



GUIDANCE MATERIAL FOR AIRWORTHINESS AND OPERATIONAL APPROVAL FOR RVSM IN AFRICA-INDIAN OCEAN (AFI) REGION

AIRWORTHINESS AND OPERATIONAL APPROVAL

1. Introduction:

1.1 Airworthiness approval must in all cases be against the requirements of the MASPS, which must be developed to meet the objectives and provisions of this guidance material. The complete MASPS will comprise specifications and procedures for the separate aspects of type approval, release from production, and continued airworthiness. These separate aspects of approval, and their applicability to the approval of existing aircraft, below.

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

1.3 The Minimum Aircraft System Performance Specification (MASPS) has been published by the Joint Aviation Authorities (JAA) as a Temporary Guidance Leaflet (TGL). This document details the airworthiness, continuing airworthiness, and operations programmes necessary to approve operators and airplanes to conduct flight in airspace where RVSM is implemented.

The requirements, which were the basis for development of the MASPS where the followings:

- a) the mean Altimetry System Error (ASE) of the group shall not exceed ± 25 m (± 80 ft);
- b) the sum of the absolute value of the mean ASE for the group and three standard deviations of ASE within the group shall not exceed 75 m (245 ft); and

- c) errors in altitude keeping shall be symmetric about a mean of 0 m (0ft) and shall have a standard deviation not greater than 13 m (43 ft) and shall be such that the error frequency decreases with increasing error magnitude at a rate which is at least exponential.

2. **Joint Aviation Authority (JAA) Temporary Guidance Leaflet (TGL) No.6**
(See explanatory note at APPENDIX A)

TGL provides detailed information on:

- a) the RVSM approval process
- b) RVSM performance requirements
- c) Aircraft system requirements
- d) Airworthiness approval
- e) Continued airworthiness (maintenance procedures)
- f) Operational approval

Together with the following Appendices:

- Appendix 1 – Explanation of W/δ
Appendix 2 – Altimetry System Error (ASE) Components
Appendix 3 – Establishing and Monitoring Static Source Errors
Appendix 4 – Training Programmes and Operating Practices and Procedures
Appendix 5 – Review of ICAO Doc-9574 – Height Keeping Errors.

TGL No.6 Rev-1 details the following minimum equipment fit for aircraft seeking airworthiness approval for RVSM operations :

- a) Two independent altitude measurement systems. Each system will need to be composed of the following elements:
 - Cross-coupled static source/system, provided with ice protection if located in areas subject to ice accretion;
 - Equipment for measuring static pressure sensed by the static source, converting it to pressure altitude and displaying the pressure altitude to the flight crew;
 - Equipment for providing a digitally coded signal corresponding to the displayed pressure altitude, for automatic altitude reporting purposes;
 - Static source error correction (SSEC), if needed to meet the performance criteria;
 - Signals referenced to a pilot selected altitude for automatic control and alerting. These signals should be derived from an altitude measurement system meeting the criteria of this document (TGL Rev.1), and, in all cases, enabling the criteria relating to Altitude Control Output and Altitude Alerting to be met.

- b) One Secondary Surveillance Radar (SSR) transponder with an altitude reporting system that can be connected to the altitude measurement system in use for altitude keeping.
- c) An altitude alerting system
- d) An automatic altitude control system.

3. Aircraft type approval

3.1 Individual or group approval should be granted only where the minimum equipment fit requirements are satisfied as embodied in the MASPS.

3.2 Individual or group approval should be granted only where it has been demonstrated that the detailed specifications developed are satisfied as embodied in the MASPS. Care should be taken when assessing an approval package that flight calibration data used as a basis for evaluating residual position error are representative of the whole aircraft group and full operational envelope in RVSM airspace, and that all error sources and variabilities, including uncertainties inherent in such flight calibration data, are accounted for in the approval process.

3.3 Good design, manufacturing, certification and maintenance practices produce a level of equipment reliability which supports RVSM. In order to ensure that over-all system integrity remains at a high level, it should be demonstrated analytically during the airworthiness approval process that the occurrence of undetected altimetry system failure should be better than 1×10^{-5} per flight hour. It is acceptable in this analysis to take into account the requirement for redundant altimetry systems and the ability of the flight crew to detect altimetry system failure through cross-checking procedures

4. Definition of aircraft type groupings

4.1 When grouping similar aircraft together, from the viewpoint of approval or evaluation of height-keeping standards or requirements, it must be recognized that aircraft with closely similar or apparently identical types or series designations are in some cases substantially different in aerodynamic design and avionics equipment. Conversely, aircraft with different series designations can be identical in all characteristics contributing to height-keeping ability.

4.2 It is therefore necessary to ensure that all individual aircraft deemed to comprise a group are of identical design and build with respect to all details which could influence the accuracy of height-keeping performance. These details should be taken to include airframe, engines, all elements of the required altimetry systems, weight, operational envelope and automatic altitude-keeping equipment.

4.3 This should not be taken to exclude approval by similarity, but where there are differences, the possible influence of the above should be assessed before granting approval or extending approval to cover such variations.

5. Release for flight from production

5.1 Specifications and procedures should be developed, and incorporated in the release requirements of the MASPS, for ensuring that all individual aircraft covered by a group approval that are manufactured or modified to meet approval standard subsequent to the granting of that approval satisfy the requirements developed accordingly. These procedures would ideally include a flight test at a minimum of one point in the operational envelope on all aircraft to demonstrate production similarity, but they may be relaxed to an appropriate level of sample testing, depending on the level of production repeatability which the manufacturer is able to validate. It may be possible to use data already available from TVE measurements to demonstrate a particular manufacturer's capability for production repeatability, but in that case it must also be shown that the uncertainties associated with the data, including their applicability to the individual aircraft group under consideration, do not invalidate the conclusions.

6. Continued airworthiness

6.1 Specifications and procedures should be developed and incorporated in the maintenance requirements of the MASPS for ensuring that all individual aircraft continue during their service life to satisfy the requirements developed accordingly. These procedures should include some type of periodic flight test demonstration of height-keeping accuracy. It may be acceptable to use independent Total Vertical Error (TVE) monitoring facilities to satisfy this requirement, provided that the errors and uncertainties associated with the measurements are shown to be consistent with the requirements, and provided that the separate contributions to TVE of airframe, avionics and Flight Technical Error (FTE) can be assessed. The periodic interval required will not necessarily be the same for all aircraft, and it may be possible to use data already available from TVE measurements to determine the appropriate validation interval.

7. Approval of existing aircraft

7.1 Before approval of existing aircraft, it is preferable that the requirements of the airworthiness be satisfied. The difficulty of applying "new build" requirements to existing airframes is recognized, however, and the following guidance is given regarding how the elements of the MASPS should be applied:

a) Type approval

The MASPS requirements are applicable. In many cases it is likely that there will already be sufficient flight test data available from the type development programme to satisfy that part of the approval requirements. In other cases it may be possible to use independent TVE data to satisfy the flight test approval requirements, when they have been developed, provided that a detailed

assessment of the type groupings to which those data are applicable can be made, and provided that the errors and uncertainties associated with those data are shown to be consistent with the requirements. If the original flight test data and independent TVE data are insufficient to support the approval requirements, it will then be necessary to generate new data. When assessing design capability from data obtained from aircraft which have been in service for an extended period, it is permissible to make an allowance for degradation with age attributable to ASE, within the limits imposed. Specialists should assess whether there are also aging effects due to autopilot systems. When using performance data to assess design capability, it will be necessary to gather more extensive data, for a given level of confidence, than if design capability could be assessed directly.

b) Repeatability control and continued airworthiness

For in-service aircraft it will be necessary to consider the requirements of release for flight from production and continued airworthiness together. It is unlikely that many existing aircraft can be shown to have undergone the production release controls envisaged above, but the objectives of those requirements may well be satisfied for aircraft which have been in service for an extended period by the continued airworthiness requirements. Such aircraft should undergo individually the appropriate continued airworthiness checks developed, as well as meeting the type approval requirements, before being granted approval. For young in-service aircraft it should be acceptable to assume that normal production repeatability has been achieved, as developed above, except where there is evidence of unusually large variations. It should be a requirement to reveal such evidence. Translation of such evidence, as is available for some aircraft from independent TVE data, into additional and specific approval requirements will depend on how well the manufacturer and/or operator can identify the source of the problem and whether it is identified as originating in production or in service.

Note: – The definitions of “extended period” and “young”, as used above, should be interpreted relative to the appropriate continued airworthiness validation interval developed against continued airworthiness.

8. State Data Base (SDB)

8.1 In order to adequately monitor the RVSM airspace in the vertical plane, State aviation authorities will be expected to maintain an SDB of all approvals that they have granted for operations within the RVSM airspace. The details of the compilation and formatting of the data and the system operating parameters are under development. Ideally, the SDBs will input to South Africa (ATNS monitoring Agency) on a regular basis, which will facilitate the tactical monitoring of aircraft approval status and the exclusion of non-approved users.

9. RVSM Documentation

9.1 Further information on the aircraft and operator approval process, policy planning and implementation issues for RVSM can be obtained at the following websites: FAA, EUROCONTROL, SATMA, MECMA and on individual State websites:

<http://www.faa.gov/ats/ato/rvsm1.htm>

<http://www.eur-rvsm.com>

<http://www.satmasat.com>

<http://www.mecma.com>
