

State Of Libya
Ministry Of Transport
Civil Aviation Authority



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LYCAA-AC AIR-002- Rev 00

**REQUIREMENTS FOR IMPLEMENTATION OF REDUCED
VERTICAL SEPARATION MINIMUM (RVSM)**

Published by Libyan Civil Aviation Authority, and Approved By:



10/3/19
Capt. Nasereddin Shaebelain
Director General

APPLICABILITY

- RVSM airspace is any airspace or route where aircraft are separated by 1,000 ft vertically, between FL 290 and FL 410, inclusive.
- The requirements on installation and type relating to RVSM shall be in accordance with the applicable part of Flight Operations Requirements.

PURPOSE

This Advisory Circular (LYCAA-AC AIR-002- Rev 00) provides guidance for obtaining approval to operate aircraft in Reduced Vertical Separation Minima (RVSM) airspace.

RELATED REGULATIONS

- Libyan Civil Aviation Law No. 6 (2005)
- Libyan Air Operation Regulations.
- Libyan Airworthiness Regulations.

NOTICE OF CHANGE:

None.

EFFECTIVITY:

This Advisory Circular (AC) comes enforce on 10th March 2019

CONTENTS:

1. APPROVAL REQUIREMENTS

- 1.1 Airspace where RVSM is applied should be considered special qualification airspace. Both the individual aircraft and the specific aircraft type or types that the operator intends to use will need to be approved by LYCAA before the operator conducts flights in RVSM airspace. These Requirements shall be complied with for the approval of specific aircraft type or types and for airworthiness and operational approval.
- 1.2 Approval will encompass the following elements: -
 - a) Airworthiness aspects (including continued airworthiness).
 - b) Operational requirements.
 - c) Provision for height monitoring of operator's aircraft.
- 1.3 Operator shall apply for RVSM approval to LYCAA, Flight Safety Directorate Airworthiness Section.
- 1.4 On satisfactory compliance with the requirements given in this AC, the operator shall be given provisional approval for the specific aircraft. Approval may be regularized after the aircraft meets the Height Monitoring Performance using HMU/GMU.

2. AIRWORTHINESS APPROVAL OF AIRCRAFT

- 2.1 Each aircraft type that the operator intends to use in RVSM airspace should have received RVSM airworthiness approval from the regulatory authority of country of manufacture/design including the approval of continued airworthiness program. LYCAA shall accept such RVSM approval and grant airworthiness approval to each aircraft on the compliance with the RVSM Data Packages.
- 2.2 RVSM Data Packages for each aircraft type/group of aircraft shall be approved by the regulatory authority of the state of design and may take the following form:
- 2.3 In-service Aircraft
 - a) Manufacturer's Service Bulletin
 - b) Aircraft Service Change
 - c) Supplemental Type Certificates
 - d) Airplane Flight manual

3. Aircraft manufactured as RVSM Complaint - AFM Statement of Compliance.

- 3.1 The operator shall obtain approval from LYCAA for each individual aircraft group and each individual aircraft to be used by the operator for RVSM operations.

3.2 Each aircraft operated by Libyan Operating Certificate holder shall have the airworthiness and the operational approval from the LYCAA prior to it being approved for use by the operator in RVSM environment.

3.3 Each aircraft shall receive approval for continued airworthiness program prior to it being reviewed for operational approval. Inspection on RVSM requirements shall be included in Operator's Maintenance Program before RVSM approval is granted for specific aircraft.

4. PROCEDURES FOR GRANT OF AIRWORTHINESS APPROVAL

4.1 Grant of RVSM airworthiness approval

4.2 New aircraft receive their RVSM airworthiness approval from the competent authority of the state of design, issued on the basis of performance and analytical data submitted supporting RVSM compliance. Compliance with the RVSM criteria shall be stated in the Aircraft Flight Manual including reference to the applicable build standard, related conditions, and limitations. The maintenance and repair manuals will give the associated airworthiness instructions.

4.3 In case of an aircraft in service, the Design Approval Holder shall submit the performance and analytical data to the competent authority of the state of design. The data shall be supplemented with the service bulletin or its equivalent that identifies the work to be done to achieve the build standard, continued airworthiness instructions, and an amendment to the Aircraft Flight Manual stating related conditions and limitations.

Approval by the competent authority indicates acceptance of that aircraft type and build standard as complying with the RVSM airworthiness criteria.

4.4 The combination of performance and analytical data, service bulletin(s) or equivalent, continued airworthiness instructions, and the approved amendment or supplement to the Aircraft Flight Manual is known as the RVSM approval data package.

4.5 For airworthiness approval of specific aircraft registered in Libya, an aircraft operator is required to apply to the LYCAA . The application shall be supported by evidence that the aircraft has been inspected, and where necessary, modified in accordance with applicable Service Bulletins, and is of a type and build standard that meets the RVSM airworthiness criteria. The operator shall also confirm that the continued airworthiness instructions are available and that the approved Flight Manual amendment or supplement has been incorporated.

Note: For RVSM airspace where an operational approval is prescribed, airworthiness approval alone does not authorize flight in that airspace.

4.6 Contents of the RVSM approval data package –

4.7 As a minimum, the data package shall consist of the following:

- a) A statement of the aircraft group or non-group aircraft and applicable build standard to which the data package applies.
- b) Definition of the applicable flight envelope(s).
- c) Data showing compliance with the performance criteria of Appendix II and paragraph 6 of this AC.
- d) The procedures to be used to ensure that all aircraft submitted for airworthiness approvals comply with RVSM criteria. These procedures will include the references of applicable service bulletin and the applicable approved aircraft flight manual amendment or supplement.
- e) The maintenance instructions that ensure continued airworthiness for RVSM approval.

4.8 Continued Airworthiness:

4.9 The following items shall be reviewed and updated as applicable to RVSM:

- a) The structural repair manual with special attention to the areas around each static source, angle of attack sensors, and doors if their rigging can affect air flow around the previously mentioned sensors.

- b) The Master Minimum Equipment List (MMEL).
- 4.10 The data package shall include details of any procedures that are not covered in above said para, but may be needed to ensure continued compliance with RVSM approval criteria.

Examples follow -

- a) For non-group aircraft where airworthiness approval has been based on flight test, the continuing integrity and accuracy of the altimetry system shall be demonstrated by ground and flight test of the aircraft and its altimetry system at intervals to be agreed with LYCAA. However, exemption from the flight test requirement may be granted if it can be demonstrated that the relationship between any subsequent airframe/system degradation and its effects on altimetry system accuracy is understood and that it can be compensated or corrected.
- b) In-flight defect reporting procedures shall be defined for identification of altimetry system error sources. Such procedure shall cover acceptable differences between primary and alternate static sources, and others as appropriate.
- c) For groups of aircraft, where approval is based on geometric inspection, periodic re-inspection shall be necessary and the intervals required should be specified.
- 4.11 Post Approval Modification

Any variation/modification from the initial installation that affects RVSM approval should be referred to aircraft type design holder and accepted by LYCAA.

5. RVSM CONTINUED AIRWORTHINESS (MAINTENANCE)

5.1 General

- 5.1.1 The integrity of the design features necessary to ensure that altimetry systems continue to meet RVSM approval criteria shall be verified by scheduled tests and inspections in conjunction with an approved maintenance program. The operator shall review its maintenance procedures and address all aspects of continued airworthiness that may be relevant.

- 5.1.2 Adequate maintenance facilities shall be available to enable compliance with the RVSM maintenance procedures.

5.2 Maintenance Programs

Each operator requesting RVSM operational approval shall establish RVSM maintenance and inspection practices acceptable to LYCAA that shall include any required maintenance specified in the data package.

These practices shall be included in the operator's approved maintenance programme.

5.3 Maintenance Documents:

The following manuals/documents shall be reviewed, as appropriate:

- a) Maintenance Manuals.
- b) Structural Repair Manuals.
- c) Standard Practices Manuals.
- d) Illustrated Parts Catalogues.
- e) Maintenance Schedule.
- f) MMEL/MEL.
- 5.4 Maintenance Practices:
- 5.4.1 The aircraft altimetry and height keeping equipment shall be maintained in accordance with the manufacturer's approved procedures and servicing schedules.
- 5.4.2 The operator's maintenance program shall include, for each aircraft type, the maintenance practices stated in the applicable aircraft and component manufacturers maintenance manuals. In addition, attention shall be given to the following items:

- a) All RVSM equipment shall be maintained in accordance with the aircraft and component manufacturers maintenance instructions and the performance criteria of the RVSM approval data package.
- b) Any modification or design change, which in any way affects the initial RVSM approval, shall be subject to a design review acceptable to LYCAA.
- c) Any repairs, not covered by approved maintenance documents, which may affect the integrity of the continuing RVSM approval, e.g. those affecting the alignment of pitot/static probes, repairs to dents or deformation around static plates, shall be subject to a design review acceptable to LYCAA .
- d) Built-in Test Equipment (BITE) testing shall not be used for system calibration unless it is shown to be acceptable by the aircraft manufacturer/design organization, and with the agreement of the LYCAA.
- e) An appropriate system leak check (or visual inspection where permitted) shall be accomplished following reconnection of a quick disconnect static line.
- f) Airframe and static systems shall be maintained in accordance with the aircraft manufacturer's inspection standards and procedures.
- g) 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 will need to be made, as specified by the aircraft manufacturer, to ensure adherence to RVSM tolerances. These checks should be performed following repairs, or alterations having an effect on airframe surface and airflow.
- h) The maintenance and inspection program for the autopilot will need to 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.
- i) Whenever the performance of the installed equipment has been demonstrated to be satisfactory for RVSM approval, the associated maintenance practices shall be consistent with continued RVSM approval. Examples of equipment to be considered are:
 - i) Altitude alerting
 - ii) Automatic Altitude Control System
 - iii) Secondary Surveillance Radar altitude reporting equipment
 - iv) Altimetry system

5.4.3 Action for non-compliance aircraft

Those aircraft positively identified as exhibiting height keeping performance errors that require investigation, shall not be operated in RVSM airspace until the following actions have been taken

- a) The failure or malfunction is confirmed and isolated; and
- b) Corrective action is taken to comply with requirements for RVSM approval.

5.4.4 Maintenance Training

Additional training may be necessary to support RVSM approval. Areas needed to be highlighted for initial and recurrent training of relevant personnel are:

- a) Aircraft geometric inspection technique.
- b) Test equipment calibration and use of that equipment.
- c) Any special instruction or procedures introduced for RVSM approval.

5.4.5 Test Equipment

- a) Test equipment should have the capability to demonstrate continuing compliance with all the parameters established in the data package for RVSM approval.
- b) Test equipment should be calibrated using reference standards at periodic intervals acceptable to LYCAA . The approved maintenance program shall include an effective quality control program with the attention to the following:

- i) Definition of required test equipment accuracy.
- ii) Regular calibrations of test equipment traceable to a master standard. Determination of the calibration interval should be a function of the stability of the test equipment.
- iii) The calibration interval should be established using historical data so that the degradation is small in relation to the required accuracy.
- iv) Regular audits of calibration facilities both in-house and outside.
- v) Adherence to approved maintenance practices.
- vi) Procedures for controlling operator errors and unusual environmental conditions which may affect calibration accuracy.

6. **CONDITIONS FOR REMOVAL OF AN RVSM APPROVAL**

The incidence of height-keeping errors that can be tolerated in an RVSM environment is very small. It is incumbent upon each operator to take immediate action to rectify the conditions that caused the error. The operator should also report the event to the LYCAA within 72 hours with initial analysis of causal factors and measures to prevent further events. LYCAA will determine the requirement for follow up reports.

Errors which should be reported and investigated are:

- TVE equal to or greater than ± 300 ft (± 90 m),
- ASE equal to or greater than ± 245 ft (± 75 m), and
- AAD equal to or greater than ± 300 ft(± 90 m).

Height-keeping errors fall into two broad categories:

- a) Errors caused by malfunction of aircraft equipment
- b) operational errors.

An operator who consistently commits errors of either variety may be required to forfeit authority for RVSM operations. If a problem is identified that is related to one specific aircraft type, then RVSM approval maybe removed for the operator for that specific type.

Another condition for the removal of RVSM approval is the change of ownership of RVSM approved aircraft. As part of the RVSM approval, LYCAA assesses the operator to ensure that they have implemented the required programmes and procedures to ensure that the integrity of RVSM is maintained –this cannot be transferred with the aircraft.

7. **REMOVAL OR AMENDMENT OF AUTHORITY**

LYCAA may amend Operations Specifications of the operator to revoke or restrict an RVSM authorization if it is found that the operator is not complying, or is unable to comply with the requirements of AC.

APPENDIX-1

Definitions

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

(1) Automatic dependant surveillance – broadcast (ADS-B):

ADS-B is an on-board surveillance application that periodically transmits aircraft parameters, such as identification, pressure altitude, position and position integrity, via a broadcast data link that is available to any receiver, either airborne or ground-based, within range of the transmitter.

(2) Aircraft type groupings:

Aircraft are considered to be members of the same group if they are designed and assembled by one manufacturer and are of nominally identical design and build with respect to all details which could influence the accuracy of height-keeping performance.

(3) Altimetry system error (ASE)

The difference between the altitude indicated by the altimeter display (assuming a correct altimeter barometric setting) and the pressure altitude corresponding to the undisturbed ambient pressure.

(4) Assigned Altitude Deviation (AAD)

The difference between the transponded altitude and the assigned altitude or flight level.

(5) Non-compliant aircraft

An aircraft whose true absolute TVE, ASE or AAD is greater than the maximum acceptable value for RVSM approved aircraft.

(6) RVSM approval

The term used to describe the successful completion of the airworthiness approval and operational approval.

(7) Target Level of Safety (TLS)

A generic term representing the level of risk which is considered acceptable in particular circumstances.

(8) Total Vertical Error (TVE)

The vertical geometric difference between the actual pressure altitude flown by an aircraft and its assigned pressure altitude (flight level).

APPENDIX-2

RVSM Monitoring

1. RVSM height monitoring programmes

A programme to monitor or verify aircraft height-keeping performance is considered a necessary element of RVSM. RVSM monitoring programmes have the primary objective of observing and evaluating aircraft height-keeping performance to gain confidence that airspace users are applying the airplane/operator RVSM approval in an effective manner and that an equivalent level of safety will be maintained.

1.1 Initial height validation monitoring

The RVSM airworthiness approval of an RVSM approval requires that the aircraft and operator be involved in an RVSM initial height validation monitoring programme. The initial height validation monitoring programme validates the aircraft's height performance for RVSM operations. For most aircraft types, monitoring is not required to be completed prior to operational approval being granted. The categories of monitoring are detailed below.

- a) Aircraft type group approved aircraft (data indicates compliance with RVSM MASPS)
- b) Two airframes from each fleet of an operator are to be monitored as soon as possible but not later than 6 months after the issue of an RVSM approval.
- c) Aircraft type group approved aircraft (insufficient data on approved aircraft)
- d) Sixty percent of airframes (roundup if fractional) from each fleet of an operator are to monitor or individual monitoring, as soon as possible but not later than six months after the issue of an RVSM approval.
- e) Bespoke/non-group aircraft
- f) One hundred percent of aircraft shall be monitored prior to the granting of an RVSM approval.

Note: *Contact with LYCAA-ANS-Control Unit is required to clarify/confirm that the operator's aircraft are in the appropriate category.*

- a) Aircraft status for monitoring.
- b) Aircraft engineering work required for the aircraft to receive RVSM airworthiness approval must be completed prior to the aircraft being monitored.
- c) Monitoring of airframes that are RVSM compliant on delivery.
- d) If an operator adds new RVSM compliant airframes of a type for which it already has RVSM approval, providing the operator has completed monitoring requirements for the type, the new airframes are not required to be monitored –except as targeted later date in the continued monitoring programme. If an operator adds new RVSM compliant airframes of an aircraft type for which it has not previously received RVSM approval, then the operator is to complete monitoring in accordance with this AC.
- e) Applicability of monitoring from other regions.
- f) Monitoring data obtained in conjunction with monitoring programmes from other regions can be used to meet pacific monitoring requirements. PARMO administers the monitoring programme in the FIRs for which it is responsible, and has access to monitoring data from other regions and will coordinate with states and operators to inform them on the status of individual operator monitoring requirements.

1.2 Continued height monitoring programme

A requirement of the RVSM operational approval is that the operator establishes a continued height monitoring programme. This programme is to ensure that a minimum of two aircraft of each aircraft type grouping of the operator have their height-keeping performance monitored, at least once every two years or within intervalsof1,000 flight hours per aircraft, whichever period longer. If an operator aircraft type grouping consists of a single aeroplane, monitoring of that aeroplane shall be accomplished within the specified period.

Note: A height-monitoring system based on global positioning satellites or an earth-based system may fulfil this function.

Monitoring data for many regional monitoring programme established in accordance with ICAO Annex 11, 3.3.5.2, may be used to satisfy the requirement.

2. RVSM monitoring methods

There are multiple methods and agencies for performing RVSM height monitoring. There are four categories.

a) Height monitoring units (HMUs)

In operation in Europe, and US,

HMU is a ground-based system consisting of two main components – height monitoring element (HME) and total vertical error monitoring unit (TMU).

i) The HME captures SSR transponder signals from aircraft replying to interrogations from radar stations. The signals contain the information from mode S and mode A/C transmissions. The HME determines the geometric height and position of an aircraft by comparing the time of reception of the SSR transponder signal at different receiver locations. This information is transmitted to the TMU as one plot per second. The data is collated by the TMU to create a track history of the aircraft passing through the area of coverage. The track information is then combined with meteorological data to evaluate the overall value for TVE.

ii) When completed, the monitoring process produces TVE, AAD and ASE readings for each aircraft measured. This data is fed to the region's monitoring agency. Currently there are no HMUs in the pacific region but there are multiple HMUs available in other regions. Contact LYCAA for further information.

b) Aircraft Geometric Height Measurement Elements (AGHMEs)

A ground-based height monitoring system in operation in the US and Canada,

The AGHME system does not require that any special monitoring devices be installed on an aircraft in order that it is monitored. It is necessary, however, that the aircraft have an operational mode S transponder. Straight and level flight through the centre of the AGHME coverage area between FL290 and FL410 is required. Contact LYCAA for further information.

c) ADS-B Height Monitoring System (AHMS)

A ground-based height keeping performance monitoring system that utilises geometric height data available from automatic dependant surveillance –broadcast (ADS-B) equipped aircraft in order to calculate the ASE. Monitoring in air space where a wide-area ADS-B network is available will not require an aircraft to specifically overfly any specific AHMS site, as normal flight operation can be monitored on a continuous basis with no operational impact. The use of ADS-B as a means to estimate ASE and comply with the ICAO Annex 6. 'Continued height-keeping monitoring requirements' has been endorsed by ICAO. Currently, the use of ADS-B for continued height-keeping monitoring purposes is operational in the US, Australia, China and Asian RVSM regions. Contact LYCAA for further information.

Note: ICAO has endorsed AHMS (ADS-B) as a means for continued height-keeping monitoring. AHMS (ADS-B) is also a means to meet the initial validation height-keeping monitoring requirements.

d) GPS Monitoring Units (GMU).

GMUs are portable aircraft-based height monitoring unit,

The GMU process requires straight and level flight between FL290 and FL410 where the GMU provider or operator will monitor the aircraft's height performance. The GMU provider will then process the data by applying differential corrections to the raw GPS data. They then submit it to PARMO where they determine the TVE. GMU monitoring is conducted globally. Contact LYCAA for further information.

3. RVSM Regional Monitoring Agencies (RMAs)

RMAs are agencies that ICAO has approved following the global implementation of RVSM. These agencies ensure the safe use of specific airspace designated by regional agreement by assessing how successfully the airspace meets the agreed TLS. The target is determined by ICAO and depends on satisfactory aircraft height-keeping performance and measurement of risk associated with operational errors.
