

Appendix D

GUIDANCE FOR THE IMPLEMENTATION OF RNAV ROUTES

1. Introduction

1.1 RNAV operations allow flying in any region of the airspace without the need to fly over the ground base navigation facilities. RNAV techniques applied in several parts of the world have proved that they have advantages over other traditional forms of navigation and that they give certain benefits, among which are:

- establishment of more direct routes;
- reduction of flight distances;
- establishment of deviation routes for aircraft flying over high traffic density areas;
- establishment of double or parallel routes to fit a larger amount of en-route traffic; and
- reduction of ground base navigation facilities.
- a better design of the airspace and the routes network.

1.3 The planning and implementation of RNAV routes demands an extensive analysis of all related issues that could affect such a process. The general guidelines for the analysis needed for this process are hereby presented.

2. Issues to consider during the implementation process

2.1 During the implementation process, the following issues must be taken into account:

- a) Start/end points of the proposed RNAV routes;
- b) The existing traffic flows and trajectories in the TMAs where the airports are located from the start/end points of the RNAV route;
- c) The incorporation of traffic coming from intermediate cities;
- d) The conventional ATS routes that are near the proposed RNAV routes;
- e) The fleet that is not RNAV equipped;
- f) The forbidden and restricted airspaces, which affect the RNAV route;
- g) The adjacent FIRs airspaces, mainly CTRs and TMAs, that could affect or be affected by the RNAV routes;
- h) The mountainous areas located near airports and along the RNAV route.

Start/end points of the RNAV routes

2.2 One of the dilemmas for the implementation of RNAV routes that will join city pairs is to determine which reference to use in order to define the end points. Most airports are located in the terminal control areas that have already established the trajectories to order the traffic flows, IFR and VFR, National and International.

2.3 The selection of these points, either existent or new, shall determine definitively the real trajectory of the route, and therefore, the FIRs, ATS conventional routes and RNAV routes, and prohibited and restricted airspaces, etc., involved in the same.

2.4 The analysis for the selection of these points will have to contemplate all factors involved in order to avoid further modifications to the proposed trajectory and consequently to repeat the whole process, which would delay the implementation.

Traffic flows and trajectories in the TMAs

2.5 Traffic conditions at the TMA of airports could determine that traffic that flies over the proposed RNAV routes comes in through a different trajectory in order to maintain the great circle or to not interfere with the established trajectories. The complexity of the TMA, the importance of the traffic flows and/or the ATC workload have to be considered and incorporated into the traffic flows.

2.6 During the RNAV routes implementation process that is being carried out in the CAR/SAM Regions, some FIRs, especially the FIRs whose airports are located in the ends of the routes, have the tendency to establish a sole entrance or exit point to/from the FIR for all the routes proceeding from a same sector. In some cases, this point is located at a distance of hundreds of nautical miles from the exit/destination aerodrome.

2.7 This happens due to the existence of forbidden and restricted airspaces as well as the preference to incorporate new RNAV routes to the existing arrival and exit trajectories. If the tendency is maintained without alterations, the flight distance may be significantly increased and it would impede the implementation of the parallel routes that will allow the optimum use of the airspace, alleviate the traffic congestion or make possible for the aircraft to fly at optimum flight levels.

2.8 Furthermore, the traffic from/to the TMAs at intermediate airports may be incorporated to the RNAV routes through SIDs/STARs and/or through RNAV auxiliary routes that allow maintaining the proposed RNAV routes in the great circle. The need to have RNAV routes arriving to intermediate cities is to be thoroughly analysed in order to avoid the separation of the great circle trajectory routes and to avoid the consequences mentioned in the last paragraph.

2.9 In this regard, it is necessary to use all necessary efforts and to establish the pertinent coordination to implement more direct RNAV routes, which will benefit air operations and the economy of air transport.

Conventional ATS Routes

2.10 It is necessary to have an analysis of the existing conventional ATS routes that coincide or are near the proposed RNAV routes. Considering that there will be numerous aircraft that will not have the area navigation equipment, there is the option to redirect to the conventional ATS routes and to move them far from the proposed RNAV routes. This will require the redesign of the airspace or they could be kept as they are and then establish maximum flight levels for these routes and minimum flight levels from RNAV routes.

2.11 During the transition stage, it seems most convenient to choose the second option, which is to segregate the use of the airspace, and for this end, there should be an extensive analysis to determine the real needs and the establishment of minimum operation requirements as well as specific ATS procedures for each block of airspace that allows the application and unequivocal compliance on behalf of the ATC and the users.

2.12 On the other hand, the analysis of traffic density in a particular traffic flow could make an RNAV route insufficient to meet the demands, considering that there are existing areas and route segments in which the aircraft are not operating at their optimum flight levels and it might be necessary to analyse establishing parallel RNAV routes to solve this situation.

Restricted and forbidden zones

2.13 Conceptually, the Airspace Management (ASM) assumes that the airspace should be dynamically shared by civil and military users. In an integrated ATM system, the airspace management is not limited to the tactical aspects of sharing airspace; it is also directed to bring strategic planning capabilities by taking into account the necessary harmonization that should exist when an airspace is shared.

2.14 In this regard, special attention should be given to the geographic location of forbidden and restricted airspaces, including the lateral and vertical boundaries and their impact on the implementation of more direct RNAV routes for the use of civil aviation.

2.15 The existence of restricted and forbidden zones affects the proposed trajectories of RNAV routes and will significantly increase the distances to be flown. Therefore, in order to accomplish the implementation of more direct RNAV routes, the corresponding authorities are required to take the necessary measures in order to have a harmonized civil/military coordination.

Mountainous Areas

2.16 The existence of mountainous areas along the boundaries of an airport may force a proposed RNAV route to be redirected in order to allow the SIDs/STARs design to be compatible with the aircraft performance during the corresponding ascent and descent.

2.17 The presence of mountainous areas along a route may affect the aircraft operations during the en-route phase and consequently may cause a redirection of the proposed RNAV route in order to comply with Annex 6 requirements, as far as oxygen provision in certain altitude and pressure conditions is concerned.