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Asia and Pacific Regions

Air Navigation Plan

Volume I, Basic ANP

Not to be used for operational purposes

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RECORD OF AMENDMENTS, ADDENDA AND CORRIGENDA

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INTRODUCTION

NEW CONCEPT OF AIR NAVIGATION PLANS

1. Air navigation plans set forth in detail the facilities, services and procedures required for international air navigation within a specified area. Such plans contain recommendations that governments can follow in programming the provision of their air navigation facilities and services, with the assurance that facilities and services furnished in accordance with the plan will form with those of other States an integrated system adequate for the foreseeable future.

2. On 26 February 1997, the ICAO Council decided that the regional air navigation plans (ANPs) should be published in two volumes: a Basic ANP and a Facilities and Services Implementation Document (FASID). It was agreed that the Basic ANP would contain stable plan material such as:

- a) the geographical area constituted by the flight information regions (FIRs) covered by the plan;
- b) the basic operational requirements and planning criteria, as approved by the Air Navigation Commission for application in all regions except Europe; and
- c) the latest planning and implementation guidance formulated for the region through recommendations by regional air navigation (RAN) meetings.

3. It was agreed that the FASID would set forth the dynamic material from the plan constituted by the facilities and services required for international air navigation within the specified area. The FASID would also include appropriate additional guidance, particularly with regard to implementation, to complement the material contained in the Basic ANP.

INTRODUCTION OF CNS/ATM ELEMENTS INTO THE PLAN

4. While the traditional focus of a regional ANP has been to cover the facilities and services required for a period of

five years, the introduction of communications, navigation and surveillance/air traffic management (CNS/ATM) systems with longer planning horizons is recognized, and CNS/ATM planning and implementation elements are being introduced progressively into regional ANPs.

5. Such introduction of CNS/ATM planning elements is guided by the Global Air Navigation Plan for CNS/ATM Systems (Global Plan), which has been developed so that it has a clear and functional relationship with the regional ANPs. This has been accomplished by dividing the Global Plan into two parts. Volume I guides further development of the operational requirements and planning criteria of the regional ANPs. The tables in Volume II form the framework to guide the implementation of CNS/ATM systems on a global basis, using the traditional regional planning processes, leading to a global integrated ATM system. The document therefore offers, under one cover, a global snapshot of progress achieved and work remaining toward implementation of CNS/ATM systems, thereby serving as a consolidated planning tool.

FORMAT AND SCOPE OF THE PLAN

6. The first volume of this document, the Basic ANP, contains general planning criteria, implementation guidelines and stable plan elements. The second volume, the FASID, sets forth in general terms the facilities, services and procedures required for international air navigation within a specified area. This FASID contains specifications that governments can follow in programming the provision of their air navigation facilities and services, with the assurance that facilities and services furnished in accordance with the basic plan will form with those of other States an integrated system adequate for the foreseeable future.

7. In technical scope, the plans comprise statements of required facilities and services in the AOP, AIS, ATM, CNS, MET and SAR fields in sufficient detail to ensure proper functioning of the plan as a whole and its adequacy to meet present and foreseen operational requirements. They also include any special procedures considered necessary to

supplement the worldwide procedures contained in Annexes and PANS. As living documents, the format and content of the Basic ANP and FASID should be kept under review by planning and implementation regional groups (PIRGs) in order, inter alia, to meet the requirements of the Global Plan.

8. In geographical scope the plan is related to one or more of the nine ICAO air navigation regions. The plan may call for the provision of basic facilities and services beyond the charted boundaries of a region where such facilities and services are necessary to meet the requirements of international air navigation within that region.

STATES' RESPONSIBILITIES

9. Each Contracting State is responsible for the provision of facilities and services in its territory under Article 28 of the Convention. The Council has recommended that these facilities and services include those specified in the ANPs.

10. Inclusion in ANPs of basic facilities and services in non-Contracting States and territories is simply a recognition that they are needed by or likely to affect international civil aircraft operations of Contracting States or the facilities and services of these States.

CONTENTS OF THE PLAN

11. This Basic ANP presents in general terms the ICAO plan for the provision of facilities and services for international air navigation in the ICAO Asia and Pacific regions. It has incorporated in an evolutionary manner requirements emanating from introduction of the Global Plan. The companion document to this plan, the FASID, includes detailed information on States' facilities, services and plans for implementation. Facilities and services outside of the prescribed regional boundaries may also have been included in order to maintain the integrity of "systems" and to ensure in so far as possible that all the facilities and services provided by any one State appear in one ANP.

12. Most of the contents of the plan have originated from recommendations of the Third ASIA/PAC Regional Air Navigation Meeting (Bangkok, May 1993) and the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG).

13. The Statement of Basic Operational Requirements and Planning Criteria (BORPC) for regional planning on which the plan is based is found in Part I. In addition, planning in the ASIA/PAC regions takes into account traffic forecasts compiled by the ASIA/PAC Traffic Forecasting Group. Part II — GEN contains information on traffic forecasting in the ASIA/PAC regions. The BORPC for regional planning in Part I is updated in light of proposals from the APANPIRG or by general review by the Air Navigation Commission in preparation for major regional meetings.

14. It should also be noted that the plan does not list all facilities and services existing in the region but only those required as approved by the Council for international civil aviation operations. Aeronautical information publications, NOTAM and other State documents should be consulted for information on additional facilities and services and for operational information in general.

15. Nothing in the manner of presentation of information in the tabulations or in the arrangement of data in this document implies endorsement or acceptance by ICAO in matters affecting the status and boundaries of States and territories.

16. Corrections to this document should be notified to the ICAO Regional Office accredited to the State concerned.

IMPLEMENTATION DATA

17. The Council, at the Seventh and Eighth Meetings of its 121st Session, decided that the explanation of "implemented" as agreed at RAN meetings should be widely publicized and the determination of whether a service or facility is implemented should be examined in that light. The agreed explanation of the term "implemented", as it applies to facilities and services included in this document, is as follows: "Facilities and services specified in the air navigation plan provided, installed, functioning and operated in accordance with appropriate ICAO specifications and procedures".

18. Additionally, the Council, at the Eighth Meeting of its 131st Session agreed to discontinue the practice of including implementation data in air navigation plan publications. Implementation is regularly monitored by the ICAO Regional Offices and the necessary data are brought to the attention of PIRGs.

19. The supplementary procedures for the region are omitted from this document since they are published for all regions in Doc 7030, *Regional Supplementary Procedures*.

DEVELOPMENT OF A CNS/ATM PLAN FOR THE ASIA/PAC REGIONS

20. In September 1991, ICAO held the Tenth Air Navigation Conference to consider the shortcomings of the air navigation systems and examine the new concept of air navigation based on satellite technology proposed by the Council's Future Air Navigation Systems (FANS) Committee (Phase II). The Conference agreed that the systems proposed by the FANS Committee (Phase II), and referred to as the ICAO CNS/ATM Systems, would meet the future needs of the international civil aviation community. Following the Tenth Air Navigation Conference, the Assembly endorsed the new ICAO CNS/ATM Systems which had recommended, inter alia, that in each ICAO region the PIRG concerned be

tasked to develop the regional CNS/ATM implementation plan.

21. In view of the above, the APANPIRG developed a high-level CNS/ATM plan which was presented to the Third ASIA/PAC Regional Air Navigation Meeting (Bangkok, May 1993). The plan has been in evolutionary development with the assistance and cooperation of ASIA/PAC States. Elements of the ASIA/PAC CNS/ATM Implementation Plan are progressively incorporated in the appropriate sections of the ASIA/PAC Basic ANP and FASID.

PROCEDURE FOR THE AMENDMENT OF REGIONAL PLANS, INCLUDING FASID MATERIAL

22. The Basic ANP and FASID may be amended by a RAN meeting or by following the amendment procedures below.

PROCEDURE FOR THE AMENDMENT OF APPROVED BASIC AIR NAVIGATION PLANS

Approved by Council on 25 February 1998

1. Introduction

The procedure outlined below has been evolved to provide a means of maintaining basic regional plans in a current condition by correspondence.

2. General criteria

2.1 The Assembly has resolved that regional plans shall be revised when it becomes apparent that they are no longer consistent with current and foreseen requirements of international civil aviation and that, when the nature of a required change permits, the associated amendment of the regional plan shall be undertaken by correspondence between the Organization and the Contracting States and international organizations concerned.

2.2 When a State cannot immediately implement a particular part or a specific detail of a regional plan, although it intends to do so when practicable, this in itself should not cause the State to propose an amendment to the plan.

3. Procedure

3.1 If, in the light of the above criteria, any Contracting State (or group of States) of a region wishes to effect a change in the approved Basic ANP for that region it should propose to the Secretary General, through the ICAO Regional Office accredited to that State, an appropriate amendment to the plan, adequately documented; the proposal should include the facts that lead the State to the conclusion that the amendment is necessary. Such amendments may include additions, modifications or deletions. (This procedure does not preclude a State having previous consultation with other States before submitting an amendment proposal to the ICAO Regional Office.)

3.2 The Secretary General will circulate the proposal, adequately documented, with a request for comments to all

provider and user States of the region considered affected as well as to user States outside the region and international organizations which may be invited to attend suitable ICAO meetings and which may be concerned with the proposal. If, however, the Secretary General considers that the proposed amendment conflicts with established ICAO policy, or that it raises questions which the Secretary General considers should be brought to the attention of the Air Navigation Commission, the proposal will be first presented, adequately documented, to the Commission. In such cases, the Commission will decide the action to be taken on the proposal.

3.3 If, in reply to the Secretary General's inquiry to States and selected international organizations, no objection is raised to the proposal by a specified date, the proposal shall be submitted to the President of the Council, who is authorized to approve the amendment on behalf of the Council.

3.4 If, in reply to the Secretary General's inquiry to States and selected international organizations any objection is raised, and if objection remains after further consultation, the matter will be documented for formal consideration by the Commission. If the Commission concludes that the amendment is acceptable in its original or other form, it will present appropriate recommendations to the Council.

3.5 Proposals for the amendment of regional plans submitted by international organizations directly concerned with the operation of aircraft, which may be invited to attend suitable ICAO meetings and which attended the meeting(s) where the relevant plan was prepared, will be dealt with in the same manner as those received from States, except that, before circulating a proposal to States and selected international organizations pursuant to 3.2, the Secretary General will ascertain whether it has adequate support from the State or States whose facilities will be affected. If such support is not forthcoming, the proposal will be presented to the Commission, and the Commission will decide on the action to be taken on the proposal.

3.6 Proposals for the amendment of regional plans may also be initiated by the Secretary General provided that the State or States whose facilities will be affected have expressed their concurrence with the proposal.

3.7 Amendment to regional plans which have been approved in accordance with the above procedure will be promulgated at convenient intervals.

PROCEDURE FOR THE AMENDMENT OF THE FACILITIES AND SERVICES IMPLEMENTATION DOCUMENT (FASID)

Approved by Council on 26 February 1997

1. Amendments to the FASID shall be effected on the basis of an adequately documented proposal submitted by a Contracting State (or a group of States) to the ICAO Regional Office; the proposal should include the facts that lead to the conclusion that the amendment is necessary. Such amendments may include additions, modifications or deletions to the FASID. (This procedure does not preclude a State having previous consultation with other States before submitting an amendment proposal to the ICAO Regional Office.)

2. The ICAO Regional Office will circulate the proposal, adequately documented, with a request for comments to the provider States in the region and to user States except those which obviously are not affected, and, for information and comments if necessary, to international organizations which may be invited to attend suitable ICAO meetings and which may be concerned with the proposal. If, however, it is considered that the proposed amendment conflicts with established ICAO policy, or that it raises questions which should be brought to the attention of the Air Navigation Commission, the proposal will be adequately documented and presented to the Commission. In such cases, the Commission will decide the action to be taken on the proposal.

3. If, in reply to the ICAO Regional Office's inquiry, no objection is raised to the proposal by a specified date, it will be deemed that a regional agreement on the subject has been reached and the proposal shall be incorporated into the FASID.

4. If, in reply to the ICAO Regional Office's inquiry, any State objects to the proposal, and if objection remains after further consultation, the matter will be documented for discussion by the respective planning and implementation regional group (PIRG) and, ultimately, for formal consideration by the Commission, if necessary. If the Commission concludes that the amendment is acceptable in its original or other form, it will present appropriate recommendations to the Council.

5. Proposals for the amendment of the FASID submitted by international organizations directly concerned with the operation of aircraft in the region, which may be invited to attend suitable ICAO meetings where the FASID was prepared, will be dealt with in the same manner as those received from States, except that, before circulating the proposal to all interested States, it will be ascertained whether the proposal has adequate support from the State or States whose facilities or services will be affected. If such support is not forthcoming, the proposal will not be pursued.

6. Proposals for the amendment of the FASID may also be initiated by the ICAO Regional Office provided that the State or States whose facilities or services will be affected have expressed their concurrence with the proposal.

7. Amendments to the FASID which have been approved in accordance with the above procedure will be promulgated at convenient intervals.

ABBREVIATIONS

All abbreviations used in this document are contained in the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400), with the exception of those used in the explanations of the various tables, which also give their meaning.

Part I

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

INTRODUCTION

1. On 22 February 2005, the Air Navigation Commission approved this Statement of Basic Operational Requirements and Planning Criteria (BORPC) which is applicable to all the ICAO regions.

2. The Commission has considered that in planning the facilities and services related to communications, navigation and surveillance/air traffic management (CNS/ATM) systems, the Global Air Traffic Management Operational Concept, supplemented by the *Global Air Navigation Plan for CNS/ATM Systems* (Doc 9750), provides the framework to be followed. In addition, relevant recommendations, accepted by the Council, contained in the report of the Eleventh Air Navigation Conference (Montreal, 22 September to 3 October 2003) should be taken into account. The importance of planning on the basis of homogeneous areas and major traffic flows, as referred to in the Global Plan, is also stressed. As ATM requirements are developed, the BORPC will be updated to take into account the most up-to-date work on follow-up activities related to the operational concept.

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.

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

4. 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 CNS/ATM systems. Due account should be taken of the possible effects that changes could have on adjacent regions.

5. 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 air traffic flows form the basis for planning of the infrastructure and arrangements which will supply the required level of air traffic services (ATS).

6. The planning should be based on historical trends or, if otherwise available, traffic forecasts, and should be used taking into account the normal ranges of operating characteristics of the aircraft. The system should be sufficiently flexible to accommodate aircraft operational characteristics outside the normal range.

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

- a) turbo-jet aeroplanes;
- b) multi-engine turboprop aeroplanes;
- c) 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);
- d) helicopters; and
- e) other aircraft (V/STOL, gliders, balloons, etc.).

Note.— Aircraft listed in e) are to be included only to the extent that they require consideration in regional planning.

8. 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.

8.1 Turbo-jet aeroplanes.

- a) *Climb performance*: 8 – 25 m/s (1 500 – 5 000 ft/min).
- b) *Speed range in cruising flight*: 780 – 1 020 km/h (420 – 550 kt) (Mach 0.71 – 0.92).
- c) *Range of desirable cruising levels*: 8 250 – 13 700 m (FL 270 – 450).
- d) *Descent performance*: 10 – 25 m/s (2 000 – 5 000 ft/min).

8.2 Multi-engine turboprop aeroplanes.

- a) *Climb performance*: 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 levels*: 5 200 – 8 250 m (FL 170 – 270).
- d) *Descent performance*: 8 – 15 m/s (1 500 – 3 000 ft/min).

8.3 Piston-engine aeroplanes and single-engine turboprop aeroplanes.

- a) *Climb performance*:
 - 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 flight*:
 - 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 levels*:

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

d) *Descent performance*:

- 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).

8.4 Helicopters.

- a) *Climb performance*: up to 8 m/s (1 500 ft/min).
- b) *Speed range in cruising flight*: up to 370 km/h (200 kt).
- c) *Range of desirable cruising levels*: up to 3 050 m (FL 100).
- d) *Descent performance*: up to 8 m/s (1 500 ft/min).

Note 1.— Further to 6 above, it is emphasized that the values given in 8 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.

9. 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.

10. 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.

11. Planning should take into account the need for an adequate number of technically qualified 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 a need. Human resource development capabilities should be compatible with the plans to implement facilities and services. A systematic and quantitative approach towards analysing human resource needs should be used to ensure that the consequential training capabilities are available and accessible.

12. 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. The integration of human factors knowledge into the design and certification of facilities, services and procedures is therefore essential. In order to achieve a workload level that would not impair safety and efficiency, as well as to introduce the capability for future expansion without major redesign or replanning, human factors issues should be considered during the process of design and certification of facilities, services and procedures, before they are operationally deployed.

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

14. 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.

15. It is essential that the overall 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.

16. 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 CNS facilities and services to facilitate the phased introduction of ATM system enhancements.

AERODROMES

International commercial air transport operations

17. Regular aerodromes and their alternates should be determined based on the needs identified by users. 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, the requirements of extended-range twin-engine operations for en-route alternate aerodromes should also be considered.

18. 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.

19. 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.

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

Note.— 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.

21. 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. The adequacy of the emergency response and rescue and firefighting services to meet the requirements of the diverted critical aircraft should be reviewed to plan the necessary augmentation from sources nearby.

Note.— Where more than one alternate aerodrome is available, the requirements should be based on the types of aircraft each is intended to serve.

International general aviation (IGA)

22. Aerodromes, in addition to those required for international commercial air transport operations, should be determined to meet the needs of the IGA flights as identified by user requirements.

23. 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.

Certification of aerodromes and safety management system

24. Annex 14 — *Aerodromes*, Volume I — *Aerodrome Design and Operations*, requires States to certify their

aerodromes used for international operations in accordance with the specifications in that Annex, as well as other relevant ICAO specifications, through an appropriate regulatory framework. Additionally, the Annex recommends that States certify aerodromes open to public use. The regulatory framework should include the establishment of criteria for certification of aerodromes. Furthermore, the certification should be based on the review and approval/acceptance of an aerodrome manual to be submitted by the aerodrome operator which would include all relevant information such as location, facilities, services, equipment, operating procedures, organization and management structure of the operator. The aerodrome manual should also include details of the aerodrome safety management system as implemented by the aerodrome operator. The intent of a safety management system is to ensure the implementation of aerodrome safety policies by an aerodrome operator, which provide for the control of safety at, and the safe use of, the aerodrome. Therefore, the safety management system of the aerodrome operator should be compatible with those of the ATS provider and other agencies working on the aerodrome to ensure total system safety.

25. The existence of basic aviation law that empowers a suitable aviation civil regulatory agency is a primary requirement. Such an entity may be the civil aviation authority or the directorate-general of civil aviation, adequately staffed to assess an application for granting of the aerodrome certificate, inspecting and evaluating the aerodrome facilities and services and operating procedures, and coordinating with other appropriate agencies such as the aviation security agency, ATS provider, aeronautical information services (AIS) and meteorological (MET) services as detailed in the aerodrome manual submitted with the application.

Note.— Further guidance on certification of aerodromes can be found in the Manual on Certification of Aerodromes (Doc 9774).

AIR TRAFFIC MANAGEMENT

26. 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 ATS to be provided, the airspace organization, the associated facilities, and the required navigation performance (RNP) should be determined on the basis of an agreed network of ATS routes or organized track system taking account of the type, density and complexity of traffic.

Airspace management

27. The airspace structure and organization should include a network of ATS routes or organized track system 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 (RNAV) 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 terminal control area (TMA) and to facilitate the description of the route and procedure in air traffic control (ATC) clearances. Standard instrument departure routes (SIDs) should be established for each instrument runway.

28. 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. To achieve this, procedures that support collaborative decision-making should be developed.

29. The airspace organization should be indicated in accordance with the ICAO airspace classification.

30. 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 coordination. 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 coordinated, and promulgated in a timely manner. Military operations should not only be promulgated in a timely manner but also through international dissemination (international NOTAM).

Air traffic services

31. 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 cooperative 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 flight information centre/area control centre (FIC/ACC);
- b) the need to minimize frequency and secondary surveillance radar (SSR) code changes, 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.

32. Area control service should be provided for instrument flight rules (IFR) flights operating in controlled airspace except where the type and density of traffic clearly do not justify the provision of such service. Controlled airspace, in the form of airways, control areas of larger dimensions and TMAs, should be recommended to encompass all relevant ATS routes. In delineating control area boundaries, due account should be taken of the factors listed in 31 above.

33. 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 TMAs 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.

34. 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 IGA aircraft where the type and density of traffic warrant it. At aerodromes used by IGA 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.

35. 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 ATC service at the earliest possible time should be recommended.

36. The ATS 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 meteorological 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.

37. Information on destination meteorological conditions, 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 FIC/ACC upon request, prior to commencement of descent. 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.

38. Contingency plans should be developed to mitigate the effects of volcanic eruptions or tropical cyclones as required. In addition, contingency plans should be developed to mitigate disruptions in ATS due to any other cause.

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

40. To assist in the prevention of CFIT, every effort should be made, in cooperation 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 cooperation 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.

Air traffic flow management and capacity management

41. Air traffic flow management and capacity 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.

Safety management

42. The Standards and Recommended Practices relating to the implementation by States of safety management programmes for ATS are contained in Annex 11 — *Air Traffic Services*, 2.26. Further provisions relating to the implementation of these safety management programmes are contained in Chapter 2 of the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444).

43. Annex 11, 2.26, requires States to implement systematic and appropriate safety management programmes in relation to the provision of ATS. It will therefore be necessary for all States to establish regulatory provisions concerning ATS safety management, together with the necessary supporting infrastructure to enable them to discharge their responsibilities in relation to oversight of these provisions. There are two prerequisites for the introduction of a regulatory system. These are:

- a) the provision, in the basic aviation law of the State, for a code of air navigation regulations and the promulgation thereof; and

- b) the establishment of an appropriate State body, herein-after referred to as the civil aviation authority (CAA), with the necessary powers to ensure compliance with the regulations.

SEARCH AND RESCUE

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

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

Note.— A SPOC may be an aeronautical or a maritime rescue coordination centre.

46. Where aircraft of the long-range and longer-range categories are required for the provision of air coverage of large oceanic SRRs, but such aircraft cannot be made available by the State responsible for SAR 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.

47. SAR organization, plans, procedures, operations and equipment should be in accordance with the provisions of Volumes I, II and III of the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual* (Doc 9731), to the extent practicable.

COMMUNICATIONS

Aeronautical fixed service (AFS) planning and engineering

48. 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.

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

49. 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.

50. The AFS 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 messages should achieve transit times of less than the following:

SIGMET and AIRMET messages, volcanic ash and tropical cyclone advisory information and special air-reports	5 minutes
Amended aerodrome forecasts (in meteorological code (TAF)) METAR/SPECI, trend forecasts and TAF	5 minutes
from 0 to 900 km (500 NM)	5 minutes
for distances exceeding 900 km (500 NM)	10 minutes

Transit times for request/reply for international operational meteorological (OPMET) data banks should be less than 5 minutes.

51. TAF bulletins 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.

52. The dissemination means for world area forecast system (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.

53. 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.

54. With the introduction of automation in ATM, many coordination functions will be accomplished through data interchange between ATM systems using aeronautical telecommunication network (ATN) applications such as ATS

interfacility data communication (AIDC) or ATS message handling services (ATSMHS). As such, the planning for ATN should include the provision of suitable gateways to facilitate the exchange of information between existing and newly established networks.

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

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

56. Air-ground data link and voice communications facilities should be recommended to meet effectively and reliably the agreed requirements for ATS 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.

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

58. Automatic terminal information service 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 certain clearance deliveries.

59. Aerodromes having a significant volume of IGA 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.

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

61. An air-to-air VHF communication channel (INTERPILOT) on the frequency 123.450 MHz should be used over remote and oceanic areas, provided users are out of range of VHF ground stations, to enable pilots to exchange the necessary operational information.

Frequency assignment plans

62. Frequency assignment planning should be done in accordance with the method applicable to the region and using the relevant ICAO Regional Office Frequency Lists.

NAVIGATION

General

63. The planning of navigation aids should be on a system basis, recognizing that the requirements for both long-range and short-range navigation may be met by different navigation systems having RNAV capability, including the global navigation satellite system (GNSS). 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 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 ATS.

64. 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 ATC structure to be established.

65. 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.

International commercial air transport operations

En-route aids

66. The en-route aids to be recommended should provide navigation assistance to permit en-route navigation on the agreed ATS route network with the accuracy required.

67. 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, VHF omnidirectional radio range (VOR) supplemented as necessary by distance measuring equipment (DME) should be installed as the primary aid for this purpose.

68. Where VOR is used, supplemented as necessary by DME, a total navigation error value for VOR of $\pm 5^\circ$ (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 $\pm 3^\circ$, appropriate precautions should be taken in respect of the routes concerned.

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

Terminal area aids

70. The terminal area aids should permit navigation for arrival and approach, holding and departure to be carried out with the accuracy required.

71. 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. Introduction of GNSS-based navigation services, such as Basic GNSS and satellite-based augmentation system (SBAS), should be considered as initial transition steps.

72. Where VOR is used as the primary aid, it should be so located as to permit the most efficient approach and ATC 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 holding is not practicable, non-directional beacons (NDBs) can be used for this purpose.

73. 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 using RNAV procedures based on

VOR/DME and when improved accuracy in navigation is a prerequisite to such flexibility.

74. Consideration should also be given to the provision of suitably located DMEs in support of RNAV procedures based on DME/DME.

Non-visual aids to final approach and landing

75. The standard non-visual aids to final approach and landing (ILS, MLS and augmented GNSS), supporting precision approach and landing operations, shall comply with general provisions in Annex 10 — *Aeronautical Telecommunications*, Volume I — *Radio Navigation Aids*, 2.1, and technical specifications in Chapter 3, and their introduction and application are expected to be in line with the strategy contained in Attachment B to Volume I.

76. In planning the requirements for aids to final approach and landing, each aerodrome should be considered in relation to its traffic, its meteorological 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 need 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, MLS or GNSS (GBAS), 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 back-up equipment and automatic changeover of facility performance Category II. It should be adjusted and maintained to the greatest possible extent and accuracy, and its performance characteristics should be published in Aeronautical Information Publications or other suitable documents.

Precision approach and landing procedures

77. Precision approach and landing operations are to be based on standard non-visual aids indicated in 75 above.

Approach with vertical guidance

78. Consideration should be given to approach with vertical guidance.

Non-precision instrument approach procedures

79. Non-precision instrument approach procedures are to be based on terminal area aids (see 70 to 74 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.

80. Particular account should be taken of 79 in the design of non-precision instrument approach procedures for use with GNSS which should also support SIDs and STARs.

RNAV procedures

81. RNAV procedures can be based on terminal area aids (e.g. VOR/DME, DME/DME) or GNSS (e.g. Basic GNSS, SBAS or GBAS positioning services).

International general aviation

Short-distance aids

82. Appropriate aids such as GNSS for short-distance navigation should be provided to serve the additional

aerodromes referred to in 22 where the density of traffic and the meteorological conditions so warrant, with due account being taken of the airborne equipment carried by aircraft. These aids should, as appropriate, be located so as to permit instrument approaches.

Flight testing of visual and non-visual navigation aids

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

SURVEILLANCE

84. Surveillance systems should provide adequate support to all phases of flight and meet ATM requirements. A table of surveillance facilities/services (including radars, automatic dependent surveillance (ADS) and automatic dependent surveillance-broadcast (ADS-B)), together with an associated chart, is considered to be a useful tool in the planning and implementation of surveillance systems.

85. Surveillance should be provided as an integral part of ATC 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. Subject to availability and cost-effectiveness, and provided that the required level of safety is maintained, ADS and ADS-B may be used in airspace where surveillance by radar is impracticable or cannot be justified.

86. 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.

METEOROLOGY

World area forecast system (WAFS) — regional aspects

87. 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. 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.

88. Requirements for the issuance of medium-level significant weather (SIGWX) forecasts (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.

Meteorological services at aerodromes

89. The meteorological service to be provided for operators and flight crews should be specified for each international aerodrome.

Aerodrome forecasts

90. TAF and amendments thereto should be exchanged to meet the needs of current flight operations, including IGA. TAF for the aerodromes of departure and destination and their respective alternates, and en-route alternates, should be disseminated so as to be available at departure aerodromes and at ATS units designated to provide data link-VOLMET or VOLMET broadcasts for aircraft in flight. In addition, they should be disseminated to be available at ATS units for transmission to aircraft in flight up to a distance from the aircraft corresponding to two hours' flying time.

91. 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 meteorological conditions.

Meteorological observations and reports

92. 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 meteorological conditions so justify, and/or reports are required for data link-VOLMET or VOLMET broadcasts, and relevant OPMET bulletin exchange schemes.

93. METAR and SPECI should be exchanged to meet the needs of current flight operations. METAR and SPECI for the aerodromes of departure and destination and their respective alternates, and en-route alternates, should be disseminated so as to be available at departure aerodromes and at ATS units designated to provide data link-VOLMET or VOLMET broadcasts for aircraft in flight. In addition, they should be disseminated to be available at ATS units for transmission to aircraft in flight up to a distance from the aircraft corresponding to two hours' flying time.

Aircraft reports and SIGMET and AIRMET information

94. 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).

95. SIGMET and AIRMET messages, as well as special air-reports which have not been used for the preparation of a SIGMET, should be disseminated to meteorological offices so as to be available at departure aerodromes for the whole route and at ATS units designated to provide data link-VOLMET or VOLMET broadcasts for aircraft in flight. In addition, they should be disseminated to be available at ATS units for transmission to aircraft in flight for the route ahead up to a distance corresponding to two hours' flying time.

International airways volcano watch (IAVW) — regional aspects

96. Planning for regional aspects of the IAVW should be undertaken, including the designation of volcanic ash advisory centres (VAACs) and selected State volcano observatories.

Tropical cyclone watch — regional aspects

97. Planning for regional aspects of the tropical cyclone watch should be undertaken for regions affected by tropical

cyclones, including the designation of tropical cyclone advisory centres (TCACs) among the centres of the WMO Tropical Cyclone Programme.

AERONAUTICAL INFORMATION SERVICES AND AERONAUTICAL CHARTS

98. 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 AFS.

99. 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.

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

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

102. Priority for the planning and implementation of aerodrome AIS units should be based on aerodrome designation (RS, RNS, RG, AS and EAS) as set out in the Appendix to Part III — AOP.

103. Pre-flight information bulletins (PIBs) should be made available at designated international aerodromes at least one hour before each flight in order to meet the operational requirements of users.

104. Planning and arrangements should be made for the introduction by States of a quality management system for aeronautical information and chart services. The system must include procedures, processes and resources necessary to ensure that the procedures are put in place for all the

functional stages of the aeronautical data process, from origination until the next intended user.

105. Aeronautical geographical coordinates should be stated in terms of the World Geodetic System — 1984 (WGS-84).

106. Arrangements should be made for those States that have not yet done so, to make available, as applicable, at least the following types of charts:

- a) Aerodrome Obstacle Chart — ICAO Type A;
- b) Aerodrome Obstacle Chart — ICAO Type C;
- c) Precision Approach Terrain Chart — ICAO;
- d) Enroute Chart — ICAO ;
- e) Area Chart — ICAO;
- f) Standard Departure Chart — Instrument (SID) — ICAO;
- g) Standard Arrival Chart — Instrument (STAR) — ICAO;
- h) Aerodrome/Heliport Chart — ICAO;
- i) Instrument Approach Chart — ICAO;
- j) Visual Approach Chart; and
- k) World Aeronautical Chart — ICAO 1:1 000 000.

107. States which have not yet produced the World Aeronautical Chart — ICAO 1:1 000 000 should in accordance with established sheet distribution and regional arrangements, take measures to ensure the preparation of the sheets for which they are responsible, either through individual effort or with the collaboration of other States or specialized cartographic agencies.

Note.— When operational or chart production considerations indicate that operational requirements can effectively be satisfied by Aeronautical Chart — ICAO 1:500 000, the chart may be made available instead of World Aeronautical Chart — ICAO 1: 1 000 000.

Part II

GENERAL PLANNING ASPECTS (GEN)

INTRODUCTION

1. As traffic volumes grow worldwide, the demands on the air traffic services (ATS) provider in a given airspace increase, as do the complexities of air traffic management. The number of flights unable to follow optimum flight paths also increases with an increase in traffic density. This creates pressure to upgrade the level of ATS by, inter alia, reducing separation standards.

Air traffic forecasts

2. Air traffic forecasts are produced in response to the needs of Contracting States of ICAO, air navigation service providers and regional planning groups, in particular the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG). Long-range forecasts of passenger traffic are produced for the Asia/Pacific regions, encompassing the intra-Asia/Pacific and trans-Pacific¹ markets, along with city-pair forecasts to include the forty busiest routes in terms of passengers carried within these regions. In addition, aircraft movements are forecast for a five-year horizon, initially for trans-Pacific traffic and city-pairs of three selected flight information regions (FIRs) of the intra-Asia/Pacific traffic. Also produced for the trans-Pacific market are forecasts of peak-period traffic of selected route groups. To this end, flight data are collected from air traffic control centres/air navigation service providers. The Asia/Pacific Area Traffic Forecasting Group (APA TFG) forecasts are updated periodically in conjunction with

APA TFG meetings, and their format and content will be modified progressively to respond to the requirements of primary users such as APANPIRG.

3. Using the underlying passenger forecasts produced by the APA TFG, the aircraft movement forecasts apply aircraft size and load factor parameters, and are contained in the ASIA/PAC FASID. The actual traffic growth has consistently been within the range of forecasts produced by APA TFG. Therefore, planning is based on the assumption that aircraft movement in the ASIA/PAC regions by 2014 will have doubled over 1998.

4. At present, wide-body aircraft dominate the trans-Pacific market, and they are expected to continue to be dominant. Average aircraft size, in terms of seats, is expected to increase by an average annual growth rate of 1.5 per cent over the 1998–2014 period from 345 seats per flight in 1998 to 438 seats in 2014. Load factors are high in the trans-Pacific market and are expected to remain so. Only a modest increase is expected over the forecast period, with assumed gradual increase from today's estimated 71 per cent load factor to 72 and 74 per cent in the years 2003 and 2014, respectively.

5. Implementation of communications, navigation and surveillance/air traffic management (CNS/ATM) systems are expected to be able to provide sufficient capacity to meet the increasing demand, while producing additional benefits in the way of more efficient flight profiles and increased levels of safety. The potential of new technologies to significantly reduce service costs, however, will require new arrangements in the provision of services and changes in ATM procedures.

6. Chapter 3 of the Global Plan provides the means to begin the process of identification of ATM requirements, on the basis of identified homogeneous ATM areas and major international traffic flows, followed by the determination of the regional and global CNS system elements needed to meet the ATM requirements.

1. For the purpose of these forecasts, Asia/Pacific is defined as the ICAO statistical region concerned, while trans-Pacific is defined as traffic between the ICAO statistical region of North America (Canada and United States) on the one hand and the ICAO statistical region of Asia/Pacific on the other hand (broken down in the use of United States data into "Asia" and "Oceanic").

Regional Implementation Concept

7. The Regional Implementation Concept defined by APANPIRG is linked to ATM improvement for the ASIA/PAC regions and the CNS requirements this generates. ATM improvements have been defined on the basis of the major international traffic flows identified in the homogeneous areas as set out in Part II of the FASID.

8. The method of identifying homogeneous ATM areas involves consideration of the varying degrees of complexity and diversity of the worldwide air navigation infrastructure. Based on these considerations, it is considered that planning could best be achieved, at the global level, if it were organized based on ATM areas of common requirements and interest, taking into account traffic density and level of sophistication required.

9. Major international traffic flows consist of areas which include groupings of routes wherein it is specified a detailed plan for the implementation of CNS/ATM systems and procedures, where the objective is to attain a seamless system throughout the area concerned. These are defined by origin and destination geographic areas which could be States/Territories, specific portions of States/Territories, or groupings of smaller States/Territories. They may also include oceanic and continental en-route areas.

10. The basic planning parameter is the number of aircraft movements which must be provided with ATM services along a particular international flow. Estimates and forecasts of annual aircraft movements over the planning period are required for high-level planning. Forecasts of aircraft movements in peak periods, such as during a particularly busy hour, are needed for detailed planning. Additionally, the establishment of major international traffic flows will require appropriate civil/military coordination and consideration of special use airspace.

11. Considering the global guidelines described in the preceding paragraphs, the ASIA/PAC regions should take into account the need to coordinate their regional plan with the adjacent regions, specially with the EUR and MID regions, since air traffic density between these regions and the ASIA/PAC regions is quite high. Coordination of the regional ASIA/PAC plan for the CNS/ATM transition with the indicated regions will be necessary. Finally, in the long term there would be a continuing need for coordination after the completion of the Global Transition Plan.

States'/Territories' plans

12. States/Territories have the responsibility for implementation of the new CNS/ATM system within their areas of responsibility. It will, however, be necessary for each State within the ASIA/PAC regions to develop and publish its own CNS/ATM implementation plan. These State plans should be coordinated within the FIRs and with adjacent FIRs to ensure the optimum use is made of all aspects of CNS/ATM.

Airlines' plans

13. The airlines have already invested significant sums to equip aircraft with transitional CNS/ATM systems such as FANS, data link, RNAV and Satcom. These systems permit use of currently available technologies to obtain early benefits within the CNS/ATM concept. To retain a cost-effective evolution towards CNS/ATM, the airlines believe that it is imperative to ensure that appropriate accommodation for these transitional systems be retained. The airlines will continue to pursue implementation of CNS/ATM on an evolutionary basis.

Benefits

14. With the benefits from the new CNS/ATM systems, there is need and enthusiasm for its implementation, but there are many hard decisions to be made, particularly on timing. Global and regional cooperation on an unprecedented scale will be required.

15. The regional planning process is the principal engine of ICAO's planning and implementation work. It is here that the top-down approach, comprising global guidance and regional-harmonization measures, converges with the bottom-up approach constituted by States/Territories and aircraft operators and their proposals for implementation options.

16. In its most basic form, the output from the regional planning process should be a listing of air navigation facilities and services, together with their achievable time frames, necessary for CNS/ATM systems implementation. These listings will be included in the ASIA/PAC regional air navigation plan (ANP) and updated by the APANPIRG with the assistance of the Regional Offices.

17. The objective of the Global Plan is to guide a progressive and coordinated worldwide implementation of the

elements of the future air navigation system in a timely and cost-beneficial manner. To this end, the plan fulfils two principal functions:

- a) it provides guidelines for use by regional planning bodies, States/Territories, service providers and users, for transitions from the current ground-based air navigation system to the future satellite-based system; and
- b) it functions as a benchmark for the evaluation of implementation progress.

18. The implementation of the current CNS/ATM systems has basically been a regional responsibility, i.e. States/Territories or groups of States/Territories working together within the framework of the concept and implementation strategy developed for the respective region by the corresponding regional planning group. ICAO air navigation planning should continue to be conducted through the established regional planning process.

Evolution and implementation

19. In considering the overall system concept, the questions of evolution and transition are most important. For instance, careful planning will be necessary to ensure that aircraft of the future are not unnecessarily required to carry a multiplicity of existing and new CNS equipment. In addition, as already referred to, there is a close relationship between the required CNS services and the desired level of ATM and, finally, there is, for reasons of both economy and efficiency, a need to ensure that differences in the pace of development around the world do not lead to incompatibility between elements of the CNS/ATM system. Particularly, because of the wide coverage of satellite CNS systems, the above considerations call for conscientious worldwide and regional coordination of the planning and implementation if such systems are to be optimized.

Human factors considerations

20. The high level of automation and interdependency of the CNS/ATM system raises several human factors issues. Lessons learned concerning human factors indicate that they should be considered as an integral part of any plan to implement the new technologies. The most important human factors issue regarding the human-machine interface is the ability of the human operator to maintain situational awareness. A by-product of degraded situational awareness is mode error. Mode error is defined as a joint human-machine

system breakdown in which a human loses track of the current machine configuration, and a machine interprets the human's input differently from that intended. The "joint human-machine system" should be considered during design of the systems so that mode errors can be pro-actively anticipated and eliminated. Furthermore, existing air navigation systems and CNS/ATM systems will operate in parallel for a period of time. Operating old and new systems in parallel will introduce human factors considerations that will also need to be considered.

21. Human factors issues should be considered before CNS/ATM technologies are implemented, during the process of design and certification of the technology and associated standard operating procedures. States in the ASIA/PAC regions and organizations which design and provide CNS/ATM systems should take into account ICAO guidelines when developing national regulations and incorporate human factors Standards in the processes of design and certification of equipment and procedures.

22. Involving human factors expertise during technology design might incur additional initial expenses, but the costs are paid once in the system's lifetime. Coping with flawed human-technology interfaces through training will result in a requirement for continuous training and higher costs.

Training planning

23. A major goal of CNS/ATM systems is to create a seamless air navigation system. A seamless air navigation environment will require an international team prepared to perform their jobs in such an environment. At the same time, shortcomings in human resource planning and training are frequently cited as an important reason for the lack of implementation of regional ANPs. Human resource development challenges will be compounded during the transition period to CNS/ATM systems. As the existing and emerging air navigation technologies will operate in parallel for a period of time, civil aviation personnel will need to learn new skills, as well as retain the skills needed to operate and maintain existing systems. To meet this challenge, a cooperative approach should be used in civil aviation training within the ASIA/PAC regions. This approach should:

- a) ensure that the training requirements of the ASIA/PAC regions are available within the regions;
- b) facilitate a training planning process that would help to determine the training capabilities needed within the

region or sub-regions for specialized types of training that individual States cannot justify based on their national training needs alone;

- c) ensure that an adequate market exists to support the development and ongoing implementation of high-quality training within one or more training centres within the region or sub-regions; and
- d) endeavour to distribute regional training activities among more training centres within the region or sub-regions.

24. Appropriate bodies should be established to facilitate regional and sub-regional training planning. A quantitative approach should be used to determine the training capabilities needed within a region or sub-region. Decisions concerning training capabilities required should be based on an aggregate of training demand for existing air navigation technologies, as well as emerging technologies. A State-to-State consultative process should be used to formulate a plan for the establishment of specific regional training centres.

25. APANPIRG should ensure that training offered within the ASIA/PAC regions is sufficient to meet the implementation requirements of the regional ANP.

IMPLEMENTATION STRATEGY

26. This section deals with the steps that can be taken and the options that can be explored to increase the probability of the facilities and services called for by the plan being fully implemented according to the sets of time lines set out in the ANP, as well as ensuring that the number of shortcomings and deficiencies is minimized. While the plan represents the collective commitment of ASIA/PAC States to provide and maintain the infrastructure that the facilities and services defined in the plan constitute as a whole, it is expected that users of the infrastructure will also cooperate to contribute indirectly to maintaining a safe and efficient environment in the region. The implementation strategy for this plan is based, therefore, on the premise that all partners involved in aviation in the region will work together harmoniously, for the most part within the APANPIRG mechanism.

27. In this regard, irrespective of the relationships that exist between service providers and users, financing is required if plans are to be implemented. Since facilities and services need to be put into place before benefits can be

enjoyed, it follows that States initial commitment to obtaining the necessary initial financing for “their” parts of the plan is key.

28. States can, of course, enact that commitment alone, but it is likely that in those cases the benefits that derive, for example, from cooperative or sharing options such as international cooperative ventures including international operating agencies, joint charges collection agencies, multi-national facilities and services or joint financing arrangements, would not be obtained.

29. Similarly, it is not always economically efficient to manage alone the expenses incurred in purchasing facilities and services and the income gathered from users of the infrastructure. Key here are the elements of cost-recovery policy with a possible emphasis on autonomy at the national level. This might lead to the creation of independent entities or bodies being established for the purpose of operating certain facilities and providing specific services, and being granted operational and financial freedom to carry out their functions.

30. If States are committed to implementing the plan, then the implementation strategy should address how that can be achieved in the most cost-effective way.

31. The vehicle for this commitment to seek out cost-effective implementation techniques is the APANPIRG mechanism where States can explore the possibilities of sub-regional approaches not only to their planning activities but also to the implementation of those plans. Such approaches might be developed with the help of the General Guidelines on the Establishment and Provision of a Multinational ICAO ASIA/PAC Air Navigation Facility/Service, set out in Part II of the FASID. Furthermore, the new involvement of the ICAO Technical Co-operation Programme in the regional planning process creates opportunities for service providers and users to work out mutually attractive implementation strategies.

32. The way in which this overall approach can move forward will be conditioned by the emphasis being placed on planning according to homogeneous areas and major traffic flows, most of the latter of which extend beyond the limits of the ASIA/PAC regions. The work being done in the context of the South Atlantic Task Force and the Technical Co-operation Programme initiative calls for work groups comprised of selected States and users to develop concrete plans for the areas defined by the major traffic flows.

33. Resources from ICAO’s modest special implementation budget or help from the Technical Co-operation

Programme to support implementation should therefore be channelled into this approach. The next steps can involve APANPIRG formalizing the work group approach mentioned in 32 and developing it as a model for use by other planning and implementation regional groups (PIRGs). This would be a natural development since other PIRGs have defined areas of interest which extend beyond their region. In addition, when such an approach gathers momentum it can serve as a

key element of ICAO's inter-regional planning which strives to balance global and regional priorities through bodies such as ALLPIRG or an ALLPIRG sub-group.

34. ICAO is active in all the above areas and stands ready to support initiatives by all partners in the planning process to achieve the steps towards the safe and efficient implementation of the planned infrastructure.

Part III

AERODROME OPERATIONAL PLANNING (AOP)

INTRODUCTION

1. This part of the Asia and Pacific (ASIA/PAC) Basic Air Navigation Plan contains elements of the existing planning system and introduces the basic planning principles, operational requirements and planning criteria related to aerodrome operational planning (AOP) as developed for the ASIA/PAC regions.

2. As a complement to the Statement of Basic Operational Requirements and Planning Criteria (BORPC) set out in Part I, Part III constitutes the stable guidance material considered to be the minimum necessary for effective planning of AOP facilities and services in the ASIA/PAC regions. A detailed description/list of the facilities and/or services to be provided by States in order to fulfil the requirements of the plan is contained in the ASIA/PAC Facilities and Services Implementation Document (FASID). During the transition and pending full implementation of the future communications, navigation and surveillance/air traffic management (CNS/ATM) system, it is expected that the existing requirements will gradually be replaced by new CNS/ATM system-related requirements. Further, it is expected that some elements of CNS/ATM system will be subject to amendment, as necessary, on the basis of experience gained in their implementation.

3. The Standards, Recommended Practices and Procedures to be applied and related guidance material are contained in:

- a) Annex 14 — *Aerodromes*, Volumes I and II;
- b) Annex 10 — *Aeronautical Telecommunications* — Volume I;
- c) *Aerodrome Design Manual* (Doc 9157);
- d) *Airport Planning Manual* (Doc 9184);

e) *Airport Services Manual* (Doc 9137).

4. Background information of importance in the understanding and effective application of this part of the plan is contained in the *Report of the Third Asia/Pacific Regional Air Navigation Meeting* (Doc 9614, ASIA/PAC/3 (1993)) on Agenda Items 2, 3 and 4.

5. A regional air navigation meeting recommendation or conclusion shown in brackets below a heading indicates the origin of all the paragraphs following that heading.

AERODROME OPERATIONAL PLANNING (AOP)

General (FASID Table AOP 1) [ASIA/PAC/3, Recs. 2/2 and 3/1]

6. A basic list of aerodromes (including their designations) required in the ASIA/PAC regions to serve international civil aviation operations is given in the Appendix to this part. The list of regular and alternate aerodromes required for international scheduled air transport, non-scheduled air transport and general aviation operations as agreed in the ASIA/PAC/3 RAN Meeting is given in Table AOP 1 of the FASID.

Runway friction measurements [ASIA/PAC/3, Rec. 4/2]

7. States should procure the necessary equipment and carry out periodic measurements of runway friction characteristics and take remedial action as necessary.

Removal of disabled aircraft

[ASIA/PAC/3, Rec. 4/3]

8. States should ensure that adequate coordination between airline operators and airport administrations exists to plan for the removal of disabled aircraft on or adjacent to movement areas, and that information concerning the capability for such aircraft removal is included in Aeronautical Information Publications.

Creation of bird control units

[ASIA/PAC/3, Rec. 4/6]

9. States should encourage airport authorities to create a bird control unit responsible for reducing bird hazards to aviation on each airport and to submit bird strike reports to ICAO to facilitate the effective use of the ICAO Bird Strike Information System (IBIS).

Closure of regular aerodromes

[ASIA/PAC/3, Conc. 2/3]

10. When a regular aerodrome is to be closed, States should ensure that sufficient alternate aerodromes remain open to provide for the safety and efficiency of aircraft approaching the regular aerodrome that may be required to divert to an alternate.

Scheduling aerodrome maintenance

[ASIA/PAC/3, Rec. 4/8]

11. States, when planning major runway maintenance work that would affect the regularity of international aircraft operations, should consider the need to notify aircraft operators sufficiently in advance prior to undertaking the scheduled work.

Aerodrome equipment, installations and services

[ASIA/PAC/3, Rec. 4/10]

12. For the general improvement of the safety, efficiency and regularity of aircraft operations, States should, with a degree of urgency, take appropriate action to provide and maintain the equipment, installations and services specified in the related Annex 14, Volume I specifications.

Aerodrome emergency plan

[ASIA/PAC/3, Conc. 4/4]

13. Each State of the ASIA/PAC region should prepare and keep up to date an appropriate aerodrome emergency plan for each international aerodrome. Guidance material for the preparation of such plans are available in the *Airport Services Manual* (Doc 9137), Part 7.

Appendix

INTERNATIONAL AERODROMES REQUIRED IN THE ASIA/PAC REGIONS

EXPLANATION OF THE LIST

CITY/AERODROME	Name of the city and aerodrome, preceded by the location indicator.
DESIGNATION	Designation of the aerodrome as: RS — international scheduled air transport, regular use RNS — international non-scheduled air transport, regular use AS — international scheduled air transport, alternate use

Note 1.— When an aerodrome is needed for more than one type of use, normally only the use highest on the above list is shown. An exception is that AS aerodromes are identified even when they are required for regular use by international non-scheduled air transport or international general aviation, as some specifications in Annex 14, Volume I place special requirements on these aerodromes.

Example — An aerodrome required for both RS and AS use would only be shown as RS in the list. However, this table may still show specific requirements for AS use.

Note 2.— When the aerodrome is located on an island and no particular city or town is served by the aerodrome, the name of the island is included instead of the name of a city.

City/Aerodrome/Designation	City/Aerodrome/Designation
AMERICAN SAMOA (United States)	YBTL TOWNSVILLE/Townsville RS
NSTU PAGO PAGO/Pago Pago Intl RS	BANGLADESH
AUSTRALIA	VGEG CHITTAGONG/M.A. Hannan Intl RS
YPAD ADELAIDE/Adelaide RS	VGZR DHAKA/Zia Intl RS
YBAS ALICE SPRINGS/Alice Springs AS	BHUTAN
YBBN BRISBANE/Brisbane RS	VQPR PARO/Paro Intl RS
YBCS CAIRNS/Cairns RS	BRUNEI DARUSSALAM
YPXM CHRISTMAS I./Christmas I. RS	WBSB BRUNEI/Brunei Intl RS
YPCC COCOS I./Cocos I. RS	CAMBODIA
YPDN DARWIN/Darwin RS	VDPP PHNOM PENH/Phnom Penh RS
YMHB HOBART/Hobart RS	VDSR SIEM REAP/Siem Reap AS
YMLL MELBOURNE/Melbourne Intl RS	CANADA¹
YSNF NORFOLK I./Norfolk I. RS	CYXX ABBOTSFORD/Abbotsford AS
YPPH PERTH/Perth Intl RS	CYYC CALGARY/Calgary Intl RS
YPPD PORT HEDLAND/Port Hedland RS	CYQQ COMOX/Comox AS
YBRK ROCKHAMPTON/Rockhampton AS	CYEG EDMONTON/Edmonton Intl RS
YSSY SYDNEY/Kingsford Smith Intl RS	CYVR VANCOUVER/Vancouver Intl RS
YPTN TINDAL/Tindal AS	CYYJ VICTORIA/Victoria Intl RNS