International Civil Aviation Organization APANPIRG/11-WP/8

ELEVENTH MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/11)
Bangkok, Thailand, 2 – 6 October 2000

Agenda Item 2.4: Other Air Navigation Matters

An updated Statement of Basic Operational Requirements and Planning Criteria (BORPC)

(Presented by the Secretariat)

SUMMARY

An updated statement of Basic Operational Requirements and Planning criteria (BORPC) for regional meeting is attached for review and necessary action.

1. INTRODUCTION

1. In accordance with its Terms of Reference APANPIRG is expected to review the Statement of Basic Operational Requirements and Planning Criteria (BORPC) which forms the basis for the development of Air Nagiation Plan (ANP), and recommend to the Air Navigation Commission (ANC) any changes to the BORPC required in the light of new developments in the air navigation field.

2. DISCUSSION

2.1 On 17 June 1999, the ANC approved the updated Statement of Basic Operational Requirements and Planning Criteria (BORPC) which incorporates the changes suggested by APANPIRG/10 meeting and other regional planning groups. This BORPC has been included in the ASIA/PAC Basic ANP.

3. ACTION BY THE APANPIRG

3.1 The meeting is invited to:

a) review the attached BORPC and suggest any changes/additions if required.

STATEMENT OF BASIC OPERATIONAL REQUIREMENTS AND PLANNING CRITERIA (BORPC) FOR REGIONAL AIR NAVIGATION PLANNING

(Approved by the Air Navigation Commission on 17 June 1999)

1. INTRODUCTION

1.1 On 17 June 1999, the Air Navigation Commission approved this Statement of Basic Operational Requirements and Planning Criteria which is appropriate to all the ICAO regions except the European Region.

1.2 The Commission has considered that in planning the facilities and services related to the communications, navigation and surveillance/air traffic management (CNS/ATM) systems, the Global Air Navigation Plan for CNS/ATM Systems, accepted by the Council, provides the framework to be followed. Among the information included in the Global Plan, the Statement of ICAO Policy on CNS/ATM Systems Implementation Chapter 2 (ICAO's Planning Structure for CNS/ATM) and Chapter 3 (Global Planning Methodology) are considered particularly pertinent to regional planning. The importance of planning on the basis of homogeneous areas and major traffic flows, as referred to in the Global Plan, is also stressed.

1.3 The Commission has also considered it unnecessary to repeat in this statement any pertinent requirements already contained in the Convention, Annexes or Procedures for Air Navigation Services.

2. GENERAL (APPLICABLE TO BOTH INTERNATIONAL COMMERCIAL AIR TRANSPORT AND INTERNATIONAL GENERAL AVIATION)

2.1 Air navigation facilities, services and procedures recommended for the area under consideration should form an integrated system designed to meet the requirements of all international civil aircraft operations. The plan should meet the requirements of all operations planned to take place in the area during the next five years, but not necessarily limited to that period, taking due account of the long-term planning and implementation strategies regarding the communications, navigation and surveillance/air traffic management (CNS/ATM) systems and its possible effects on adjacent regions.

2.2 Traffic forecasts have a special role in planning the implementation of CNS/ATM systems. The forecasts represent the demand for future ATM. Forecasts of aircraft movements within homogeneous ATM areas and along major international traffic flows form the basis for planning of the infrastructure and arrangements which will supply the required level of ATS. A uniform strategy has been agreed by ICAO for the purpose of preparing traffic forecasts in support of the regional planning process.

2.3 The planning should be based on traffic forecasts and should take account of the following normal ranges of operating characteristics of the aircraft listed therein. However, the table of aircraft operations referred to in ICAO Doc 8144 (Directives to Regional Air Navigation Meetings and Rules of Procedure for their Conduct) could be used in the absence of traffic forecasts. The system should be sufficiently flexible to accommodate aircraft operational characteristics outside the normal range.

2.4 Aircraft, engaged or planned to be engaged, in international operations have been grouped into the following categories:

a) supersonic turbo-jet aeroplanes;

b) subsonic turbo-jet aeroplanes;

c) multi-engine turboprop aeroplanes;

d) piston-engine aeroplanes and single-engine turboprop aeroplanes with:

1) a normal cruising speed of more than 260 km/h (140 kt) (type A); and
2) a normal cruising speed up to 260 km/h (140 kt) (type B);

e) helicopters; and

f) other aircraft (V/STOL, gliders, balloons, etc.). ***Note.*** *Group f) to be included only to the extent that it requires consideration in regional planning.*

2.5 The normal operating characteristics listed below for each group of aircraft should be taken into account in the development of facilities, services and procedures to the extent that relevant categories operate, or will operate, within the system.

2.6 **Supersonic turbo-jet aeroplanes**

a) *Climb performanc*e: At subsonic speed 20-50 m/s (4 000 - 10 000 ft/min); at supersonic speed 8-16 m/s (1 500 - 3 000 ft/min) during transonic acceleration up to 13 100 m (FL 430); at supersonic cruising speed 2 – 8 m/s (500 – 1 500 ft/min) above 13 100 m (FL 430).

b) *Speed range in cruising flight*: At subsonic speed (Mach 0.95); at supersonic speed above 13 100 m (FL 430) Mach 1.7 - 2.0.

c) *Range of desirable cruising level*s: At subsonic speed 7 600 – 11 200 m (FL 250 - 370); at supersonic cruise-climb technique speed 15 240 - 18 280 m (FL 500- 600).

d) *Descent performanc*e: At supersonic speed: 20 - 25 m/s (4 000 - 5 000 ft/min); at subsonic speed 15 - 20 m/s (3 000 - 4 000 ft/min).

e) *Contingency performanc*e: If unable to obtain or maintain supersonic speed, SST aircraft will use the values shown in a) or d) above against subsonic speed.

2.7 **Subsonic turbo-jet aeroplanes**

a) *Climb performanc*e: 8 – 25 m/s (1 500 – 5 000 ft/min).

b) *Speed range in cruising flight*: 780 – 1020 km/h (420 – 550 kt) (Mach 0.71 - 0.92).

c) *Range of desirable cruising level*s: 8 250 – 13 700 m (FL 270 – 450).

d) *Descent performanc*e: 10 – 25 m/s (2 000 – 5 000 ft/min).

2.8 **Multi-engine turboprop aeroplanes**

a) *Climb performanc*e: 5 – 15 m/s (1 000 – 3 000 ft/min).

b) *Speed range in cruising flight*: 460 – 650 km/h (250 – 350 kt).

c) *Range of desirable cruising level*s: 5 200 – 8 250 m (FL 170 – 270).

d) *Descent performanc*e: 8 – 15 m/s (1 500 – 3 000 ft/min).

2.9 **Piston-engine aeroplanes and single-engine turboprop aeroplanes**

a) *Climb performanc*e:

1) Type A: 2 – 10 m/s (500 – 2 000 ft/min);
2) Type B: 2 – 5 m/s (500 – 1 000 ft/min).

b) *Speed range in cruising fligh*t:

1) Type A: 260 – 460 km/h (141 – 250 kt);
2) Type B: 110 – 260 km/h (60 – 140 kt).

c) *Range of desirable cruising level*s:

1) Type A: up to 6 100 m (FL 200);
2) Type B: up to 3 050 m (FL 100).

d) *Descent performanc*e:

1) Type A: 5 – 10 m/s (1 000 – 2 000 ft/min);
2) Type B: 2 – 5 m/s (500 – 1 000 ft/min).

2.10 **Helicopters**

a) *Climb performanc*e: up to 8 m/s (1 500 ft/min).

b) *Speed range in cruising fligh*t: up to 370 km/h (200 kt).

c) *Range of desirable cruising level*s: up to 3 050 m (FL 100).

d) *Descent performanc*e: up to 8 m/s (1 500 ft/min).

Note 1.) *Further to 1.3 above, it is emphasized that the values given 1.3.3 to 1.3.7 represent average values covering the majority of aircraft types in each category. Also, depending on circumstances (e.g. load, stage length of a flight) considerable deviations from them may occur for specific flights.*

Note 2.) *Performance of military aircraft not covered by the above values may be considerably in excess of those quoted. It is, however, assumed that in such cases national arrangements will be made to cater for these aircraft.*

2.11 Planning should not include an aerodrome or other facility or service used only by operators of the State in which the aerodrome or other facility or service is located unless such planning is required to protect the integrity of the plan.

2.12 Planning for facilities and services, in addition to meeting the operational requirements, should take into account the need for:

a) efficiency in operation; and

b) economy in equipment and personnel, with due consideration being given to capability for future expansion without major redesign or replanning.

2.13 Planning should take into account the need for an adequate number of technically trained and competent personnel to be employed in the system to supervise, maintain and operate air navigation facilities and services and should result in recommendations, as necessary, to meet such need.

2.14 The facilities, services and procedures recommended for implementation should not result in imposing on flight crew or ground personnel, employed in the system developed in accordance with the plan, a workload level that would impair safety or efficiency.

2.15 Special operational features of the area under consideration, such as those which may have been associated with causal factors noted in accident investigation reports and incident reports, should be taken into account, particularly if there are indications, such as those given in the "recommendations" of aircraft accident investigation reports and incident reports, that special measures are called for to prevent recurrence of accidents and incidents from the same cause or causes.

2.16 Planning for facilities and services should normally provide for their availability on a 24-hour basis. In cases where part-time availability is deemed adequate to meet the operational requirements, a brief description of the circumstances should be given in the plan. Lighting aids should be planned when use of the aerodromes at night or during low-visibility conditions is expected.

2.17 It is essential that the over-all plan:

a) satisfy the requirements of all aircraft, including domestic and military traffic to the extent that it may affect international traffic;

b) ensure compatibility of facilities, services and procedures with those recommended for operations in adjacent areas;

c) ensure that operators have access to information necessary to exercise effective operational control;

d) provide for speedy exchanges of necessary information between the various units providing air navigation services and between such units and operators; and

e) take account of aircraft performance and navigational capability in specifying requirements for the carriage of airborne equipment, as well as having due regard for the operational environment.

2.18 In the development of the plan, full cognizance should be taken of the cost-effectiveness of the recommended facilities, services and procedures. Planning should be directed towards facilitating implementation of essential improvements required for existing and anticipated operations in the region. The objective should be to expedite the eradication of current deficiencies in the air navigation facilities and services. Project management techniques should be employed for the implementation of communications, navigation and surveillance (CNS) facilities and services to facilitate the phased introduction of air traffic management (ATM) system enhancements.

3. AERODROMES

3.1 International commercial air transport operations

3.1.1 Regular aerodromes and their alternates should be determined to meet the needs of the flights listed in the table of aircraft operations or the use, as approved by the Council, of traffic forecasts. When studying the requirements for alternate aerodromes, the guiding principle should be that, to the greatest practicable extent, the

requirements for alternate aerodromes be satisfied by regular aerodromes used for international aircraft operations. Additionally, consideration should be given to provisions to meet the requirement of en-route alternate aerodromes for extended-range twin-engine operations, as and when necessary.

3.1.2 Physical characteristics, visual aids, and emergency as well as other services should be determined for each regular and alternate aerodrome required for international operations and should include runway length and strength, as well as the aerodrome reference code(s) selected for runway and taxiway planning purposes.

3.1.3 Where at an aerodrome, planning for Category II or III operations, as the case may be, is not a requirement during the plan period but such operations are contemplated at a time beyond the plan period, planning should take into account the possible requirement for Category II or III operations so that at least one runway and the related ground-air environment may be provided in the future to accommodate such operations.

3.1.4 In cases where the extension or development of an aerodrome to meet infrequent critical operations would entail disproportionate expenditures, alternative solutions should be explored.

> ***Not****e.) If it is found that the full operational requirements cannot be met at an aerodrome, then the maximum practicable development to facilitate operations should be recommended and the relevant reasons for this included in the report.*

3.1.5 At alternate aerodromes, the physical characteristics should be determined in accordance with the landing requirements of the diverted critical aircraft and the take-off requirements for the aircraft for a flight to the aerodrome of intended destination. To ensure safe taxiing operations, a specified taxiway route should be determined for the diverted critical aircraft.

> ***Not****e.) Where more than one alternate aerodrome is available, the requirements should be based on the types of aircraft each is intended to serve.*

3.2 International general aviation (IGA)

3.2.1 Aerodromes, in addition to those required for international commercial air transport operations, should be determined to meet the needs of the IGA flights listed in the table of aircraft operations or the use, as approved by the Council, of traffic forecasts.

3.2.2 Physical characteristics, visual aids, and emergency as well as other services should be determined for each aerodrome to meet at least the needs of the most commonly used aircraft operated or intended to be operated at the aerodrome by IGA and should include runway length and strength, as well as the aerodrome reference code(s) selected for runway and taxiway planning purposes.

4. AIR TRAFFIC MANAGEMENT

4.1 Air traffic management should enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints without compromising agreed levels of safety. The air traffic services to be provided, the airspace organization, the associated facilities, and the required navigation performance should be determined on the basis of an agreed network of ATS routes and the type, density and complexity of traffic.

4.2 Airspace management

4.2.1 The airspace structure and organization should include a network of ATS routes established so as to enable aircraft to operate along, or as near as practicable to, the preferred flight path, in both the horizontal and vertical planes, from the departure aerodrome to the destination aerodrome. ATS routes based on area navigation, also including flexible routes, should be recommended where appropriate and feasible. ATS routes shall be great circles between

significant points, wherever possible. Standard instrument arrival routes (STARs) should be established when the density of air traffic justifies their application in a TMA and to facilitate the description of the route and procedure in air traffic control clearances. Standard instrument departure routes (SIDs) should be established for each instrument runway. SIDs and STARs should be laterally segregated to the extent possible.

4.2.2 Whenever the circumstances warrant, the airspace organization should be designed to support the ultimate goal of allowing each aircraft to fly its own optimized flight path. The airspace organization should be indicated in accordance with the ICAO airspace classification.

4.2.3 Airspace restrictions should be subject to a continuing review procedure with the object of eliminating them or reducing their restrictive effects to a minimum, with particular emphasis on the need to achieve effective civil/military co-ordination. Permanent segregation of airspace should be avoided. Temporary airspace reservations, where necessary to cater for large formation flights or other military air operations, should be minimized in time and space, closely co-ordinated, and promulgated in a timely manner. Military operations should not only be promulgated in a timely manner but also through international dissemination (international NOTAM).

4.2.4 Planning for routes required for supersonic aircraft should take account of areas that are to be protected from the adverse effect of sonic boom and of the possible need for the pilot-in-command to avoid any hazardous meteorological conditions which may be encountered in the area in which transonic acceleration is planned. To cater for such circumstances, an alternative route or routes should be available, and alternative points for starting transonic acceleration may be required.

4.3 **Air traffic services**

4.3.1 Flight information service and alerting service should be provided throughout the area under consideration. The plan of flight information regions (FIRs) should provide for the least number of FIRs compatible with efficiency of service and with economy. In this connection, the evolutionary introduction of CNS/ATM systems should be taken into account and consideration should be given to co-operative efforts for introducing more efficiency in airspace management by reducing the number of FIRs. In delineating FIR boundaries, due consideration should be given to:

a) the need for adequate air-ground communications coverage from the location of the FIC/ACC;

b) the need to minimize frequency changes and position reporting by aircraft, and coordination between FICs/ACCs; and

c) the need to minimize problems relating to climbing and descending traffic at major aerodromes located in the vicinity of FIR boundaries.

4.3.2 Area control service should be provided for IFR flights along all ATS routes to be used by international aircraft operations, except where the type and density of traffic clearly do not justify the provision of such service. Flights by supersonic aircraft, during the transonic and supersonic phases of flight, should be provided with air traffic control service ensuring separation from all other flights. Controlled airspace, in the form of airways, control areas of larger dimensions and terminal control areas, should be recommended to encompass all relevant ATS routes. In delineating control area boundaries, due account should be taken of the factors listed in 4.3.1 above.

4.3.3 Approach control service should be provided at all aerodromes used for international aircraft operations and equipped with navigation aids for instrument approach and landing, except where the type and density of traffic clearly do not justify the provision of such service. Controlled airspace, in the form of terminal control areas and control zones, should be recommended to encompass at least the climb to cruising level of departing aircraft and the descent from cruising level of arriving aircraft.

4.3.4 Aerodrome control service should be provided at all regular and alternate aerodromes to be used for international commercial air transport operations. Aerodrome control service should also be provided at those additional

aerodromes used by international general aviation aircraft where the type and density of traffic warrant it. At aerodromes used by international general aviation aircraft, where the type and density of traffic clearly do not justify the provision of aerodrome control service, the provision of aerodrome flight information service by a unit located at the aerodrome should be recommended.

4.3.5 Air traffic advisory service should not be recommended as part of the plan. Where provided (to IFR flights in advisory airspace or on advisory routes), its replacement by air traffic control service at the earliest possible time should be recommended.

4.3.6 The air traffic services system and procedures should:

a) permit the most efficient use to be made of the airspace by all users and provide for the most expeditious handling of the various types of traffic;

b) be so designed that the number of air-ground communications contacts, frequency changes and SSR code changes required of aircraft, and the amount of coordination required between ATS units, are kept to a minimum;

c) ensure the prompt and timely transmission to all aircraft concerned of information on hazardous weather conditions, operational flight information and other available information affecting the safety and efficiency of flight;

d) require the use of uniform altimeter setting procedures throughout the area under consideration when operating below the established transition level or climbing up to the established transition altitude; and

e) establish a common transition altitude on an area basis and, where possible, on a regional basis.

4.3.7 Information on destination weather, the integrated operational status of facilities associated with the runway in use, and the runway conditions, should be provided to aircraft (in voice or data format) by the transmission of operational flight information service (OFIS) messages, including VOLMET, or by the appropriate area control centre or flight information centre upon request, prior to commencement of descent or, in the case of supersonic aircraft, prior to the deceleration/descent phase. Where this information is transmitted in voice format, a discrete frequency should be assigned for this purpose. Air-ground data links are particularly efficient for this type of service, as well as for clearance delivery, and should be recommended when a sufficient number of aircraft are appropriately equipped.

4.3.8 The flight plan to be submitted for a flight by a supersonic aircraft should provide, within the existing flight plan format, the specific information on transonic and supersonic flight phases necessary for ATS purposes.

4.3.9 Procedures should be developed to facilitate ATC handling of descent by aircraft from cruise necessitated by solar cosmic radiation.

4.3.10 To assist in the prevention of controlled flight into terrain (CFIT), efforts should be made to implement a minimum safe altitude warning (MSAW) system or equivalent.

4.3.11 To assist in the prevention of CFIT, every effort should be made, in co-operation with the operators, to identify locations at which unwanted ground proximity warning system (GPWS) warnings occur. These warnings can occur due to conflict between ATS procedures, or operator procedures, and the characteristics of the terrain and/or those of the GPWS equipment in use. Effort should further be made, with co-operation between the ATS authority and the operators to eliminate the occurrence of unwanted GPWS warnings by appropriate adjustment of ATS and/or operator procedures.

Note. *– Where adjustment of procedures is not possible, or is not effective, it may be possible to eliminate unwanted warnings, at a specific location, by GPWS envelope*

modulation. This possibility will be based on technical data of the equipment manufacturer and will be proposed by the operator for acceptance by the operator's authority.

4.4 **Air traffic flow management**

4.4.1 Air traffic flow management should be provided to ensure an optimum flow of air traffic to, from, through or within defined areas during times when demand exceeds, or is expected to exceed, the available capacity of the ATS system, including relevant aerodromes. However, this should not preclude the need for planning airspace to adequately meet demand.

5. **SEARCH AND RESCUE**

5.1 Planning for search and rescue service should take into account, to the maximum practicable extent, existing facilities even if they are provided for purposes not connected with search and rescue. Such planning should take into account the delimitation of maritime search and rescue regions.

5.2 A single SAR point of contact (SPOC) should be designated for each SRR to facilitate co-operation with the associated mission control centre (MCC) of the COSPAS-SARSAT* system.

***Note**.) A SPOC may be an aeronautical or a maritime RCC.*

5.3 Where aircraft of the long-range (LRG) and longer-range categories are required for the provision of air coverage of large oceanic search and rescue regions, but such aircraft cannot be made available by the State responsible for search and rescue services, specific cooperative arrangements should be made for the deployment of such aircraft from other locations in an attempt to meet the requirements for sufficient air coverage of the appropriate regions.

5.4 Search and rescue organization, plans, procedures, operations, and equipment should be in accordance with the provisions of volumes 1, 2 and 3 of the International Aeronautical and Maritime Search and Rescue manual (Doc 9731), to the extent practicable.

6. **COMMUNICATIONS**

6.1 **Aeronautical fixed service (AFS) planning and engineering**

6.1.1 The AFS recommended should be designed to meet the agreed requirements for AIS, ATS, MET, SAR and aircraft operating agencies for voice, message and data communications.

6.1.2 The planning of the aeronautical fixed telecommunication network (AFTN) should be based on the guidance material contained in the *Manual on the Planning and Engineering of the Aeronautical Fixed Telecommunication Network* (Doc 8259) and taking into account the predominating characteristics for conditions in the region or area concerned.

6.1.3 a) If a meteorological operational telecommunication network is recommended, it should be designed so as to meet transit time criteria as follows:

In the peak season of the year, even in the average peak hours, at least 95 per cent of the

*COSPAS - Space system for search for vessels in distress
SARSAT - Search and rescue satellite-aided tracking

messages should achieve transit times of less than the following:

SIGMET, AIRMET, volcanic ash and tropical cyclone advisory messages and special air-reports	5 minutes
Amendments to aerodrome forecasts	5 minutes
Aerodrome reports/landing forecasts/aerodrome forecasts/selected special reports:	
from 0 to 550 NM	5 minutes
for distances exceeding 550 NM	10 minutes

b) If international OPMET data banks are recommended, transit time for request/reply should be less than 5 minutes.

6.1.4 Aerodrome forecast messages originated by meteorological offices in the region should be available, at all locations in the region to which they are addressed, at least 30 minutes before their period of validity commences.

6.1.5 The dissemination means for WAFS products should be such as to guarantee availability of these products throughout the region at international aerodromes and other locations as appropriate to meet operational needs.

6.1.6 Planning of ATS ground to ground communication networks comprising direct and switched ATS speech circuits should take account of operational voice-communication requirements. It should also take into account relevant ICAO documentation with regard to the application of analogue and digital voice switching and signalling systems.

6.1.7 With the introduction of automation in air traffic management many coordination functions will be accomplished through data interchange between ATM systems using ATN applications such as ATS Interfacility Data Communication (AIDC) or ATS message handling service (AMHS), for example. As such, the planning for ATN should include the provision of AFTN/AMHS gateways to facilitate the exchange of information between existing and newly established networks.

6.1.8 For planning of AFS, attention should be paid to the establishment of institutional arrangements for the implementation by States of co-ordinated digital networks, using appropriate technology to meet, in an integrated way, current and future communication requirements.

6.2 Aeronautical mobile service (AMS) and aeronautical mobile satellite service (AMSS)

6.2.1 Air-ground data link and voice communications facilities should be recommended to meet effectively and reliably the agreed requirements for air traffic services as well as, to the extent required, all other classes of traffic acceptable on the AMS. The facilities should employ voice and data communications links based on available transmission media (e.g. HF, VHF, satellite). This decision should be based on system performance and economical criteria to comply with operational needs.

6.2.1.1 Regional planning should take into account AMSS ground earth station (GES) redundancy requirements in co-ordination with the AMSS service provider(s) with a view to avoiding an unnecessary proliferation of facilities.

6.2.2 ATIS and VOLMET or OFIS broadcasts should be recommended only if overloading of air-ground channels due to request/reply communications has occurred, or is expected to occur. When justified by the number of aircraft suitably equipped, data links should be recommended for these functions, as well as for clearance delivery.

6.2.3 Aerodromes having a significant volume of international general aviation traffic should be served by stations of the AMS, and such stations should operate on frequencies within the bands normally used by aircraft constituting this traffic.

6.2.4 Selective calling (SELCAL) devices should be employed, wherever possible and necessary, at aeronautical stations.

6.2.5 An air-to-air VHF communication channel (INTERPILOT) is approved for use over remote and oceanic areas, provided users are out of range of VHF ground stations, to enable pilots to exchange the necessary operational information. The recommendation for use of frequency 123.45 MHz for this purpose has been adopted by the Council of ICAO with an applicability date of 4 November 1999.

6.3 Frequency assignment plans

6.3.1 Frequency assignment work should be done in accordance with the method proposed by the ASIA/PAC/2 RAN Meeting (1983) (Recommendation 6/1, which was approved by the Council of ICAO on 28 June 1983, refers) and using the relevant ICAO Regional Office Frequency Lists.

7. NAVIGATION

7.1 General

7.1.1 The planning of navigation aids should be based on a system basis, recognizing that the requirements for both long range and short range navigation may be met by different navigation systems having area navigation capability, including the global navigation satellite system (GNSS), and it may be practicable to establish ATS routes not provided with ground station-referenced aids for suitably-equipped aircraft. For routes or areas which require that aircraft achieve an acceptable level of navigation accuracy, the requirement should be specified e.g. in the form of a required navigation performance (RNP) type to support a selected horizontal separation minimum, or a minimum aircraft system performance specification (MASPS) to support a selected vertical separation minimum. The navigation systems should meet the needs of all aircraft using it and form an adequate basis for the provision of air traffic services.

7.1.2 Where aircraft are using different systems for navigation and position determination within the same controlled airspace, the facilities involved should, in so far as practicable, be located and oriented to enable a fully integrated air traffic control structure to be established.

7.1.3 Planning should take into account the need of civil aircraft for sufficiently accurate navigation guidance to remain clear of restricted, prohibited and danger areas as required.

7.2 International commercial air transport operations

7.2.1 En-route aids

7.2.1.1 The en-route aids to be recommended should provide navigation assistance to permit en-route navigation on the agreed air traffic services route network with the accuracy required.

7.2.1.2 It is expected that GNSS will ultimately meet all requirements for en-route navigation. Planning for other en-route aids should take due account of the need for a gradual transition towards the use of GNSS in lieu of en-route ground-based navigation aids. Pending implementation of GNSS, VOR supplemented as necessary by DME should be installed as the primary aid for this purpose.

7.2.1.3 Where VOR is used, supplemented as necessary by DME, a total navigation error value for VOR of ±5E (95 per cent probability) should be assumed for planning purposes. However, the specific value of VOR radial signal error for individual facilities/radials should be obtained by flight checking, and if these values are worse than ±3E, appropriate precautions should be taken in respect of the routes concerned.

7.2.1.4 Long-distance radio navigation aids continue to be provided where required.

*7.2.2 **Terminal area aids**

7.2.2.1 It is expected that GNSS will ultimately meet all requirements for terminal navigation. Planning for other terminal aids should take due account of the need for a gradual transition towards the use of GNSS in lieu of terminal area ground-based navigation aids.

7.2.2.2 The terminal area aids to be recommended should permit navigation for approach, holding and departure to be carried out with the accuracy required. Where VOR is used as the primary aid, it should be so located as to permit the most efficient approach and air traffic control procedures and to give the pilot maximum assistance in adhering to requisite patterns. Whenever possible, VORs should be located and operated so that they can serve both the requirements for en-route and terminal navigation guidance, including holding. Where the provision of VORs for the holding is not practicable, NDBs can be used for this purpose. Consideration should be given to the provision of DME to be collocated with VORs whenever this is required to ensure necessary ATC flexibility in the routing of air traffic in a given TMA and when improved accuracy in navigation is a prerequisite to such flexibility.

7.2.3 Non-visual aids to final approach and landing

7.2.3.1 The standard non-visual aids to final approach and landing, supporting precision approach and landing operations, shall comply with general provisions in Annex 10, Volume I, 2.1, and their introduction and application are expected to be in line with the strategy contained in Attachment B to Volume I.

7.2.3.2 In planning the requirements for aids to final approach and landing, each aerodrome should be considered in relation to its traffic, its weather conditions and other aspects of its physical environment. In addition, the following two aspects should be taken into consideration in the determination of specific requirements:

a) *The aerodynamic and handling characteristics of the aircraft*

Turbo-jet aeroplanes have need for precise approach path guidance during approach and landing, irrespective of weather conditions. Such guidance should be provided to runways intended to serve these aeroplanes as follows:

1) On a runway having significant traffic the facilities to be provided should be an ICAO standard non-visual aid to final approach and landing, complemented by a visual approach slope indicator system. When a standard non-visual aid cannot be implemented in the first instance, this should not delay the installation of a visual approach slope indicator system.

2) On a runway not having significant traffic, the facilities to be provided should at least include a visual approach slope indicator system.

b) *Routine auto-coupled approaches*

Where auto-coupled approaches are to be made on a routine basis, an ICAO standard non-visual aid to final approach and landing, i.e. ILS or MLS, should be provided as appropriate to the type of operation planned at the aerodrome. In the case of an ILS of facility performance Category I, the ILS should be of Category II signal quality, without necessarily meeting the associated reliability and availability criteria for backup equipment and automatic change-over of facility performance Category II, but it should be adjusted and maintained to the greatest possible extent and accuracy, and its performance characteristics should be published in AIPs or other suitable documents.

7.2.3.3 **Non-precision instrument approach procedures**

7.2.3.3.1 Non-precision instrument approach procedures can be based on aids other than the standard non-visual aids (see 6.2.3.1 above) which should also support SIDs and STARs. These approach procedures should be constructed whenever possible in accordance with the concept of the stabilized approach; to provide an equivalent three degree final approach glide path; to eliminate stepped approaches; and to provide a final approach fix.

7.2.3.3.2 Particular account should be taken of 6.2.3.3.1 in the design of non-precision instrument approach procedures for use with GNSS which should also support SIDs and STARs.

7.3 **International general aviation**

7.3.1 Short-distance aids

7.3.1.1 Appropriate aids such as GNSS for short-distance navigation should be provided to serve the additional aerodromes referred to in 2.2.1 where the density of traffic and the meteorological conditions so warrant, due account being taken of the airborne equipment carried by aircraft. These aids should, as appropriate, be located so as to permit instrument approaches.

7.4 **Flight testing of visual and non-visual navigation aids**

7.4.1 Cooperative arrangements for the flight testing of visual and non-visual navigation aids (Annex 10, Volume I, Chapter 2, paragraph 2.7) should be recommended where flight testing on a national basis would be impracticable or uneconomical.

8. SURVEILLANCE

8.1 Surveillance systems should provide an adequate support to and meet the needs of ATM. A table of radar facilities, together with an associated chart, is considered to be a useful tool in the planning and implementation of surveillance systems, including automatic dependent surveillance (ADS).

8.2 Surveillance should be provided as an integral part of air traffic control where practicable and desirable or necessary in the interest of safety, efficiency and economy of operations, in particular for those areas where traffic density and/or the multiplicity or complexity of ATS routes create constraints. Primary and/or secondary surveillance radar systems may be used to fulfil this requirement. When technology permits, provided that the required level of safety is maintained, automatic dependent surveillance (ADS) may be used in airspace where surveillance by radar is either impracticable or cannot be justified in terms of traffic volumes and air safety.

8.3 Provision should also be made for the use of surveillance systems for the purpose of monitoring air traffic and identifying civil aircraft in areas where they might otherwise be intercepted.

> ***Note.)*** *This requirement does not constitute a justification or operational requirement for installation of new radars. Since interceptions would normally only take place under existing military radar control, this should be interpreted as a requirement for a State to make better use of existing measures and to improve civil/military coordination.*

9. METEOROLOGY

9.1 **World area forecast system (WAFS) - Regional aspects**

9.1.1 Planning for regional aspects of the WAFS should be undertaken, with particular reference to user States' requirements for WAFS products, service areas and areas of coverage of charts to be included in flight documentation.

9.1.2 Areas of coverage of charts to be provided under the WAFS should be selected so as to ensure the required coverage for flights departing aerodromes in each service area, whilst minimizing, as far as practicable, the workload of regional area forecast centres (RAFCs) and the occupancy of telecommunication channels.

9.1.3 The transmission of RAFC products normally should be completed nine hours before validity time. The time period should be adjusted so as to meet the needs of the majority of the flight stages for which the charts are required.

9.1.4 Requirements for the issuance of medium-level significant weather (SIGWX) charts (FL 100 – 250) under the WAFS should only be specified for limited geographical areas having a large number of international flight operations using those flight levels and for extended-range operations.

9.1.5 Requirements for upper air wind/temperature charts for flight levels additional to flight level 340 should only be specified where such flight levels are used by a significant number of flight operations.

9.1.6 Where a significant number of SST operations form part of the regional plan, a requirement for SIGWX and upper air wind/temperature charts covering flight levels appropriate to those operations should be specified.

9.2 **Meteorological services to be provided**

9.2.1 The meteorological service to be provided for operators and flight crew members should be specified for each regular aerodrome.

9.2.2 Aerodrome forecasts and amendments should be exchanged to meet the needs of current flight operations, including flights under centralized operational control. Aerodrome forecasts for the aerodromes of departure and destination and their respective alternates, and en-route alternates, including those for extended-range operations, should be disseminated so as to be available at departure aerodromes and at stations designated to provide OFIS (including VOLMET) broadcasts for aircraft in flight.

9.2.3 The determination of the aerodromes at which landing forecasts are required should take into consideration relevant operational and climatological factors, including the weekly number of flights requiring those forecasts and the incidence of adverse weather conditions.

9.2.4 For international general aviation, information concerning weather conditions at aerodromes of destination and at relevant alternate aerodromes and concerning en-route weather conditions should be made available or should be easily procurable.

9.3 **Meteorological observations and reports**

9.3.1 Meteorological observations and reports should be made at hourly intervals. However, the intervals should be half-hourly at aerodromes where the volume of traffic and the variability of weather conditions so justify, and/or they are required for any OFIS (including VOLMET) broadcasts which may be recommended and relevant OPMET bulletin exchange schemes.

9.3.2 Routine and selected special reports should be exchanged to meet the needs of current flight operations. Reports for final destinations and departure and destination alternates should be disseminated so as to be available at departure aerodromes within about two hours' flying time from the aerodrome to which those reports refer. In addition, they should be disseminated to be available for transmission to aircraft in flight up to a distance from the aircraft corresponding to two hours' flying time. For extended-range operations and flights conducted under centralized operational control, reports for final destinations, departure, en-route and destination alternates for the whole route

should be exchanged so as to be available at the aerodrome of departure using, to the extent possible, services of international operational meteorological (OPMET) data banks and/or predetermined AFTN distribution.

9.3.3 Routine reports for significant observing stations along and adjacent to the route* should be disseminated so as to be available at the departure aerodrome for up to a distance corresponding to two hours'* flying time from the aerodrome, and for aircraft in flight for a distance corresponding to two hours'* flying time from the aircraft.

9.3.4 Arrangements should be made for the provision of reports of runway visual range for precision approach runways and for runways used for take-off during periods when the visibility or runway visual range is less than 1 500 metres.

9.4 **Aircraft reports and SIGMET information**

9.4.1 For international air routes having a high density of air traffic, air-reporting exemption or designation procedures should be developed to reduce the frequency of routine air-reports commensurate with the minimum requirements of meteorological offices. The procedures should be included in the *Regional Supplementary Procedures* (Doc 7030).

9.4.2 SIGMET messages, as well as special air-reports which have not been used for the preparation of a SIGMET, should be disseminated to meteorological watch offices so as to enable them to be made available for aircraft prior to departure and aircraft in flight for the route ahead up to a distance corresponding to two hours' flying time. In the case of non-stop flights operating on especially long routes, SIGMETs and special air-reports for the whole route should be made available at the departure aerodrome and for transmission to aircraft in flight.

9.4.3 Notwithstanding the requirements stated in 8.4.2, SIGMETs and special air-reports related to tropical cyclones and volcanic ash clouds should be available at departure aerodromes for the whole route for non-stop flights intending to cross areas which may be affected by these phenomena.

9.4.4 Arrangements should be made for the transmission to ATS units of information on hazardous weather conditions, including SIGMET information, special air-reports, wind shear warnings, aerodrome warnings and thunderstorms, with a view to ensuring the adequate and timely availability of such information for ground-to-air transmission, including VOLMET broadcasts.

9.5 **International Airways Volcano Watch (IAVW) - Regional aspects**

9.5.1 Planning for regional aspects of the IAVW should be undertaken, including the designation of volcanic ash advisory centres (VAAC) responsible for providing advisory information to meteorological watch offices and area control centres on the occurrence, extent and movement of volcanic ash in the atmosphere.

9.6 **Tropical Cyclone Watch**

9.6.1 A tropical cyclone advisory centre (TCAC) should be designated for regions affected by tropical cyclones. The TCAC should be responsible for monitoring the development of tropical cyclones in the region and providing advisory information to meteorological watch offices regarding the position, forecast direction and speed of movement, central pressure and maximum surface wind of the tropical cyclones.

10. **AERONAUTICAL INFORMATION SERVICES AND AERONAUTICAL CHARTS**

10.1 The designation of international NOTAM offices and their areas of responsibility should be based on maximum efficiency in the dissemination and exchange of aeronautical information/data by telecommunications and on optimum use of the aeronautical fixed service (AFS).

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* With possible exceptions for certain routes

10.2 Arrangements for the international exchange of elements of the Integrated Aeronautical Information Package and aeronautical charts should be established to meet the needs of all forms of international civil aviation.

10.3 Arrangements for the transmission and exchange of NOTAMs should be examined with a view to recommending measures to ensure that adequate information is available to users in a timely manner, and that its presentation is efficient as to format and selective as to contents.

10.4 The advantages of using AIS automation integrated systems should be considered when planning the exchange of aeronautical information/data.

10.5 Priority for the planning and implementation of AIS aerodrome units should be based on aerodrome designation (RS, RNS, RG, AS and EAS) as set out in the Basic ANP AOP-1 table.

10.6 Pre-flight information bulletins (PIBs) originated by AIS aerodrome units should be available at each designated international airport at least one hour before each flight in order to meet the operational requirements of users.

10.7 The World Geodetic System - 1984 (WGS-84) should be implemented in support of GNSS-based operations and to assist in the prevention of CFIT (paragraph 4.3.11 refers). The status of WGS-84 implementation should be the object of periodic examination.

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