

REDUCED VERTICAL SEPARATION MINIMUM OPERATIONS - FLIGHT CREW TRAINING AND OPERATIONAL CONSIDERATIONS

1. Introduction

1.1 This brief has been produced to provide guidance for operators and flight crew as a consequence of the planned introduction of reduced vertical separation minimum (RVSM) operations in the airspace of most European States on 24 January 2002.

1.2 RVSM operations are already a feature of the North Atlantic Minimum Navigation Performance Specification (MNPS) airspace and have been implemented in certain areas and on certain routes in Pacific Oceanic airspace. Other ICAO regions and States are expected to include RVSM operations in their respective airspace in due course.

1.3 Detailed guidance on the Approval for RVSM operations has already been published by a number of States in addition to detailed information on the European RVSM programme (EURRVSM). Technical and operational guidance on RVSM has also been published by the Joint Aviation Authorities in the form of a Temporary Guidance Leaflet Number 6 (Revision 1) 'Guidance Material on the Approval of Aircraft and Operators for Flight in Airspace above FL290 where a 300 m (1000 ft) Vertical Separation Minimum is Applied'.

2. Flight Crew Training for RVSM Operations

2.1 Flight crews will need to have an in-depth knowledge of the criteria for operating in RVSM airspace, and initial and recurrent training requirements will need to reflect this. The following paragraph in this section highlights items which may need additional emphasis.

2.2 Additional items for crew RVSM training programmes:

- (a) The knowledge and understanding of any ATC phraseology applicable to each area of RVSM operation;
- (b) The knowledge and understanding of any published contingency procedures applicable to each area of RVSM operation;
- (c) The minimum equipment requirements for safe RVSM flight;
- (d) The reinforcement of cockpit drills to ensure that ATC clearances are fully understood, correctly complied with and queried should the need arise;
- (e) Information on the use and limitations of standby altimeters;
- (f) Visual perception differences at altitudes where previously a 2000 ft separation was applied;
- (g) Characteristics of the aeroplane(s) altitude capture systems;
- (h) Any additional aeroplane operating restrictions applicable to an RVSM environment;
- (i) Aeroplane and/or autopilot handling considerations if turbulence is experienced and the requirement to alert ATC if such an encounter prevents compliance with RVSM operation/clearance;
- (j) TCAS/ACAS operating characteristics and the need to ensure that currently acceptable rates of climb or descent may need to be modified whilst changing flight level, particularly when entering or flying within RVSM airspace;
- (k) The requirement for any aeroplane/operator combination to have been granted State approval for RVSM operations and that this approval may have to be in addition to any other approvals required for operation in given airspace.

3. Flight Crew Operating Practices and Procedures

3.1 All RVSM airspace is defined by ICAO as 'special qualification airspace'. Accordingly it is important that all operators provide their flight crews with a resume of any special procedures or phraseology applicable to a given RVSM operation. Holders of Air

Operator Certificates (AOC) are required to have an 'operations manual' In which all pertinent details and procedures are specified. Non-AOC holders are not required to have such a document, however, given the nature of RVSM airspace and RVSM operations, they will be expected to make readily available to flight crews a similar set of instructions to those shown below for inclusion in operations manuals.

3.2 Specimen Entry for Operations Manuals: Procedures for Flight in RVSM Airspace

RVSM Operations - General

Before Flight

Ensure that the aeroplane has been approved for flight in RVSM airspace and that its serviceability state satisfies dispatch requirements for the route Intended to be flown, noting any operating limitations that might apply (eg restricted range of Math Nos.). Review the current flight levels to which RVSM rules apply, noting that there may be differences between regional or national airspace RVSM applications. Enter 'W' at Item 18 of the ICAO flight plan (or at item 'Q' of a repetitive flight plan) indicating that the aeroplane has State approval to be flown within RVSM airspace. Enter any additional annotations that may be required to signify that additional navigation approval requirements have been met (eg MNPS navigation approval, BRNAV approval or similar lateral navigation performance approvals).

Carry out external checks in accordance with the appropriate guidance which will include ensuring that pitot and static ports, and the surfaces on which these are mounted are free of damage. In addition, there may be additional RVSM critical areas on the skin of the aeroplane which will also have to be checked for damage or deterioration. When inside the aeroplane, confirm that any contingency checklists are to hand, and that the technical log contains nothing to show that RVSM entry conditions cannot be met (Two primary altitude measurement systems, one automatic altitude-control system, and one altitude-alerting device comprise the minimum equipment standard for flight within any RVSM airspace). When checking altimeters on the ground, confirm that all altitude indications are within the tolerances specified for the aeroplane.

In Flight - Before Entering RVSM Airspace

Ensure that the aeroplane has an ATC clearance to enter RVSM airspace, then confirm that aeroplane serviceability still allows flight to be made in such airspace. Carry out an altimeter cross check shortly before entering or after levelling-off and record on the pilot log or flight plan that no errors are apparent: at least two primary altimeters must agree within the tolerances specified for the aeroplane. If TCAS/ACAS is installed, leave the mode selector in the 'TA/RA' or 'normal' position. Ensure that the altitude-alerting system is operative. Review actions that should be taken in the event that compliance with ATC clearances cannot be maintained.

In Flight - Entering, Flying Within and Leaving RVSM Airspace

When approaching the first cleared flight level, and/or when changing flight level in RVSM airspace, aim to keep vertical speed within 500 to 1000 ft per mm: do not exceed 1500 ft per mm, and ensure that the aeroplane neither undershoots nor overshoots the cleared flight level by more than 150 ft, manually overriding if necessary. One automatic altitude-control system should be operative and engaged throughout the cruise. Exceptions to the requirement for the altitude-control system to remain engaged are when it may be necessary to re-trim the aeroplane, or when the aeroplane encounters turbulence and operating procedures necessitate disengaging or modifying this mode. Any disengagement should be kept to as short a period as is necessary.

At time intervals not exceeding 60 minutes, or when required by aeroplane operating drills, carry out altimetry system cross checks, If these are outside the tolerances specified for the aeroplane, carry out appropriate drills which may include having to alert ATC that RVSM flight cannot be maintained. Any deviations from the assigned flight level greater than 300 ft (90 m) must be reported to ATC and thence to the Authority via the Mandatory Occurrence Reporting Scheme.

After Flight in RVSM Airspace

Ensure that any unserviceabilities that could prevent subsequent flight within RVSM airspace are recorded on the technical log sector record page and where possible ensure that an adequate debrief is given to engineering personnel to assist in system rectification. **Contingencies - Applicable to all RVSM Airspace General**

Report to air traffic control, as soon as practicable, any event that may affect ability to comply with the current clearance, examples being: severe turbulence, loss of thrust, loss of pressurisation, need to divert, uncertainty of present position, etc. If, at any time, it is not possible to notify air traffic control immediately that a problem has occurred and obtain a new clearance before departing from the old, comply as accurately as possible with any procedures that may be specified for the airspace. In all cases a good look out should be maintained, and if the aeroplane is equipped with TCAS/ACAS, the visual display should be used to assist in the sighting of proximate traffic. **Information obtained from the TCAS traffic display must not be used for self-separation.**

The following equipment failures must be reported to air traffic control:

- Loss of thrust on one or more engines necessitating descent;
- Loss of one or more altimetry systems;
- Failure of all automatic altitude-control systems;
- Failure of any other equipment that could affect the ability of the aeroplane to maintain flight as cleared.

Contingencies - Applicable to Specified RVSM Airspace

An operator should ensure that the operations manual contains all current procedures promulgated for his area(s) of operation and includes any RVSM area-specific R/T phraseology. The operator should also ensure that any changes are incorporated in manuals as soon as they are promulgated. The following text may be included verbatim in operations manuals, if desired. It is presented in this brief in order to explain the rationale behind the differences in RVSM procedures in relation to areas of application.

EUR RVSM Airspace -

In this RVSM airspace, It is expected that all aeroplanes will be in continuous radio contact with ATC either on the assigned frequency or on the distress and emergency frequency (121.5MHz). They will therefore be able to advise ATC of any abnormal circumstances where RVSM performance requirements cannot be met, Including encounters with turbulence greater than 'moderate'. ATC will then respond and issue an appropriate revised clearance before the pilot Initiates a deviation from the original clearance. It is recognised, however, that there may be some circumstances (such as an emergency descent following the loss of cabin pressurisation) where deviations may have to occur with little or no prior notice to ATC. In such cases the pilot will need to obtain a revised clearance as soon as possible after the deviation.

North Atlantic and other Oceanic or Remote RVSM Airspace

For oceanic and remote area RVSM applications, where continuous direct controller-pilot communication may not always be possible, a range of contingencies have been

considered which allow independent action by flight crews, in general, they permit crews, in exceptional circumstances, to deviate from assigned clearances by selecting flight levels and/or tracks where other aeroplanes are least likely to be encountered. During such deviations, crews are required to make maximum use of aeroplane lighting and to transmit relevant information on all appropriate frequencies, including the distress and emergency frequency. Once contact with ATC has been re-established, the crew will be assisted and issued with new clearances as required. Offset track procedures may be permitted if an encounter with turbulence is considered to be due to wake vortex.

4. TCAS/ACAS Alerts and Warnings

Note: For use by pilots of TCAS/ACAS-equipped aeroplanes whose operations are not specified within an operations manual.

4.1 In the event that a Traffic Advisory (TA) is issued, commence a visual search for the threat aeroplane and prepare to respond to a Resolution Advisory (RA), if one should follow. In the event that an RA is issued, initiate the required manoeuvre immediately, subsequently adjusting power and trim. **Manoeuvres should never be made in a direction opposite to that given by the RA even if there is a conflict between the RA and an ATC instruction to manoeuvre.** Note that manoeuvres should never be made in a direction opposite to that given by the RA, and that RAs should be disregarded only when the potentially conflicting traffic has been positively identified and it is absolutely clear that no deviation from the current flight path is needed. All RAs should be reported to air traffic control (a) verbally, as soon as practicable, and (b) in writing, to the Authority, after the flight has ended, using the form contained in the relevant Aeronautical Information Circular.

5. Conclusion

5.1 RVSM above FL 290 is expected to become a standard feature in many regions beyond the end of the year 2000. Its introduction follows many years of extensive international collaboration and research which resulted in the conclusion that such a reduction in vertical separation could occur without imposing over-demanding technical and operational requirements. However, it cannot be introduced to any airspace unless all concerned with such introduction are content that it can be applied safely and all those engaged in aeroplane operation are competent to operate in accordance with the appropriate procedures.

6. For further Information see your State Approval Authority