These tests and inspections should be performed as established by the airframe manufacturer. These checks should also be performed following repairs, or alterations having an effect of airframe surface and airflow.

(8) The maintenance and inspection program for the autopilot should ensure continued accuracy and integrity of the automatic altitude control system to meet the height-keeping standards for RVSM operations. This requirement will typically be satisfied with equipment inspections and serviceability checks.

(9) Where the performance of existing equipment is demonstrated as being satisfactory for RVSM approval, it should be verified that the existing maintenance practices are also consistent with continued RVSM approval integrity. Examples of these are:

(e) Maintenance practices for non-compliant aircraft:

When RVSM performance errors are revealed, the following actions must be taken:

(1) The failure or malfunction is confirmed and isolated, and

(2) Corrective action is carried out as required and verified to insure RVSM approval integrity.

(f) RVSM Maintenance training requirements.

Areas that need to be highlighted for initial and recurrent training of RVSM shop and line personnel are:

(1) Aircraft geometric inspection techniques.

(2) Test equipment calibration/usage techniques.

(3) Any special documentation or procedures introduced by RVSM approval.

(g) Test Equipment.

(1) General. The test equipment should have the capability to demonstrate continuing compliance with all the parameters established for RVSM approval in the initial data package or as approved by the approving authority.

(2) Standards. Test equipment should be calibrated utilizing reference standards whose calibration is certified as being traceable to the national standard. It should be calibrated at periodic intervals as agreed by the approving authority. The approved maintenance program should encompass an effective quality control program which includes the following:

(i) Definition of required test equipment accuracy.

(ii) Regular calibrations of test equipment traceable to a master inhouse standard. Determination of calibration interval should be a function of the stability of the test equipment. The calibration interval should be established on the basis of historical data so that degradation is small in relation to the required accuracy.

(iii) Regular audits of calibration facilities both inhouse and outside.

(iv) Adherence to acceptable shop and line maintenance practices.

(v) Procedures for controlling operator errors and unusual environmental conditions which may affect calibration accuracy.

EAC 91-9.19 Operational approval

(a) Operators should submit an application to the ECAA that contains information in the form and manner prescribed by the ECAA. Each operator must submit his application at least 30 days before the date of intended operation along with the following:

(1) Eligibility airworthiness documents: Sufficient documentation should be available to establish that the aircraft has an appropriate AFM, AFM Supplement (AFMS), if applicable. and is otherwise suitably qualified to fly within RVSM Airspace.
(2) Description of aircraft equipment to be used for RVSM operations.
(3) Operational training programs and operating practices and procedures.
(4) Operational manuals and checklists.
(5) Operating history that identifies relevant past problems and incidents, if any, and actions taken to correct the situation.
(6) Minimum Equipment List (MEL) relevant updates.
(7) Maintenance program relevant updates.
(8) Awareness of the necessity to follow up action after navigation error reports, and the potential for removal of RVSM operating authority.

(b) Operators should fulfill the requirements of paragraph (7) on aircraft systems.
(c) Each aircraft type that an operator intends to use in RVSM Airspace must receive airworthiness approval prior to the operational approval being granted.

EAC91-9.20

Each Operator shall establish procedures which ensures that a minimum of two aeroplanes of each aircraft type grouping have their height-keeping performance monitored, at least once every two years or within intervals of 1 000 flight hours per aero plane, whichever period is longer. If an operator aircraft type grouping consists of a single aero plane, monitoring of that aero plane shall be accomplished within the specified period.

Note. — Monitoring data from any regional monitoring programme established in accordance with ECAR 172.89(a)(3), may be used to satisfy the requirement.

APPENDIX 1
Training Programs and Operating Practices and Procedures

91-9 app.1.21 Introduction

The following items should be standardized and incorporated into training programs and operating practices and procedures. Certain items may already be adequately standardized in existing operator programs and procedures. New technologies may also eliminate the need for certain crew actions.

91-9 app.1.23 Flight Planning

During flight planning the crew should pay particular attention to conditions which may affect operation in RVSM airspace. These include, but may not be limited to:

(a) Verifying that the aircraft is approved for RVSM operations.
(b) Reported and forecast weather conditions on the route of flight;
(c) Minimum equipment requirements pertaining to height-keeping systems; and
(d) If required for the specific aircraft group; accounting for any aircraft operating restriction related to RVSM airworthiness approval.

91-9 app.1.25 Preflight procedures at the aircraft for each flight

The following actions should be accomplished during preflight:

(a) Review maintenance logs and forms to ascertain the condition of equipment required for flight in the RVSM airspace, and ensure that maintenance action has been taken to correct defects to required equipment;
(b) During the external inspection of aircraft, particular attention should be paid to the condition of static sources and the condition of the fuselage skin in the vicinity of each static source and any other component that affects altimetry system accuracy (this check may be accomplished by a qualified and authorized person other than the pilot, e.g., a flight engineer or maintenance personnel);
(c) Before takeoff, the aircraft altimeters should be set to the local altimeter (QNH) setting and should display a known elevation (e.g. field elevation) within the limits specified in aircraft operating manuals. The two primary altimeters should also agree within limits specified by the aircraft operating manual. An alternative procedure using QFE may also be used;

Note. The maximum value for these checks cited in operating manuals should not exceed 75 ft.

(d) Before take-off, equipment required for flight in RVSM airspace should be operational, and indications of malfunction should be resolved.

91-9 app.1.27 The equipment and functional requirements for RVSM operations.

(a) Two primary altitude measurement systems.
(b) One automatic altitude-control system.
(c) One altitude-alerting device.
(d) One SSR altitude reporting transponder.
(e) Static Source Error Correction (SSEC)/Position Error Correction (PEC), if required to meet the requirements of ICAO doc.9574 must be applied automatically.

Note 1. Dual equipment requirements for altitude-control systems may be established by regional agreement after an evaluation of criteria such as mean time between failures, length of flight segments and availability of direct pilot-controller communications and radar surveillance.

Note 2. Should any of the required equipment fail prior to the aircraft entering RVSM airspace, the pilot should request a new clearance so as to avoid flight in this airspace;

Note 3. Operating Transponder. An operating transponder may not be required for entry into all designated RVSM airspaces. The operator should ascertain the requirement for an operational transponder in each RVSM area where operations are intended. The operator should also ascertain the transponder requirements for transition areas adjacent to RVSM airspace.

91-9 app.1.29 In-Flight procedures

The following policies should be incorporated into crew training and procedures:

(a) Crews should comply with aircraft operating restrictions (if required for the specific aircraft group) related to RVSM airworthiness approval.

(b) 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);

(c) 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;

(d) When 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);

(e) An automatic altitude-control system should be operative and engaged during level cruise, except when circumstances such as the need to retrim 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;

(f) The altitude-alerting system should be operational;

(g) At intervals of approximately one hour, crosschecks between the primary altimeters should be made.

91-9 app.1.31 Post flight

In making maintenance log book 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. The following information should be noted when appropriate:

(a) Primary and standby altimeter readings.

(b) Altitude selector setting.

(c) Subscale setting on altimeter.

(d) Autopilot used to control the airplane and any differences when the alternate system was selected.

(e) Differences in altimeter readings if alternate static ports selected.

(f) Use of air data computer selector for fault diagnosis procedure.

(g) Transponder selected to provide altitude information to ATC and any difference if alternate transponder or altitude source was manually selected.

91-9 app.1.33 Special emphasis items:

Crew training. The following items should also be included in cockpit crew training program:

(a) Knowledge and understanding of standard ATC phraseology used in each area of operations;

(b) Importance of crew members cross checking each other to ensure that ATC clearances are promptly and correctly complied with;

(c) Use and limitations in terms of accuracy of standby altimeters in contingencies. Where applicable, the pilot should review the application of SSEC/PEC through the use of correction cards;

(d) Problems of visual perception of other aircraft at 1,000 ft (300 m) planned separation during night conditions, when encountering local phenomena such as northern lights, for opposite and same direction traffic, and during turns;

(e) Characteristics of aircraft altitude capture systems, which may lead to the occurrence of overshoots;

(f) Relationship between the altimetry, automatic altitude control, and transponder systems in normal and abnormal situations; and

(g) Aircraft operating restrictions (if required for the specific aircraft group) related to RVSM airworthiness approval.