AFI AIR NAVIGATION PLAN

VOLUME I, BASIC ANP

PROPOSED NEW LAYOUT AND CONTENT

November 2012
FOREWORD

The principles that were adopted in the proposed layout of the Basic Air Navigation Plan (ANP) and how this is foreseen to relate to the Facilities and Services Implementation Document (FASID) and Supporting material are:

1. There should be a clear relationship between the Regional Plan (in this case, the AFI ANP (Doc 7474)), the Global Air Navigation Plan (Doc 9750) and Global ATM Operational Concept (Doc 9854).

2. The Basic ANP should reflect the conceptual objectives for the region whilst including the current to medium term requirements. The material included should minimise the requirement for continual amendment. Dynamic lists such as descriptions of ATS routes are referenced to the FASID as appropriate or flagged as candidates for the proposed web-based air navigation planning tool.

3. The FASID should provide sufficient detail of current and emerging programmes to provide the reader with an overview and sufficient detail of the current to short-term environment.

4. Guidance material on the detail of programmes or concepts should be contained in supplementary material referenced appropriately or adopted as AFI Documents.
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PART 0 – INTRODUCTION

GENERAL

1. Air navigation plans (ANPs) set forth in detail the facilities, services and procedures required for international air navigation within a specified area. Such plans contain recommendations that States 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 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, including the Basic Operational Requirements and Planning Criteria (BORPC), as approved by the Air Navigation Commission (ANC) for application in all regions.

3. On 8 March 2011, the ICAO Council decided that the BORPC should be withdrawn from all regional air navigation plans and that an updated BORPC will be included in the Global Air Navigation Plan (Doc 9750).

4. The Basic ANP contains stable plan material such as:

   a) the geographical area constituted by the flight information regions (FIRs) covered by the plan; and

   b) the latest planning and implementation guidance formulated for the region through recommendations by the region’s Planning and Implementation Regional Group (PIRG). The material included should minimise the requirement for continual amendment.

5. The FASID sets 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 PERFORMANCE BASED REQUIREMENTS INTO THE PLAN

6. The traditional focus of a regional ANP has been to cover the facilities and services required for a period of five years. However, with the introduction of performance based requirements, with longer planning horizons, it is recognized that concepts such as Performance Based Navigation (PBN) (Doc 9613), Required Communication Performance (RCP) (Doc 9869) and Global Performance of the Air Navigation System (Doc 9883) will be introduced progressively into the AFI ANP. Introduction of such performance based requirements is guided by the ICAO Global Air Navigation Plan (Doc 9750), which has been developed so that it has a clear and functional relationship with the regional ANPs. The evolution and development of the AFI ANP will also be guided by the ATM Operational Concept (Doc 9854) as endorsed by the 11th Air Navigation Conference (Montreal, 22 September – 3 October 2003) and as amended from time to time.
RELATIONSHIP BETWEEN GLOBAL, REGIONAL AND NATIONAL PLANNING

7. Planning takes place at global, regional and national levels. Planning is accomplished with the help of planning tools and methodologies that are used primarily at the regional and national levels, conditioned by guidance from the global level. The basis for effective planning is the ATM operational concept, which should support the development of regional and national implementation plans that will support system architectures.

STATES' RESPONSIBILITIES

8. 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 air navigation plans.

9. Inclusion in air navigation plan documents of basic facilities and services provided by non-Contracting States and territories is simply 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.

AIR NAVIGATION PLAN — AFI REGION

10. This basic air navigation plan document presents in general terms the ICAO plan for the provision of facilities and services for international air navigation in the ICAO Africa-Indian Ocean (AFI) Region. It has incorporated in an evolutionary manner requirements emanating from the ICAO Global Air Navigation Plan. In this respect the Plan spans current requirements whilst indicating the development path to reach the Global ATM Operational Concept. The companion element to this plan, the AFI FASID, and in time an associated global database¹, includes detailed information on States’ facilities, services, and plans for implementation. The FASID and associated database will be routinely updated to reflect the implementation of Regional Planning Initiatives and Programmes. Facilities and services outside of the prescribed regional boundaries may also be included in order to maintain the integrity of “systems” and to ensure in so far as possible that all the facilities and services required are listed in the document. The relationship between the Basic and FASID and associated electronic databases is shown in Figure 2 below.

11. It should also be noted that the AFI ANP does not list all facilities in the region but only those required for international civil aviation operations. Documents from the Integrated Aeronautical Information Package and other publications should be consulted for information on additional facilities and for operational information in general.

¹ Details of ATS routes, reporting points and other such data will be migrated to an Integrated Web-based Air navigation Tool and the reader will be provided with an electronic link to access the material. It is anticipated that in time more applications will be migrated to this global database. This tool has not yet been fully developed. (check status before publication)
12. Globally, there are a number of air navigation services (ANS) development programmes underway that contribute to the ICAO Global ATM Operational Concept and Global Air Navigation Plan. These include NEXGEN (USA); China ATM Development; and FIANS (India); SESAR (EU States); CARATS (Japan) and the Future ATM System of the Russian Federation. Whilst much of the content of this document reflects ANS developments over a number of years, developing programmes’ implementation steps will be referenced to Global Plan Initiatives (GPIs) thus showing linkage to the Global Air Navigation Plan.

ESTABLISHMENT AND PROVISION OF A MULTINATIONAL ICAO AFI AIR NAVIGATION FACILITY/SERVICE

13. The operation of multinational air navigation services is well established within the AFI Region. ICAO Doc 9082 details the ICAO policies on charges for air navigation services. ICAO Doc 9161 – Manual on Air Navigation Services Economics provides additional information on the various models adopted globally. The introduction of multi-national air navigation services does not dilute the principle that a State has the responsibility of overseeing the provision of air navigation services and that it shall maintain that responsibility within its sovereign airspace as well as within the airspace over the high seas for which it has accepted the responsibility for the provision of services. Where there is no intention to change or modify the flight information region (FIR) boundaries nor the facilities and services currently listed in the ANP there is not a requirement to amend the ANP. However, should changes to the FIR boundaries or to the facilities and services provided be required, such changes are likely to be subject to the ANP amendment procedure and should therefore be examined on a case-by-case basis. Any multinational arrangements for the provision of air navigation services should be registered with ICAO (Article 83 of the Convention (Doc 7300) and Rules for Registration with ICAO of Aeronautica l Agreements and Arrangements (Doc 6685)).

PROCEDURE FOR THE AMENDMENT OF REGIONAL PLANS, INCLUDING FASID MATERIAL

14. The Basic ANP and FASID may be amended by a regional air navigation meeting or by following the amendment procedures below. Changes to traffic forecasts in Part I — GEN of the FASID do not require formal amendment.

2 Advice will be available from the ICAO Regional Office.
PROCEDURE FOR THE AMENDMENT OF APPROVED
BASIC AIR NAVIGATION PLANS

Approved by Council on 25 February 1998

15. Introduction

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

16. General criteria

16.1 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.

16.2 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.

17. Procedure

17.1 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 air navigation plan for that region it should propose to the Secretary General, through the 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 regional office.)

17.2 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.

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

17.4 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 Air Navigation Commission. If the Commission concludes that the amendment is acceptable in its original or other form, it will present appropriate recommendations to the Council.

17.5 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 above, 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.
17.6 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.

17.7 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

18. 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 the amendment proposal to the ICAO Regional Office.)

19. 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 Air Navigation Commission. In such cases, the Commission will decide the action to be taken on the proposal.

20. 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.

21. 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 Air Navigation 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.

22. 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.

23. 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.

24. Amendments to the FASID which have been approved in accordance with the above procedure will be promulgated at convenient intervals.
25. 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 any tables appearing herein, which also give their meaning.
INDEX OF STATES AND TERRITORIES REFLECTING THE GEOGRAPHICAL SCOPE OF REGIONAL ANP, PIRG MEMBERSHIP AND REGIONAL OFFICE ACCREDITATION (to be checked and updated before publication)

26. This index is for the purpose of determining the geographical scope of the Regional Air Navigation Plan (ANP) and the associated Planning and Implementation Regional Group (PIRG) and Regional Office (R/O) that organize the planning and implementation of that Region.

27. Explanation of the List:

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AFI ANP, VOLUME I, BASIC ANP
PART I – AFI REGION GENERAL PLANNING ASPECTS (GEN)

GEOGRAPHICAL SCOPE

1. In geographical scope, the Africa-Indian Ocean Region Air Navigation Plan is related to the ICAO Africa-Indian Ocean air navigation region. 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.

SUB-REGIONAL GROUPINGS

2. A number of States within the ICAO AFI Region are members of one or more sub-regional groupings which have development plans to improve air navigation services; such plans contribute to the regional implementation of the ICAO Global Planning Initiatives. Regional sub-groups include the African Union (AU); African Civil Aviation Commission; the Arab Civil Aviation Commission; States members of the Agency for the Safety of Aerial Navigation in Africa and Madagascar (ASECNA), Common Market for Eastern and Southern Africa (COMESA), Economic and Monetary Union of Central Africa (CEMAC), Economic Community of Central African States (CEEAC), Economic Community of Western African States (ECOWAS), States members of the Roberts Flight Information Region, States of the South African Development Community (SADC) and East African Community (EAC), Western African Economic and Monetary Union (WAEMU).

Note: Diagram or list of regional sub-groupings to be inserted in the FASID or database.

FLIGHT INFORMATION REGIONS (to be checked and updated before publication)

3. Flight Information Regions (FIRs) within the AFI Region are being consolidated. The table below shows the ICAO approved AFI Region FIR status in 2009 and the forecast position for 2015. It is anticipated that further changes will be made and up to date information will be available from the ICAO Regional Office. Details of Flight Information Regions within the AFI air navigation region are contained in a centralised data base and can be accessed at <www.xxxxxxx >.

<table>
<thead>
<tr>
<th>STATE</th>
<th>FIR/s approved in 2009</th>
<th>FIR/ approved for 2015 (see note)</th>
<th>Comments</th>
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<td>and Accra</td>
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Note: Insert chart (possibly diagrammatic as opposed to definitive co-ordinates. Co-ordinates will, however, have to be listed in an authoritative document as they provide the legal basis for the FIR boundary definition).
PERFORMANCE BASED APPROACH

4. Global Approach

4.1. States have agreed that Global Air Navigation should be predicated on a performance based environment. The transition to such a performance based environment results in consideration of a number of differing expectations. These general expectations are relative to the effective operation of the ATM system and include access and equity; capacity; cost effectiveness; environmental impact; flexibility; flight efficiency; interoperability; participation and collaboration; predictability; safety; and security. These expectations often compete with each other. Some aviation community members (the Global Air Traffic Management Operational Concept (Doc 9854) refers) have explicit economic expectations, others favour efficiency and predictability, while some are concerned with access and equity; and all have safety expectations. For optimum air navigation system performance, each of these sometimes competing expectations needs to be balanced. In an integrated system, changes to one expectation area will likely have an effect on other areas. It is necessary, therefore, to assess the effect on the whole system when planning a change in a specific area. This may require, or lead to, trade-offs in performance. This is generally acceptable with the exception of safety, wherein acceptable levels of safety must be achieved. The ICAO planning objective is to achieve a performance based global air traffic management (ATM) system through the implementation of air navigation systems and procedures in a safe, progressive, cost-effective and cooperative manner.

5. AFI Region Planning

5.1. The regional planning and implementation process is the principal engine of ICAO’s planning framework. It is here that the top-down approach comprising global guidance and regional harmonization measures converge with the bottom-up approach constituted by national planning by States. In an effort to assist planners in weighing outcomes and making appropriate decisions, the Manual on Global Performance of the Air Navigation System (Doc 9883) has been developed. In this respect ICAO has defined 11 Key Performance Areas (KPAs), one for each of the Global ATM Operational Concept (Doc 9854) expectations outlined in Paragraph 4.1 above.

Within the AFI Region, performance objectives based on the ICAO KPA are being developed by APIRG Sub-groups. Whilst these performance objectives will be common throughout the AFI Region, it is envisaged that local performance targets and related key performance indicators (KPIs) with associated metrics and data collection requirements will be tailored to meet the specific needs of homogeneous areas within the respective AFI sub-region

5.2. In conducting this work APIRG Sub-groups have taken into account the following guiding principles,

a) Ensure that activities will aim at the improvement of the system (as a whole) with the benefit of the end users (strong focus on outcomes);

b) Avoid duplication of efforts and use, to the maximum extent possible, existing arrangements/solutions;

c) Whenever possible, build on current or developing processes, or existing data/statistics that may contribute to a specific KPA;

d) Exploit existing best practices in other areas that might contribute to this work;

f) Give due regard to the resource implications associated with any proposals;

g) Follow a stepwise approach starting from a subset of realistic indicators (qualitative rather than quantitative) to ensure a smooth transition and to alleviate the workload for the collection, consolidation and analysis of data.
5.3. The development of common AFI Region performance objectives and associated KPI will be managed through the APIRG process. Initial objectives and associated indicators for safety; capacity; efficiency and environment; and cost-efficiency have been developed. Brief details are reflected in the relevant Parts of this Volume.

5.4. The introduction of performance objectives, local performance targets, associated KPIs and data metrics is a dynamic process requiring routine review. Consequently, details of this performance material will be shown in the AFI FASID.

GLOBAL PLANNING INITIATIVES (GPIs)

6. The Global Air Navigation Plan (Doc 9570) was developed in consideration of the operational concept and the Strategic Objectives of ICAO. Most significantly, the revised Global ANP was developed on the basis of an industry roadmap which was developed in follow up to the Eleventh Air Navigation Conference in an effort to facilitate implementation of the Recommendations of the Conference and ensure that focused efforts would lead to near- and medium-term benefits. The Global ANP, therefore, contains near- and medium-term guidance on air navigation system improvements necessary to support a uniform transition to the ATM system envisioned in the ATM operational concept (Doc 9854). Long-term initiatives will be added to the Global ANP as the technology matures and the supporting provisions are developed. In accordance with the Global ANP, planning will be focused on specific performance objectives, supported by a set of “Global Plan Initiatives” (GPI). These initiatives are options for air navigation system improvements that when implemented result in direct performance enhancements. States and regions will choose initiatives that meet performance objectives, identified through an analytical process, specific to the particular needs of a State, region, homogeneous ATM area or major traffic flow.

7. A full description of ICAO Global Plan Initiatives (GPIs) is provided in Chapter 1 of the Global Air Navigation Plan.

REGIONAL PLAN INITIATIVES (RPIs)

8. The adoption of the Global ATM Operational Concept (Doc 9854) and the Global Air Navigation Plan (Doc 9570) has resulted in a number of proposed AFI Region air navigation improvement requirements, which stem from the GPIs described above. Within the AFI Region the APIRG is responsible for the management and review of the ICAO AFI Air Navigation Plan. Consequently the inclusion of air navigation service improvement programmes at regional and sub-regional level will be endorsed through the APIRG process. States concerned will, however, retain responsibility for the implementation of such programmes and plans.

HUMAN FACTORS CONSIDERATIONS

9. The high level of automation and interdependency of the air navigation systems 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.

10. Human factors issues should be considered before air navigation technologies are implemented, during the process of design and certification of the technology and associated standard operating procedures. States, Air Navigation Services providers and organizations in the AFI region which design and provide air navigation systems should take into account ICAO guidelines (Human Factors Guidelines for Air Traffic Management (ATM) Systems (Doc 9758)) when developing national regulations and incorporate human factors Standards in the processes of design and certification of equipment and procedures.

3 See APIRG Procedural Handbook.
SAFETY CONSIDERATIONS

11. It is an ICAO Strategic Objective to enhance global aviation safety. Due account must be taken of the global Standards and Recommended Practices (SARPs) that have been established requiring the implementation of safety management. States are responsible for the implementation of national safety management programmes. The safety management process should be embedded within AFI -region programmes at the pre-implementation, implementation and post-implementation phases. In coordination with the AFI Regional Aviation Safety Group (RASG-AFI), the APIRG should endorse safety plans associated with such regional or sub-regional programmes.

12. Consistent application of safety management throughout an ICAO Region is one of the Global Safety Initiatives (GSI) of the ICAO Global Aviation Safety Plan (GASP). Planners should ensure that safety considerations of air navigation services development programmes are consistent with the GASP and associated GSI.

13. An Air Navigation Deficiency is a situation where a facility, service or procedure does not comply with a regional air navigation plan approved by the Council, or with related ICAO Standards and Recommended Practices (SARPs), and which situation has a negative impact on safety, regularity and/or efficiency of international civil aviation. Air navigation deficiencies should be identified and reported to the Regional Office who will determine whether the reported deficiency is a case of non-compliance with the AFI ANP or SARPs. States are responsible for the prompt rectification of deficiencies to navigation services for which they are responsible for. The ICAO Regional Office would provide guidance and assistance to rectify such deficiencies as necessary. Detailed information on the process of identifying and managing navigation deficiencies is contained in the APIRG Handbook.

ENVIRONMENT

14. It is an ICAO Strategic Objective to minimize the adverse effect of global civil aviation on the environment. Regional planning groups should ensure environmental factors are taken into consideration when performance based systems implementation plans are developed. The results of environmental analysis can be useful in providing national decision-makers within the various sub-regions with information upon which to base airspace architecture decisions and in providing information on what the aviation industry is doing now to protect the environment in the future. Environmental considerations should, however, not compromise acceptable levels of safety and be balanced against operational and economic considerations.
HOMOGENEOUS AREAS AND MAJOR TRAFFIC FLOWS (to be checked before publication)

ATM HOMOGENEOUS AREAS IN THE ICAO AFI REGION (Charts to be replaced to reflect AFI)
**MAJOR TRAFFIC FLOWS - AFI REGION**

<table>
<thead>
<tr>
<th>Areas of routing (AR)</th>
<th>Traffic Flows</th>
<th>Areas involved</th>
<th>Type of area covered</th>
<th>Remarks</th>
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<tbody>
<tr>
<td><strong>Africa-Indian Ocean (AFI) Region</strong></td>
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<tr>
<td>AR1</td>
<td>Europe — South America (EUR/SAM) (oceanic)</td>
<td>Atlantico ¹, Canarias, Casablanca, Dakar Oceanic, Recife, Sal Oceanic</td>
<td>Oceanic en route low density in southern part and oceanic high density in northern part</td>
<td>Major traffic flow EUR/SAM</td>
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<tr>
<td>AR2</td>
<td>Atlantic Ocean interface between the AFI, NAT and SAM Regions</td>
<td>Accra, Dakar, Johannesburg, Luanda, Sal</td>
<td>Oceanic en route low density</td>
<td>Homogeneous ATM area AFI/NAT/SAM</td>
</tr>
<tr>
<td>AR3</td>
<td>Europe — Eastern Africa routes including the area of the Indian Ocean</td>
<td>Addis Ababa, Antananarivo, Asmara, Cairo, Dar es-Salaam, Entebbe, Khartoum, Mauritius, Mogadishu, Nairobi, Seychelles, Tripoli</td>
<td>Continental en route/oceanic low density</td>
<td>Major traffic flow AFI/EUR</td>
</tr>
<tr>
<td>AR5</td>
<td>Continental Western Africa including coastal areas</td>
<td>Accra, Addis Ababa, Brazzaville, Dakar, Dar-es-Salaam, Entebbe, Kano, Khartoum, Kinshasa, Nairobi, NDjamena, Niamey, Roberts</td>
<td>Continental/oceanic low density</td>
<td>Homogeneous area AFI (this is a growing traffic, developing into major traffic flow)</td>
</tr>
<tr>
<td>AR6</td>
<td>Trans-Indian</td>
<td>Antananarivo, Bombay ¹, Johannesburg Male ¹, Mauritius, Melbourne ¹, Seychelles</td>
<td>Oceanic high density</td>
<td>Homogeneous ATM area AFI/ASIA</td>
</tr>
</tbody>
</table>

**AIR TRAFFIC FORECASTS, SYSTEM CAPACITY AND AIR TRAFFIC DEMAND**

15. Regional traffic forecasting mainly supports regional ATM planning functions in the region and is made available to all States for which information is prepared. All States generally prepare individual forecasts, taking account of the regional information, for national planning purposes. This information should be shared through at least the sub-regional groupings to enable effective regional planning development.

16. The scope of Air Traffic Flow Management (ATFM) is one of attempting to balance the twin imperatives of Demand and Capacity. Within this scope, the goal is to enable flight punctuality and efficiency having regard to the available resources with the emphasis on optimising the network capacity. This should be achieved through a robust and comprehensive collaborative decision-making process that will enable widespread dissemination of relevant and timely information to all airspace users.
IMPLEMENTATION STRATEGY

17. Doc 9570 – the Global Air Navigation Plan describes a planning methodology that enables the incorporation of Regions/States existing development plans to create an evolutionary path towards a global ATM system. The Global ANP is supported by planning tools which take various formats (e.g. software applications, planning documentation, web-based reporting forms, project management tools). As AFI States and sub-regions consider implementation of the initiatives, they should use common programmers templates such as those contained in the planning tools as the basis to establish performance objectives and implementation timelines as well as to develop a comprehensive schedule and programme of planning activities to accomplish the work associated with the initiatives. In addition, the planning tools will provide links to relevant guidance material and documentation in order to assist the planner throughout the planning process. This will ensure a uniform approach to implementation of the initiatives.

18. Plans should be underpinned by the safety management process.
AFI ANP, VOLUME I, BASIC ANP

PART II – AERODROMES / AERODROME OPERATIONS (AOP)

AERODROME OPERATIONAL PLANNING (AOP)

GENERAL

1. This part of the document presents the ICAO AFI regional provisions related to the Aerodrome Operational Planning of facilities and services required for international air navigation.

AERODROMES

2. For regular and alternate aerodromes, used for international operations, the general physical characteristics, visual aids and services should be in accordance with the relevant ICAO provisions.

Physical characteristics

3. The specific physical characteristics for each regular use international aerodrome should meet the requirements of the critical aircraft.

4. The specific physical characteristics for each alternate use international aerodrome should be based on the requirements of the diverted critical aircraft.

5. In those cases where the extension or development of an aerodrome in accordance with the provisions contained in paragraphs 3 and 4 above would only be required to meet infrequent operations of the critical aircraft but would entail disproportionate expenditures, specific arrangements should be made between operators and the State concerned regarding the reasonable practical development of the aerodrome in question. The results of such arrangements, together with relevant reasons, should be reflected in Table AOP of the FASID.

Aerodrome services

Rescue and fire fighting services

6. Rescue and fire fighting services at international aerodromes should be provided at the required level of protection, as expressed by means of required aerodrome category for rescue and fire fighting in accordance with Annex 14, Volume I and reflected in Table AOP of the FASID. Rescue and fire fighting services should keep abreast of latest techniques and should practice these through exercises at regular intervals. Such exercises should also be organized for any off-aerodrome rescue and fire fighting services which may be called upon to assist in an emergency occurring at the aerodrome. [Annex 14, Volume I, Chapter 9]

7. Rescue and fire fighting services at international aerodromes should be capable of meeting the specified response time and be kept in a state of readiness throughout those times when the aerodrome is available for use. [Annex 14, Volume I, Chapter 9]

Runway surfaces
8. In amplification of relevant provisions in Annex 14, Volume I, runway surfaces should be constructed and/or treated so as to ensure continuous good friction characteristics when wet. Runway markings should consist of non-slip materials. [Annex 14, Volume I, Chapter 3 and 5]

Runway visual range

9. A secondary power supply should be provided for runway visual range (RVR) observing systems which use instrumental means.

Visual and non-visual aids for aerodrome operations

10. The provision of non-visual and visual aids for aerodrome operations should take into account:

   a) aircraft performance characteristics of those aircraft likely to use the aerodrome in question;
   b) prevailing meteorological conditions;
   c) use of the aerodrome at night or during low visibility conditions;
   d) aerodrome layout;
   e) expected traffic density; and
   f) other relevant local conditions.

11. The provision of approach, runway and taxiway lighting, should be in accordance with the Standards and Recommended Practices detailed in Annex 14, Volume I, for the appropriate runway type of approach or take-off operations.

12. In addition to the Standards of Annex 14, Chapter 5, visual approach slope indicator or precision approach path indicator systems should be provided for all runways to be used by aircraft engaged in commercial air transport operations.

13. During low visibility operations, the sensitive area associated with radio navigation aids required for the conduct of instrument approaches and take-offs should be kept clear from obstacles likely to interfere with their correct functioning and use.

14. The immediate vicinity of visual aids required for the conduct of instrument approaches and take-offs should be made accessible so that this area can be kept clear from snow, ice and obstructions likely to interfere with their correct functioning and use.

Non-precision approach aids

15. Where required by the topographic and/or environmental situation of an aerodrome, improved track guidance during departure and/or approach by specific non-visual and/or visual aids should be provided even if such aids would not normally be required in accordance with the above provisions.

16. At aerodromes used by international general aviation only, consideration should be taken of the location of existing navigation aids provided in relation to the aerodrome in question and their potential use for approach purposes. Specific approach and landing aids should only be provided if this is warranted from a cost effectiveness point of view.

17. When it has been determined that navigation guidance to an aerodrome without precision approach is required and this requirement cannot be met by use of a suitable ground based radio navigation aid or by Global Navigation Satellite System (GNSS), it should be covered by the provision of a VOR on or in the
vicinity of that aerodrome and located so that it permits the establishment of a straight-in non-precision approach procedure for the aerodrome, based on that VOR.

Precision approach aids/Approach with vertical guidance

18. Regardless of prevailing weather conditions, aircraft engaged in commercial air transport operations have a need for precise approach path guidance during approach and landing. The type of approach aid and associated appropriate visual aids required are dependent on the operational needs. Depending on the Obstacle Clearance Altitude/Height (OCA/H) required, approach procedures with vertical guidance (APV) (baro-VNAV and/or augmented GNSS) shall make use of either non-precision approach or precision approach aids.

Note 1.— GBAS might be considered in the future as an alternative navigation aid for CAT II and III precision approach and landing.

Note 2.— As agreed by ICAO APIRG, the target date for the completion of implementation for the Approach procedures with vertical guidance (APV) (baro-VNAV and/or augmented GNSS) for all instrument runway ends in ICAO AFI Region is 2016.

19. At aerodromes where there is a requirement to conduct Low Visibility Take-offs, the appropriate visual and non-visual aids should be provided.

20. At aerodromes where auto-coupled approaches are conducted on a routine basis, the quality of the signal in space of the supporting precision approach aid should be suitable for auto-coupled approaches.

21. When an ILS auto-coupled approach to a runway is being conducted outside Low Visibility Conditions (Low Visibility Procedures (LVP) not in force), it is possible that some disturbance of the ILS signal may occur. Flight crew should inform ATC if they wish to conduct an autoland with protection of the localizer sensitive area (LSA). In this case, ATC should inform the flight crew if protection of the LSA cannot be provided.

Implementation strategy of DMEs associated to the approach and landing operations

Note.— Within the AFI Region it is likely that various types of operations on the same runway are supported by different approach aids, such as ILS or augmented GNSS. For these conditions, specific requirements related to the use of the distance information supporting the approach and landing phase have been developed.

22. To avoid operational confusion in case of ILS/GNSS simultaneous operations, the GNSS distance reading along the approach should be the same as the ILS DME.

OPERATIONS

General

23. Measures should be taken to reduce, to the extent possible, the risk of collision between aircraft and wildlife during all flight phases conducted on or in the vicinity of aerodromes. Such measures should include:

a) the reduction of wildlife concentrations at and near aerodromes, both by appropriate planning and practical measures;

b) the collection and dissemination, in appropriate form, of information on wildlife movements; and
c) the development of procedures permitting ATS to alert flight crews of potential wildlife hazards.

Runway visual range

Note 1.— Where RVR information is required for operations in both directions of the runway, the same sites would normally be used for both directions, e.g. RVR information representative of the stop-end of the runway would normally be provided from the site serving the touchdown zone of the opposite direction.

Note 2.— RVR requirements for take-off in low visibility are usually met by facilities provided to support landings under such conditions.

Low visibility operations

24. For departure operations in RVR conditions less than a value of 550 m, sufficient visual and non-visual guidance should be available to control the aircraft in the event of both a discontinued take-off in adverse circumstances and a continued take-off after failure of the critical engine.

25. Low visibility operations should also require the existence of appropriate runway incursion protection measures, surface movement guidance and control systems, and emergency procedures provided in conjunction with suitable Low Visibility Procedures.

Reduced runway declared distances for take-off

Note.— In the following operational requirements the term “intersection” is used to cover both intersection and junction concepts.

26. Paragraph 2.8 of Annex 14, Volume I, requires that the following full runway declared distances be calculated and promulgated for each runway intended to be used by aircraft operators engaged in international commercial air transport:

a) Take-off run available (TORA);

b) Take-off distance available (TODA);

c) Accelerate stop distance available (ASDA); and

d) Landing distance available (LDA).

27. The reduced runway declared distances for take-off should consist, as for full runway declared distances, of TORA, TODA and ASDA.

28. The datum-line from which the reduced runway declared distances for take-off should be determined is defined by the intersection of the downwind edge of the specific taxiway with the runway edge. The loss, if any, of runway length due to alignment of the aeroplane prior to take-off should be taken into account by the operators for the calculation of the aeroplane’s take-off weight.

29. Intersections used as intermediate take-off positions should be identified by the “taxiway designator” to which the datum-line of the associated reduced runway declared distance for take-off refers.

30. At each international aerodrome, specific minimum visibility for take-off should be established, regulating the use of intersection take-off positions. These minima should permit the appropriate ATC unit to maintain a permanent surveillance of the ground movement operations, and the flight crews to constantly secure their position on the manoeuvring area, so as to exclude any potential risk of confusion as to the
identification of the aircraft and intersections used for take-off. The minima should be consistent with the surface movement guidance and control system (SMGCS) provided at the aerodrome concerned.

31. The provision of marking and lighting aids together with signs should ensure the safe control and guidance of aircraft towards and at take-off intersections appropriate to the minimum visibility criteria retained. At the runway holding position of the associated intersection take-off position, such signs should indicate the runway heading and the remaining take-off run available (TORA) in metres.

Air traffic services

Note.— The following operational requirement relates to the provisions of Air Traffic Services for all traffic on the manoeuvring area of an aerodrome and all aircraft flying in the vicinity of an aerodrome.

32. Aerodrome control service should be provided at all regular and alternate aerodromes. Aerodrome control service should also be provided at those aerodromes used by international general aviation aircraft, but only when the type and density of traffic warrant it.

Surface movement guidance and control systems (SMGCS)

33. Surface movement radar (SMR) should not be used for other than monitoring tasks unless identification procedures are implemented.

Note.— Material on the application of advanced SMGCS is presented in Attachment F to Part III — AOP of the AFI FASID.

Specific aeroplane operations

B747-400 Operations — General

Note.— Material on the impact of operations of Specific Aeroplanes on aerodromes is presented in Attachment E to Part III — AOP of the AFI FASID.

34. Where the minimum separation/clearance distances as specified in Annex 14, Volume 1, Table 3-1 do not permit B747-400 operations at existing airports the following options to overcome such problems should be considered by the appropriate authority in consultation with the operators:

— apply selective taxi routes where feasible;
— remove objects where feasible;
— reduce size of aircraft stands where feasible;
— implement reduced separation distances.

Note.— Although these options may have a degrading effect on either the provision of suitable stands or on the ground movement capacity/efficiency of the aerodrome, they should however be given particular attention so as to permit B747-400 operations.

35. Where the minimum separation/clearance distances as specified in Annex 14, Volume I, Table 3-1 cannot be provided by the existing layout of an aerodrome, States may introduce lower separation standards provided that an aeronautical study indicates that such lower separation distances do not adversely affect the safety or significantly affect the regularity of operations of aeroplanes. Experience in some States with operation of B747-400 has shown that it may be permissible, if specific measures have been implemented to reduce separation distances on taxiways, apron taxiways and aircraft stand taxilanes to the dimensions specified in Attachment G to Part III — AOP of the AFI FASID.

36. The provision of unambiguous and conspicuous taxi guidance to flight crews under all operational conditions prevailing at the aerodrome by appropriate means (e.g. visual aids, marshaller, etc.) is an essential prerequisite for operations conducted with lower separation distances. Equally important is the provision of
good taxiway surface friction conditions at all times to ensure proper braking and nosewheel steering capability of aeroplanes.

39. Regarding turns, reduced separations/clearance distances are based on the assumption that the cockpit should remain above the taxiway centre line marking/lighting as accurately as possible and at taxi speeds commensurate with actual operating conditions prevailing, except that for aircraft stand taxilanes a different technique, as specified in the AIP, may apply.

B747-400 Operations - Reduced separation distances on taxiways/apron taxiways

37. Whenever minimum separation distances between the centre lines of parallel taxiways or between taxiway/apron taxiway centre line and object, as specified in Annex 14, are reduced in accordance with Attachment G to Part III — AOP of the AFI FASID, taxiway centre line lighting should be provided for night, winter or low visibility operations.

38. On parallel taxiways, the separation distances between the centre lines should be not less than 76 m (Attachment G to Part III — AOP of the AFI FASID refers).

39. In straight portions of a taxiway or apron taxiway, the separation distance between the centre line and an object such as a building or a parked aircraft should be not less than 41.5 m and in taxiway or apron taxiway curves, the separation distances between the centre line and an object should be not less than 45.5 m (Attachment G to Part III — AOP of the AFI FASID refers).

B747-400 Operations - Reduced separation distances on aircraft stand taxilanes

40. On aircraft stand taxilanes, where reduced separation distances exist, proper guidance such as centre line lights or equivalent guidance (e.g. marshaller, etc.) should be provided for night, winter or low visibility operations.

41. All objects not providing the minimum separation/clearance distance as specified in Annex 14, should be properly marked or lighted (Annex 14, Chapter 6 refers).

42. Apron service roads should be properly marked with service road boundary lines and apron safety lines (Annex 14, Chapter 5 refers).

43. Along straight portions of an aircraft stand taxilane, the separation distance between the centre line and an object such as a parked aircraft or a building should be not less than 40 m, whereas the wing tip clearance of an aircraft turning from a taxilane into an aircraft stand should not be less than 7.5 m as recommended in Annex 14, Chapter 3.

Note.— The separation distance between the taxilane, centre line and an object or edge of a service road may further be reduced to not less than 37.5 m provided that the object (e.g. blast fence) does not exceed a height of 3 m above the relative taxilane centre line.

44. In curves of aircraft stand taxilanes the separation distances should not be less than 42.5 m, as specified in Annex 14, Table 3-1, whereas the wingtip clearance of an aircraft taxiing on a curved taxilane or turning from one taxilane into another taxilane/taxiway should not be less than 7.5 m.

Note.— Where vertical clearance criteria are being considered, the separation distance between the taxilane centre line and the edge of the service roads or an object, which may not exceed a height of 3 m above the relative taxilane centre line, should be not less than 41.5 m.
45. On aircraft stands, where reduced clearance distances exist, guidance by visual docking guidance system should be provided.

46. All objects for which reduced clearances apply, should be properly marked or lighted (Annex 14, Chapter 6).

47. An aircraft stand equipped with a visual docking guidance system should provide the minimum clearance of 5 m between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects.

Note.— The clearance distance between an aircraft on a stand provided with azimuth guidance by a visual docking guidance system and an object or edge of a service road may further be reduced subject to local circumstances provided that the object (e.g. blast fence) does not exceed a height of 3 m above the surface of the relative aircraft stand.

CAPACITY

Aerodrome capacity

48. States should ensure that adequate consultation and, where appropriate, cooperation between airport authorities and users/other involved parties is executed at all international aerodromes to satisfy the provisions of 53 to 63.

49. States should provide and coordinate communication and exchange of information between the States’ international aerodromes and international organizations involved with aerodrome capacity issues.

50. Consultation procedures should be established between aerodrome authorities and users commensurate with local conditions and appropriate to the specific purpose the consultation process is intended to serve (capacity assessment/demand forecasting, etc.).

51. Regular consultation between airport authority and users should preferably be effected by local working groups composed of all parties involved, including ATS where applicable. Alternatively, a local group may be replaced by a national committee.

52. At aerodromes where environmental concerns prevail with a potential impact on aerodrome capacity, a dialogue-oriented activity with communities will be required in which users should actively participate.

Aerodrome capacity assessment and requirement

53. The declared capacity/demand condition at aerodromes should be periodically reviewed in terms of a qualitative analysis for each system component and, when applicable, the result of the qualitative assessment upon mutual agreement be used for information in Table AOP of the FASID.

54. The future capacity/demand, based on a forecast for the next seven years, should be agreed upon after close cooperation between airport authorities and affected users and the relevant capacity requirements reflected in Table AOP of the FASID.

55. Operators should consult with aerodrome authorities when future plans indicate a significant increased requirement for capacity resulting in one of the elements reaching a limiting condition. This forecast should then be shown as an updated requirement in Table AOP of the FASID for the appropriate element.

56. Each aerodrome in the region will have its own requirement in the mix of the above-mentioned elements. However, if there is a capacity limitation at an aerodrome this will have an impact on the surrounding links
in the overall capacity chain and vice versa. Therefore, it is essential that the specific element that causes the limitation in the traffic flow be identified and adjusted.

57. Aerodrome capacity should be assessed and declared by aerodrome authorities in consultation with the parties involved for each component (terminal/apron/aircraft operations) using agreed methods and criteria for level of delays.

Note 1.— The result of the aerodrome capacity assessment, as required by and detailed in paragraphs 53 to 56, should be reflected in Table AOP of the FASID against each airport entry listed in this table.

Note 2.— The figures used to reflect this assessment, together with the updating process of these elements, are detailed in the explanation of Table AOP of the FASID.

58. Where restrictions in aerodrome capacity are identified, a full range of options for their reduction or removal should be evaluated by the aerodrome authority, in close cooperation with the operators and other involved parties. Such options should include technical/operational/procedural and environmental improvements and facility expansion.

59. At many aerodromes, airspace capacity has influence on the aerodrome capacity. If the declared capacity of a specified airspace has influence on airport operations, this should be indicated and action undertaken to reach a capacity in this airspace corresponding to the airport capacity.

60. Major research and development programmes should be undertaken in order to implement new initiatives for increasing airport capacity.

61. Due to lack of capacity at many international airports, a better and more efficient utilization of existing runways is required. Runway selection procedures and standard taxi routes at aerodromes should ensure an optimum flow of air traffic with a minimum of delay and a maximum use of available capacity. They should also, if possible, take account of the need to keep taxiing times for arriving and departing aircraft to a minimum.

62. Extreme traffic peaking at aerodromes generates congestion and severe economic penalties, such as under-utilization of costly aerodrome facilities and services, inefficient facility design criteria and delays to aircraft and passengers. Improvements should be obtained from effective consultation between the airlines, aerodrome and government authorities to achieve maximum capacity utilization.

63. The possibility of overcoming capacity limitations should also take the use of other aerodromes in the vicinity into consideration.

Note.— Guidance material on capacity and level of service is presented in Attachment C to Part III — AOP of the AFI FASID. Issues related to the Management of Critical Areas for navigation aids need to be taken into account when assessing aerodrome capacity.

PLANNING CONSIDERATIONS

Alternate aerodromes

64. Requirements for alternate aerodromes should, if at all possible, be satisfied by existing regular aerodromes. However, where in specific cases the designation of another aerodrome in close proximity to a regular aerodrome would result in appreciable fuel conservation or other operational advantages, this aerodrome may be designated for use as an alternate aerodrome only.

65. Planning of alternate aerodromes should be made on the basis of the following objectives:

   a) to ensure that at least one suitable alternate is available for each international operation;
b) to ensure that the facilities at the designated alternate aerodrome(s) are appropriate for the alternate operation.

**Physical characteristics**

66. Even though at specific aerodromes CAT II or III operations may not be a requirement during the period covered by the plan, account should nevertheless be taken in the planning for such aerodromes of possible future requirements in order to avoid costly and disruptive modifications at a later date. This applies in particular whenever replacement or improvement programmes are undertaken. However, investments needed to prepare for future CAT II or III operations at specific aerodromes should always be subject to cost-benefit analysis.

**Non-visual aids for aerodrome operations**

67. When developing implementation and/or decommissioning plans for all weather operations at international aerodromes, due consideration should be given to specific operations requirements of general aviation.

**Non-precision approaches**

68. At aerodromes used by international general aviation only, potential use of navigations aid(s) already required for other purposes should be considered to support instrument approach procedures at these aerodromes.

69. Approach procedures with vertical guidance (APV) may allow for a more safe and efficient operation. Moreover, they may provide an opportunity for the progressive rationalization of NDBs and VORs, while ensuring the provision of necessary backup. The impact of any reduction in the ground based navigation infrastructure, due to its replacement by new technology (e.g. GNSS), on the requirement for airborne equipment should be the subject of early assessment during the planning process.
Precision approaches

70. The strategy for the planning of All Weather Operations, based on the Global Strategy (paragraph 4 of Attachment B to Annex 10, Volume I refers), is to:

a) continue ILS operations to the highest level of service as long as operationally acceptable and economically beneficial;

b) promote the use of MMR (Multi Mode Receiver) or equivalent airborne capability to maintain aircraft interoperability;

c) validate the use of GNSS, with such augmentations as required, to support approach and departure operations, including CAT I operations, and implement GNSS for such operations as appropriate; and

d) complete feasibility studies for CAT II and III operations, based on GNSS technology, with such augmentations as required. If feasible, implement GNSS for CAT II and III operations where operationally acceptable and economically beneficial.

71. On the basis of the above strategy for the planning of all weather operations, recognizing the need for consultation among all parties concerned, (e.g. States, aerodrome authorities, aircraft operators) as well as to monitor the evolution of the Transition Key Issues (TKIs), a Road Map for All Weather Operations in the AFI Region should be developed by APIRG and should be used as the basis for the planning of all weather operations at international aerodromes in the AFI Region.

72. The Road Map for All Weather Operations in the AFI Region should be used as the basis for the development and updating of the Air Navigation Plan and/or Regional Supplementary Procedures (SUPPS) necessary for the planning and implementation of all weather operations at international aerodromes in the AFI Region.

73. The agreed level of service (i.e. non-precision, precision CAT I, etc.) is reflected in Table AOP of Part III of the AFI FASID, while the agreed technical plan for ILS and GNSS implementation and decommissioning is reflected in Supplement Table CNS-4B to Part IV of the AFI FASID.

OPERATIONS

General

74. Where noise abatement methods are applied to aircraft while on approach to land, the low power approach technique should be utilized, provided the necessary facilities and services are available at the aerodrome concerned. These comprise:

a) the availability of positive glide path information on the landing runway;

b) the use of ATC TMA procedures compatible with the low power approach technique;

c) the provision of significant range information along the approach path (distance from touchdown).

Note 1.— Such range information could be provided by different means, such as radar, DME or appropriate airborne navigation equipment.

Note 2.— Guidance material on low power approach techniques for noise abatement purposes is contained in Attachment B to Part III — AOP of the AFI FASID.
Air traffic services

Note.— The following requirements relate to the provision of Air Traffic Services for all traffic on the manoeuvring area of an aerodrome and all aircraft flying in the vicinity of an aerodrome.

Aerodrome flight information service (AFIS)

75. At aerodromes used by international general aviation, where the provision of aerodrome control service is not yet justified, AFIS should be provided by a unit located at the aerodrome.

Note.— The term AFIS is used to describe a service at international general aviation (IGA) aerodromes where an aerodrome control service is not provided (Annex 11 and guidance material on AFIS contained in ICAO Circular 211 refer).

76. In determining whether aerodrome control service or AFIS should be provided at a given IGA aerodrome, the appropriate ATS authority is expected to give due consideration to the type(s) of air traffic involved, the density of air traffic, the topographical and meteorological conditions, and such other factors as may be pertinent to safety and efficiency, including the language or languages to be used in air-ground communications.

78. Where an aerodrome control service is not clearly justified by the complexity, density of air traffic, topographic and prevailing meteorological conditions, an AFIS should be provided by a unit located at those aerodromes. An AFIS should also be provided as an intermediate step between no service at all and an aerodrome control service.

Aerodrome control service and surface movement guidance and control systems (SMGCS)

79. Low Visibility Procedures should be based on the provisions of the Manual on All-Weather Operations (Doc 9365).

80. Guidance material has been produced on surface movement radar (SMR) identification procedures. In order to harmonize the use of SMR in the region, it is recommended that these procedures be implemented to allow more effective use of SMR. Where SMR identification procedures are already in operation it is recommended that they be reviewed taking into account the guidance material now available.

Note.— Guidance material on SMR identification procedures is contained in ICAO Doc 9426, Air Traffic Services Planning Manual.

81. Due to the difficulty in maintaining aircraft and vehicle identification on primary SMR displays only, significant increases in ATS capacity can be achieved when identification labelling is made available.

82. In order to fully exploit capacity gains, the advanced surface movement guidance and control systems (SMGCS) should operate from runway to parking position and vice versa. The use of advanced SMGCS will require the controlling authority to accept an increasing responsibility for aircraft safety in low visibility conditions. The level of service provided should be maintained from the runway to the stand and should be provided by properly trained and/or licensed personnel.

83. Where an advanced SMGCS is used to provide guidance from one area of responsibility to another, coordination procedures should be implemented taking into account all the aspects of the changing division in responsibility for collision avoidance during low visibility conditions.

Note.— Guidance material on responsibility aspects can be found in ICAO Doc 9476, Manual of Surface Movement Guidance and Control Systems (SMGCS).
84. Where radar service is provided for approach control, the possibility to provide aerodrome control service with information from radar for the final approach segment, similar to the information provided to the approach control, should be considered. With appropriate regulations the coordination could be improved and the management of arrivals and departures more efficiently conducted.

Specific aeroplanes operations

Reduced runway declared distances for take-off

85. At aerodromes regularly used by international commercial air transport, take-offs from runway/taxiway intersections may be justified for the following reasons:

a) runway capacity improvement;
b) taxi routes distances reduction;
c) noise alleviation; and
d) air pollution reduction.

86. To this end, the appropriate authorities should, upon prior consultation with aircraft operators, agree on the selection of suitable intermediate intersection take-off positions along the runway(s). Accordingly, authorities should determine the reduced runway declared distances for take-off associated with each selected intersection take-off position and establish the specific ATC rules and operational procedures/limitations. Such provisions should be published in the State AIP.

Note.— Detailed operational requirements governing the implementation of reduced runway declared distances for take-off are contained in 28 to 33. Additional guidance is contained in Part III — AOP of the AFI FASID.

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AFI ANP, VOLUME I, BASIC ANP
PART III – COMMUNICATIONS, NAVIGATION AND SURVEILLANCE (CNS)

GENERAL

1. Communications, Navigation and Surveillance (CNS) facilities and services should meet the requirements of those other components of the air navigation system which they are intended to serve.

2. In planning for those other components, economy and efficiency should be taken into account in order to ensure that the requirements for the provision of CNS facilities and services can be kept to a minimum.

3. CNS facilities and services should fulfil multiple functions whenever this is feasible.

COMMUNICATIONS

AERONAUTICAL FIXED SERVICE (AFS)

Basic requirements

4. The aeronautical fixed service (AFS) should satisfy the communication requirements of ATS, ATFM, AIS, MET and SAR, including specific requirements in terms of system reliability, message integrity and transit times, with respect to printed as well as digital data and speech communications. If need be, it should, following agreement between individual States and aircraft operators, satisfy the requirements for airline operational control. [Annex 3, 11.1; Annex 11, 6.2; Annex 12, 2.4; Annex 15, Chapter 9; Annex 10, Volume II, Chapter 4]

5. To meet the data communication requirements, a uniform high-grade aeronautical network should be provided, based on the aeronautical telecommunication network (ATN), taking into account the existence and continuation of current networks. This network is hereafter referred as the AFI-ATN Network. [Annex 10, Volume III, Part I]

Existing network

6. Pending future development of the AFI ATN, the current requirements should be met by the use of:

   a) Aeronautical Fixed Telecommunication Network (AFTN);
   
   b) ATS message handling systems (AMHS), AMHS COM centres and gateways;
   
   c) dedicated networks of ATS providers;
   
   d) Operational meteorological information (OPMET) circuits and centres;
   
   e) ATS speech networks and circuits;
   
   f) ATS computer-to-computer data networks and circuits; and
g) the Satellite distribution system for information relating to air navigation (SADIS).
7. All possible arrangements should be made to ensure that, in case of breakdown of a communications centre or circuit, at least high-priority traffic continues to be handled by appropriate means.

8. Emergency procedures should be developed to ensure that, in case of a centre breakdown, all the parties concerned are promptly informed of the prevailing situation.

9. AFS planning should permit flexibility in detailed development and implementation.

**The AFI-ATN network**

10. The AFI-ATN Network should have sufficient capacity to meet the basic requirements for data communications for the services mentioned in 4. above.

11. The AFI-ATN Network should be able to:
   a) support applications carried by the existing network as listed in 6 above;
   b) support gateways enabling inter-operation with existing networks; and
   c) support ground communications traffic associated with air-ground data link applications.

   *Note. — A requirement for the AFI-ATN Network to carry digital speech may have to be considered as and when this becomes practicable and cost effective.*

12. The AFI-ATN Network should make optimum use of dedicated bilateral aeronautical links and other communication means commensurate with the operational quality of service (QoS) requirements.

13. The plan for the implementation of the AFI-ATN Network should take into account the need for cost-effective evolution in terms of network capacity and allow for a progressive transition from existing ground communication networks and services to a uniform, harmonised and integrated communications infrastructure.

14. In case means other than dedicated bilateral links are used by the AFI-ATN Network, implementation priority, high availability, priority in restoration of service and appropriate levels of security should be ensured.

15. The AFI-ATN Network should provide for interregional connections to support data exchange and mobile routing within the global ATN.

16. In planning the AFI-ATN Network, provisions should be made, where required, for interfacing with other international networks.

**Network services**

17. The Transmission Control Protocol/Internet Protocol (TCP/IP) communication protocol should be used for the initial implementation of AMHS.

18. The migration of flight data exchange from X.25 to TCP/IP should be planned.
19. The migration of international or regional ground networks to the AFI-ATN network based on internet protocol (IP) to support AFS communication requirements, while reducing costs, should be planned. 
[Annex 10, Volume III, Part I].

**Network management**

20. A centralised off-line network management service should be provided to participating AFTN/CIDIN/AMHS centres in the AFI Region.

**Specific ATS requirements**

21. Where ATS speech and data communication links between any two points are provided, the engineering arrangements should be such as to avoid the simultaneous loss of both circuits.

22. Special provisions should be made to ensure a rapid restoration of ATS speech circuits in case of outage.

23. The direct access speech capability provided between ATS units should permit contact to be established as rapidly as necessary commensurate with the functions of the unit concerned.  
[Annex 11, 6.2]

24. Data circuits between ATS systems should provide for both high capacity and message integrity.

25. The OLDI application, which provides functionalities equivalent to ATS Inter-facility Data Communication (AIDC), should be considered as appropriate for automated exchange of flight data between ATS units.

**Specific MET requirements**

26. In the transmission of operational meteorological information on the AFI-ATN Network the specified transit times should be met on at least 95 per cent of occasions.  
[Annex 3, 11.1.11]

27. The increasing use of the GRIB and BUFR code forms for the dissemination of the upper wind and temperature and significant weather forecasts and the planned transition to the BUFR code form (or table driven code form) for the dissemination of OPMET data should be taken into account in the planning process of the AFI-ATN Network.

28. In planning the AFI-ATN Network, account should be taken of changes in the current pattern of distribution of meteorological information resulting from the increasing number of long-range direct flights and the trend towards centralized flight planning.

*Note.* — *Specific requirements concerning ATFM and AIS have still to be developed.*

**AERONAUTICAL MOBILE SERVICE (AMS)**
30. Air-ground communications facilities should meet the agreed communication requirements of the air traffic services, as well as all other types of communications which are acceptable on the AMS to the extent that the latter types of communications can be accommodated.

31. To meet the air-ground data communication requirements, a high-grade aeronautical network should be provided based on the ATN, recognising that other technologies may be used as part of the transition. The network needs to integrate the various data links in a seamless fashion and provide for end-to-end communications between airborne and ground-based facilities.

32. Whenever required, use of suitable techniques on VHF or higher frequencies should be made.

33. Operation on HF should only be employed when use of VHF is not feasible. When HF is used, the single side-band technique should be employed.

34. Aerodromes having a significant volume of International General Aviation (IGA) traffic should be provided with appropriate air-ground communication channels.

**Air-ground communications for ATS**

35. Air-ground communications for ATS purposes should be so designed that they require the least number of frequency and channel changes for aircraft in flight compatible with the provision of the required service. They should also provide for the minimum amount of coordination between ATS units and for optimum economy in the frequency spectrum used for this purpose.

36. In addition, uniform values of designated operational coverage (DOC) expressed in terms of range and height of VHF air-ground communication channels should be used for identical ATS functions in accordance with the table contained in Attachment F to Part IV – CNS of the AFI Basic ANP. Deviations from these values at specific locations or for specific functions should only be made in those cases where adequate operational justification for such a deviation is provided by the State(s) concerned.

37. In order to achieve optimum economy in the use of the radio frequency spectrum used commonly for inter-national and national ATS air-ground communications (VHF), the above criteria should also be applied to national planning in the field of VHF air-ground communications.

**Air-Ground Data Link Communications**

38. The following Strategy should be followed for the harmonised implementation of the data link communications in the ICAO AFI Region:

   a) Any additional aircraft implementation of Automatic Dependent Surveillance - Contract (ADS-C) should either;

      i) utilise without change the existing DO-258A/ED-100A 4 (FANS-1/A) ADS-C; or

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4 RTCA/EUROCAE Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications (FANS 1/A INTEROP Standard)
ii) move to the full implementation of the internationally agreed common technical
definition that will be defined based on relevant provisions and guidance
material (*Manual of Air Traffic Services Data Link Applications* (Doc 9694))
developed by ICAO and its technical bodies.

Partial or divergent aircraft data link evolutions should not be pursued, as they will
continue to promote divergent paths to the detriment to the broader community.
Interim steps or phases toward full implementation of the common technical
definition in ground systems should only be pursued on a regional basis, after
coordination between all States concerned.

b) Any additional aircraft implementation of Controller-Pilot Data Link Communications
(CPDLC) should either:

i) utilise without change the existing DO-258A/ED-100A (FANS-1/A) or DO-280B/ED-
110B\(^5\) (ATN) CPDLC for ACM/ACL/AMC\(^6\) data link services, or

ii) move to the full implementation of the internationally agreed common technical
definition, based on *Procedures for Air Navigation Services — Air Traffic Management*
(PANS-ATM, Doc 4444), and other operational material as appropriate.

Partial or divergent aircraft data link evolutions that result in excluding messages from
aircraft systems should not be pursued, as they will continue to promote divergent paths to
the detriment to the broader community. Interim steps or phases toward full implementation
of the common technical definition in ground systems should only be pursued on a regional
basis, after coordination between all States concerned.

Harmonization of operational procedures for implementation of the above packages
is considered essential. States, planning and implementation regional groups, air
navigation services providers and other ATS coordinating groups should adopt
common procedures to support seamless ATS provision across flight information
region boundaries, rather than each State or Region developing and promulgating
unique procedures for common functions.

39. Controller Pilot Data Link Communications (CPDLC) based on ATN VHF Data Link Mode 2
(VDL2) implementation is an agreed strategy for deployment of air-ground data link
communications in the ICAO AFI Region.

**Required Communication Performance (RCP)**

40. The RCP concept characterizing the performance required for communication capabilities that
support ATM functions without reference to any specific technology should be applied wherever
possible.

41. The States should determine, prescribe and monitor the implementation of the RCP in line with
the provisions laid down in the ICAO RCP Manual (Doc 9869).

\(^5\) RTCA/EUROCAE Interoperability Requirements Standard For ATN Baseline 1 (ATN B1 INTEROP Standard)
\(^6\) Air traffic control communications management/Air traffic control clearances and information/Air traffic control microphone check.
NAVIGATION

General

42. Planning of navigation services associated with the ATS route network should be done on a total system basis, taking full account of the navigation capabilities as well as cost effectiveness. The total system composed by station-referenced navigation aids, satellite based navigation systems and airborne capabilities should meet the performance based requirements for navigation guidance of all aircraft using the system and should form an adequate basis for the provision of positioning, guidance and air traffic services.

43. Account should be taken of the fact that certain aircraft may be able to meet their long-range and short-range navigation needs by means of self-contained aids, thus eliminating the need for the provision of station-referenced aids along routes used by such aircraft, as well as the need to carry on board excessive redundancies.

44. The Global ATM Operational Concept, endorsed by ICAO 11th Air Navigation Conference (AN-Conf/11) and published as ICAO Doc 9854, provides the framework for the development of all regional ATM concepts. AN-Conf/11 also endorsed a number of technical recommendations affecting navigation, including the harmonization of air navigation systems between regions, frequency planning, the transition to satellite based air navigation, curved RNAV procedures, and the use of multiple GNSS signals and the rapid implementation of approaches with vertical guidance.

45. The ICAO Performance Based Navigation (PBN) Manual was developed in direct response to an AN-Conf/11 recommendation.

46. In September 2007, the ICAO 36th Assembly issued Resolution 36-23 urging States to:
   a) Complete PBN implementation plans by 2009;
   b) Implement RNAV and RNP operations (where required) for en route and terminal areas; and
   c) Implement approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches, by 2016 (with 30 per cent by 2010 and 70 per cent by 2014).

47. The following PBN Implementation Roadmap addresses and supports this Resolution as amended in 2010, whereby States and Planning and Implementation Regional Groups (PIRGs) were expected to complete a PBN implementation plan by 2009.

   THE AFI PBN IMPLEMENTATION ROADMAP

48. Recognizing the benefits to be derived from the PBN concept, the AFI Region States shall ensure that all RNAV and RNP operations and procedures are in accordance with the PBN concept as detailed in ICAO Doc 9613 thereby ensuring a globally harmonized and coordinated transition to PBN avoiding unnecessary costs to operators in achieving certification and operational approvals for worldwide navigation application.

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7 In 2010, the ICAO Assembly replaced Resolution 36-23 with Resolution 37-11.
49. The AFI PBN Regional Roadmap is designed to provide guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organizations, on the expected evolution of the regional navigation system in order to allow planning of airspace changes, enabling ATM systems and aircraft equipage.

50. The PBN Implementation Roadmap for the ICAO AFI Region exists within the context of the AFI region operating environment.

51. Given the requirement for interoperability this Roadmap represents the parent source of the strategic regional planning context.

52. The following are key driving factors to the development of the Roadmap:
   a) Move towards GNSS becoming the prime positioning source for all phases of flight using Galileo/GPS/GLONASS, GBAS and SBAS;
   b) SBAS (Satellite-Based Augmentation System) becomes available for suitably equipped aircraft to enable increased access to medium and smaller airports in the time frame in accordance with the AFI GNSS Strategy;
   c) GBAS (Ground-Based Augmentation System) becomes available using GPS L1 for some users in particular operating environments in the time frame in accordance with the AFI GNSS Strategy;
   d) A mandate for the carriage of GNSS may be envisioned by APIRG for application in certain parts of the AFI Region;
   e) Evolution of improved low visibility operations using GBAS to support CAT II and III operations with GPS L1 then with multi constellation GNSS;
   f) 4D trajectory management is foreseen beyond 2020;
   g) Advanced RNP with an initial Required Time of Arrival (RTA) capability is a step towards 4D trajectory management;
   h) Extended use of RNAV1 for approach as a means of transitioning from permanent routes through Conditional Routes to 4D Business/Mission Trajectories;
   i) The continued provision of DME as a backup to GNSS is consistent with safety targets;
   j) Replacement of Conventional Non-Precision Approaches by approaches with vertical guidance in accordance with the AFI GNSS Strategy;
   k) The progressive decommissioning of VORs and NDBs made possible by the GNSS evolution.

**Principles of PBN Implementation**

53. The broad principles for PBN Implementation derived from the operational requirements of the AFI Region and the concepts and strategies discussed above are:
   a) The Navigation Application and Infrastructure Strategy are required to meet the requirements detailed in the ICAO Global ATM Operational Concept. As such, the Roadmap lays the foundations for achieving the goals of User Preferred Trajectories together with improved access, safety and reduced environmental impact targets;
b) GNSS becomes the primary and potentially a sole means of navigation, to the degree that this can be demonstrated to be safe and cost effective; and

c) Given that satellite-based Navigation increasingly co-exist with satellite-based Surveillance and Communication services, the Roadmap takes due account of all ATM/CNS components.

54. The application of these principles shall:

a) identify and evolve from the needs and priorities of both users and providers of the navigation systems and/or services;

b) provide tangible and early benefits for the users;

c) safeguard capital investments, necessary to maintain the existing infrastructure and future rationalisation plans;

d) take due account of sub-regional institutional arrangements and regulations;

e) accommodate geographical differences in capabilities, performance requirements and infrastructure;

f) enable coherent development plans within the AFI region and ensure an appropriate interface to the adjacent regions; and

g) Accept the continued operations of aircraft with lower navigation capabilities for as long as operationally feasible.

Benefits

55. The following are the benefits expected to be derived by implementation of PBN:

a) Improved safety, efficiency and reduced environmental impact through the implementation of continuous and stabilized descent procedures using vertical guidance accompanied by the gradual elimination of Non-Precision Approaches by 2016;

b) Implementation of more flexible and precise approach, departure, and arrival paths that will reduce dispersion and will enable improved airspace design fostering increased capacity;

c) Flight efficiency by the extension of RNAV applications allowing for more optimised trajectories;

d) Increased capacity through implementation of additional parallel routes and additional arrival and departure points in terminal areas;

e) Increase capacity through reduction of lateral and longitudinal separation enabled by RNAV and RNP;

f) Reduced environmental impact resulting from savings in fuel and through noise reduction by the improved placement of routes using RNAV and RNP;

g) Mission effectiveness improved through the accommodation of aircraft with lower navigation capability for as long as operationally feasible;

h) Improved airport access through provision of APV and RNP APCH or RNP AR APCH;
i) Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring; and

j) Interoperability with other ICAO regions.

**PBN APPLICATIONS**

**En-Route Operations**

56. The ICAO AFI Region is characterized by diverse air traffic volumes and densities, operational requirements and CNS/ATM capabilities. Partly this emanates from the fact that the Region includes high-density continental and low density remote continental areas. Therefore a single RNAV/RNP navigation specification may not meet operational requirements of the whole Region and different navigation applications may be applied by different homogeneous ATM areas.

**TMA Operations**

57. Requirements for TMA operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. It also involves the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

58. The mix of traffic differs remarkably between airports. This together with airspace restrictions which can prevent the introduction of special RNAV/RNP routes is likely to result in the capability of an airport to introduce RNAV or RNP operations being constrained by the lower capability of aircraft using that airport. It is consequently possible that airports within a single TMA could have differing capability for introduction of PBN operations.

59. As a result, the States should develop their own national plans for the implementation of PBN in TMAs, based on the PBN Manual, seeking the harmonization of the application of PBN and avoiding the need for multiple operational approvals and applicable aircraft separation criteria.

60. The following PBN strategy was agreed in the ICAO AFI Region:

   a) Implementation of any RNAV or RNP application shall be in compliance with ICAO PBN Manual (Doc 9613);

   b) The target date for the completion of implementation for the Approach procedures with vertical guidance (APV) (APV/Baro-VNAV and/or APV/SBAS) for all instrument runway ends is 2016;

**Instrument Approaches**

61. States should introduce PBN approaches that provide Vertical Guidance to enhance safety. These should be based on APV, Baro-VNAV and/or Space Based augmentation Systems (SBAS) where possible. Conventional approach procedures and conventional navigation aids should be maintained to support non-equipped aircraft during the transitional period.
62. With the expected reduction and subsequent removal of VOR and NDB it is expected that conventional NPAs will have to be withdrawn until 2025. The States should make clear their own individual plans in order to assist operators in their planning for the transition to PBN.

**NAVIGATION INFRASTRUCTURE**

*(To Be developed)*

**Transition Strategy**

63. During transition to PBN, sufficient ground infrastructure for conventional navigation systems must remain available. Before existing ground infrastructure is considered for removal, users should be consulted and should be given reasonable transition time to allow them to equip appropriately to attain equivalent PBN-based navigation performance. States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised. This could be guaranteed by performance of safety assessments and consultations with the users.

64. States should cooperate on a multinational basis to implement PBN in order to facilitate seamless and inter-operable systems.

65. States are encouraged to consider catering for traffic according to navigation capability and granting benefits to aircraft with better navigation performance, taking due consideration of the needs of State/Military aircraft.

66. States should encourage operators and other airspace users to equip with PBN-capable avionics. This can be achieved through early introductions of RNP approaches, preferably those with vertical guidance.

**Safety Documentation & Monitoring Requirements**

*Need for safety documentation*

67. To ensure that the introduction of PBN applications is undertaken in a safe manner, in accordance with relevant ICAO provisions, implementation shall only take place following conduct of a safety documentation that would demonstrate that an acceptable level of safety will be met. Additionally, ongoing periodic safety reviews should be undertaken where required in order to establish that operations continue to meet the target levels of safety.

*Use of specific navigation aids*

68. Where, within a given airspace, specific groups of users have been authorized by the competent authorities to use special aids for navigation, the respective ground facilities should be located and aligned so as to provide for full compatibility of navigational guidance with that derived from the internationally agreed and ICAO Annex 10 compliant systems.

69. States should ensure and oversee that Navigation Service Providers (i.e. providers of the navigation signals in space) take appropriate corrective measures promptly whenever a significant degradation in the accuracy of navigation aids (either space based or ground based or both) is detected.
SURVEILLANCE

Planning Considerations

70. The ICAO AFI Region is currently characterized by the use of the following surveillance systems:

a) Secondary Surveillance Radars (SSR) Mode A, C and S in some terminal and en-route continental airspaces;

b) Primary Surveillance Radars (PSR) in some terminal airspaces;

c) Automatic Dependent Surveillance – Broadcast (ADS-B) and Wide Area Multilateration (WAM) in some parts.

Automatic Dependent Surveillance – Contract (ADS-C) in some parts of the oceanic and remote continental airspace.

71. In order to meet the anticipated future operational requirements by 2020 in an evolutionary manner, the following guiding principles to the development of surveillance infrastructure were agreed in the AFI Region:

a) An independent surveillance system to track non-cooperative targets where and when required. This will be provided by PSR unless and until an alternative solution is required and developed;

b) An independent surveillance system to track co-operative targets. This can be enabled by SSR Mode A/C or SSR Mode S or Wide Area Multilateration;

c) Dependant co-operative surveillance based upon ADS-B providing positional data of suitable quality. The common, internationally agreed technical enabler for this type of surveillance is 1090 MHz Extended Squitter based ADS-B data link. ADS-C in remote continental and oceanic areas only;

d) Since aircraft will have the necessary Mode S and ADS-B equipage, the choice of Cooperative surveillance technology (Mode S, ADS-B, Multilateration) remains flexible with the service provider determining the best solution for their particular operating environment, based on cost and performance; and

e) The progressive use of surveillance data onboard of ‘ADS-B In’ equipped aircraft to support Air Traffic Situational Awareness (ATSAW) and spacing applications and later separation applications. This also allows for increased delegation of responsibility for separation to the flight crew.
FREQUENCY MANAGEMENT

Planning Considerations

General

72. Frequency assignment planning in the AFI region should be carried out in accordance with the provisions of Annex 10 supplemented, as necessary, by regional recommendations and technical criteria developed for this purpose. Detailed guidance on frequency assignment planning for AMS and radio navigation aids will be developed by the AFI Frequency Management Group.

AMS

73. Frequencies should be assigned to all VHF AMS facilities, taking into account:

   a) agreed geographical separation criteria based on 8.33 kHz interleaving between channels for the area where this channel spacing is applicable;

   b) agreed geographical separation criteria based on 25 kHz interleaving between channels;

   c) agreed geographical separation criteria for the implementation of VDL services;

   d) the need for maximum economy in frequency demands and in radio spectrum utilization; and

   e) A deployment of frequencies which ensures that international services are planned to be free of interference from other services using the same band.

74. The priority order to be followed in the assignment of frequencies to service is:

   a) ATS channels serving international services (ACC, APP, TWR, FIS);

   b) ATS channels serving national purposes;

   c) channels serving international VOLMET services;

   d) channels serving ATIS and PAR; and

   e) channels used for other than ATS purposes.

75. The criteria used for frequency assignment planning for VHF AMS facilities serving international requirements should, to the extent practicable, also be used to satisfy the need of national VHF AMS facilities.

76. Special provisions should be made, by agreement between the States concerned, for the sharing and the application of reduced protection of non-ATC frequencies in the national sub-bands, so as to obtain a more economical use of the available frequency spectrum consistent with operational requirements.
77. It should be ensured that no air/ground frequency is utilized outside its designated operational coverage.

100. It should be ensured that the stated operational requirements for coverage of a given frequency can be met for the transmission sites concerned, taking into account terrain configuration.

**Radio navigation aids**

101. Frequencies should be assigned to all radio navigation facilities taking into account:

   a) agreed geographical separation criteria based on assignments of 50 kHz-spaced frequencies to ILS localizer and VOR, X and Y channels to DME and 25 KHz space frequencies to GBAS;

   b) the need for maximum economy in frequency demands and in radio spectrum utilization; and

   c) a deployment of frequencies which ensures that international services are planned to be free of interference from other services using the same band.

102. The principles used for frequency assignment planning for radio navigation aids serving international requirements should, to the extent possible, also be used to satisfy the needs for national radio aids to navigation.
INTRODUCTION

1. This part of the Africa-Indian Ocean Region Basic Air Navigation Plan introduces the long-term AFI Region ATM requirements based on the Global ATM Operational Concept. While the operational concept is visionary and even challenging, many of the current practices and processes detailed in the BORPC will continue to exist throughout the planning horizon. In this sense, the introduction of the new concepts should be seen as evolutionary. Following the description of the Concept, this Part provides detail on the ATM requirements during the transition to the ATM Concept’s Operational Components. Description of specific delivery programmes and associated electronic links are contained in the ATM element of the FASID.

2. The Standards, Recommended Practices and Procedures to be applied are contained in:
   a) Annex 2 — Rules of the Air;
   b) Annex 6 — Operation of Aircraft;
   c) Annex 11 — Air Traffic Services;
   d) *Procedures for Air Navigation Services — Air Traffic Management* (Doc 4444);
   e) *Procedures for Air Navigation Services — Aircraft Operations* (Doc 8168);
   f) *Regional Supplementary Procedures* (Doc 7030) – AFI Region; and

ATM OPERATIONAL CONCEPT COMPONENTS

General

3. To achieve the Global ATM Operational Concept, improvements to the ATM system should be based on the provision of integrated services by means of the concept components described below. The separate components form one system. Figure 1, depicts the interrelationship of the system components and the convergence into a single system.
The ATM System needs to be disaggregated to understand the sometimes complex interrelationship between its components.

The ATM System: A Holistic Entity
Disaggregated for discussion and role understanding

Complex Interaction

Information Management

All components must be present in the ATM System

ATM System: A Holistic Entity

The ATM System cannot, however, function without any one of its components. The components must be re-integrated.

AOM — Airspace management
DCB — Demand/capacity balancing
AO — Aerodrome operations
TS — Traffic synchronization
CM — Conflict management
AUO — Airspace user operations
ATM SDM — ATM service delivery management

Figure 1.

4. The transition to adoption of the new concepts should be an iterative process underpinned by satisfactory cost benefit analysis. ATM improvements planned prior to the adoption of the Global ATM Operational Concept should not necessarily be abandoned as they should provide short to medium term system wide improvements; they should, however, be assessed for compatibility with the Global ATM Operational Concept to avoid nugatory expense.

5. The ATM concept components introduced above are described in more detail as follows:

Airspace Organisation and Management

6. Airspace organisation will establish airspace structures in order to accommodate the different types of air activity, volume of traffic and differing levels of service. Airspace management is the process by which airspace options are selected and applied to meet the needs of the ATM community. Key conceptual changes include:

a) all airspace will be the concern of ATM and will be a usable resource;

b) airspace management will be dynamic and flexible;

c) any restriction on the use of any particular volume of airspace will be considered transitory; and

d) all airspace will be managed flexibly. Airspace boundaries will be adjusted to particular traffic flows and should not be constrained by national or facility boundaries.
Aerodrome operations

7. As an integral part of the ATM system, the aerodrome should provide the needed ground infrastructure including, *inter alia*, lighting; taxiways; runway, including exits; and precise surface guidance to improve safety and to maximize aerodrome capacity in all weather conditions. The ATM system will enable the efficient use of the capacity of the aerodrome airside infrastructure. The key conceptual changes include:

a) runway occupancy time will be reduced;

b) the capability to safely manoeuvre in all weather conditions whilst maintaining capacity;

c) precise surface guidance to and from a runway will be required in all conditions; and

d) the position (to an appropriate level of accuracy) and intent of all vehicles and aircraft operating on the movement area will be known and available to the appropriate ATM community members.

Demand and capacity balancing

8. Demand and capacity balancing will strategically evaluate system-wide traffic flows and aerodrome capacities to allow the airspace users to determine when, where and how they operate, while mitigating conflicting needs for airspace and aerodrome capacity. This collaborative process will allow for the efficient management of the air traffic flow through the use of information on system-wide air traffic flow, weather and assets. The key conceptual changes include:

a) through collaborative decision-making at the strategic stage, assets will be optimized to maximize throughput thus providing a basis for predictable allocation and scheduling;

b) through collaborative decision-making, at the pre-tactical stage when possible, adjustments will be made to assets, resource allocations, projected trajectories, airspace organization, and allocation of entry/exit times for aerodromes and airspace volumes to mitigate any imbalance; and

c) at the tactical stage, actions will include dynamic adjustments to the organization of airspace to balance capacity; dynamic changes to the entry/exit times for aerodromes and airspace volumes; and adjustments to the schedule by the users.

Traffic synchronization

9. Traffic synchronization refers to the tactical establishment and maintenance of a safe, orderly and efficient flow of air traffic. The key conceptual changes include:

a) (where traffic density/complexity allows) there will be dynamic 4-D trajectory control and negotiated conflict-free trajectories;

b) Choke points will be eliminated; and

c) optimization of traffic sequencing will achieve maximization of runway throughput.
Conflict management

10. Conflict management will consist of three layers: strategic conflict management through airspace organization and management, demand and capacity balancing and traffic synchronization; separation provision; and collision avoidance.

11. Conflict management will limit, to an acceptable level, the risk of collision between aircraft and hazards. Hazards that an aircraft will be separated from are: another aircraft, terrain, weather, wake turbulence, incompatible airspace activity and when the aircraft is on the ground, surface vehicles and other obstructions on apron and manoeuvring area. The key conceptual changes include:

   a) strategic conflict management will reduce the need for separation provision to a designed level;

   b) the ATM system will minimize restrictions to user operations; therefore, the pre-determined separator will be the airspace user, unless safety or ATM system design requires a separation provision service;

   c) the role of separator may be delegated, but such delegations will be temporary;

   *Note. The separator is the agent responsible for separation provision for a conflict and can be either the airspace user or a separation provision service provider.*

   d) in the development of separation modes, separation provision intervention capability must be considered;

   e) the conflict horizon will be extended as far as procedures and information permit; and

   f) collision avoidance systems are part of ATM safety management, but will not be included in determining the calculated level of safety required for separation provision.

Airspace user operations

12. Airspace user operations refer to the ATM-related aspect of flight operations. The key conceptual changes include:

   a) accommodation of mixed capabilities and worldwide implementation needs will be addressed to enhance safety and efficiency;

   b) relevant ATM data will be used for an airspace user’s general, tactical and strategic situational awareness and conflict management;

   c) relevant airspace user operational information will be made available to the ATM system;

   d) individual aircraft performance, flight conditions, and available ATM resources will allow dynamically-optimised 4-D trajectory planning;

   e) collaborative decision-making will ensure that aircraft and airspace user system design impacts on ATM are taken into account in a timely manner; and

   f) aircraft will be designed with the ATM system as a key consideration.

ATM service delivery management
13. ATM service delivery management will operate seamlessly from gate-to-gate for all phases of flight and across all service providers. The ATM service delivery management component will address the balance and consolidation of the decisions of the various other processes/services, as well as the time horizon at which, and the conditions under which these decisions are made. Flight trajectories, intent and agreements will be important components to delivering a balance of decisions. The key conceptual changes include:

a) services to be delivered by the ATM service delivery management component will be established on an as-required basis subject to ATM system design. Where services are established they will be provided on an on-request basis;

b) ATM system design will be determined by collaborative decision-making and system-wide safety and business cases;

c) services will be delivered by the ATM service delivery management component through collaborative decision-making, balance and optimise user-requested trajectories to achieve the ATM community’s expectation; and

d) management by trajectory will involve the development of an agreement that extends through all the physical phases of the flight.

INFORMATION MANAGEMENT

14. The global ATM system foreseen in the operational concept was based on a collaborative decision-making environment where the timely availability of high-quality and reliable electronic aeronautical, meteorological, airspace and flow management information would be necessary. Thus a key enabler to ensure the effectiveness of the ATM System is the provision of information services through the concept of Information Management. Information management will provide accredited, quality assured and timely information used to support ATM operations.

15. The exchange and management of information used by the different processes and services must ensure the cohesion and linkage between the seven ATM system concept components shown in Figure 1 above and should be available through a system wide information management (SWIM) system.

ATM IN THE TRANSITION TO THE CONCEPT

16. During the transition to achieving the ATM Concept the following ATM elements should be provided:

Airspace Organization and Management

17. The airspace organization should provide the strategies, rules and procedures by which the airspace will be structured to accommodate the different types of air activity, volume of traffic, and differing levels of service and rules of conduct. The principles of organization should be applicable in all complexities of airspace. Airspace management is the process by which the airspace options are selected and applied to meet the needs of the ATM community. The following organizational principles underlying these strategies, rules and procedures should be adopted:

a) all airspace should be managed flexibly. Airspace boundaries should be adjusted to particular traffic flows and should not be constrained by national or facility boundaries;

b) airspace management processes should, subject to system capability, safety and capacity, accommodate dynamic flight trajectories and provide optimum system solutions;
c) when conditions require that different types of traffic be segregated by airspace organization, the size, shape and time regulation of that airspace should be set to minimize the impact on operations. However, aircraft neither operating in that particular mode, nor equipped accordingly for such airspace, should be accommodated by the system where deemed safe and appropriate. Accommodation should be made without constraining the primary use of that airspace;

d) priority for the use of specific airspace should not be constrained by the primary usage or equipage on a routine basis. While it is recognized that airspace designation is useful, it should not be organized in a manner that permanently precludes the possibility of mixed usage/mixed equipage operations;

e) airspace use should be coordinated and monitored in order to accommodate the conflicting legitimate requirements of all users and to minimize any constraints on operations;

f) airspace reservations should be planned in advance with changes made dynamically whenever possible. The system should also accommodate unplanned requirements;

g) structured route systems should be applied only where required to enhance capacity or to avoid areas where access has been limited or where hazardous conditions exist; and

h) airspace structures and division levels should be harmonised.

Civil/Military Coordination

Note 1 - Annex 11 contains provisions on civil-military coordination and Annex 15 contains provisions for the promulgation of the relevant AIS by the competent authority responsible for the provision of ATS in the area within which the operations will take place.

Note 2 - The application of the flexible use of airspace (FUA) over the high seas is without prejudice to the rights and duties of States regarding access to high seas airspace under the Chicago Convention. Articles 3 a) and d) to the Chicago Convention apply.

Note 3 - The FUA provisions are not mandatory for application by States. They are intended to be a method to ensure maximum harmonisation of the application of the FUA in the AFI Region.

18. States should aim at the creation of one single integrated system catering to both civil and military requirements. The related organization of the airspace should satisfy the requirements of all users in an optimum way.

19. States should establish civil/military coordination bodies to ensure, at all levels, the coordination of decisions relating to civil and military problems and airspace and traffic management (paragraph xx above refers).

20. States should arrange for close liaison and coordination between civil ATS units and relevant military operational control and/or air defence units in order to ensure integration of civil and military air traffic or its segregation, if required. Such arrangements would also contribute to the reduction or elimination of the need for interception of strayed or unidentified aircraft.

21. Military exercises likely to affect civil flight operations should be scheduled, whenever possible, so as not to coincide with peak periods of civil air traffic and/or not to affect areas where a high density of civil air traffic occurs.

Flexible Use of Airspace (FUA)
22. Airspace should not be designated as either purely civil or purely military airspace, but should rather be considered as one continuum in which all users’ requirements have to be accommodated to the maximum extent possible.

23. States should apply the flexible use of airspace concept whenever:
   a) activities require the reservation of a volume of airspace for their exclusive or specific use for determined periods due to the characteristics of their flight profile or their potential hazards and the need to ensure effective and safe separation from non-participating air traffic;
   b) different types of aviation activities occur in the same airspace but with different requirements. Their coordination should seek to achieve both the safe conduct of flights and the optimum use of available airspace;
   c) accuracy of information on airspace status and on specific air traffic situations, and timely distribution of this information to civil and military controllers and controlling military units has a direct impact on the safety and efficiency of operations; and
   d) timely access to up-to-date information on airspace status is essential for all parties wishing to take advantage of airspace structures made available when planning their flights.

Flexible Use of Airspace Over The High Seas

24. The flexible use of airspace concept also covers airspace over the high seas. Its application should therefore be without prejudice to the rights and duties of States under the Convention on International Civil Aviation (Chicago Convention) and its annexes, or the 1982 UN Convention on the Law of the Sea (UNCLOS).

25. Regulations governing flights of State aircraft over the high seas should, to the maximum extent practicable, comply with the relevant provisions of Annex 2. Where this is not possible due to the nature of the operations involved, measures should be taken to ensure that other aircraft are not endangered by such operations. These should preferably be established in coordination with the State responsible for the provision of air traffic services over that part of the high seas affected by such operations.

Airspace Structure

(Chart ATS 1)

26. The AFI airspace infrastructure should evolve to meet the changing demands of the aviation community. Provider States should coordinate their airspace planning to balance the conflicting but legitimate requirements of all users in order to efficiently provide sufficient capacity to meet traffic demands, to ensure optimum utilisation, to ensure compatibility with their respective neighbours and to guarantee the safety of flight.

27. Flight Information Regions (FIR). Parameters of AFI Region FIRs are detailed in the Part I of Basic ANP. A State may delegate to another State the responsibility for establishing and providing air traffic services in flight information regions, over the territories of the former or make arrangements for the provision of services within high seas airspace for which it has responsibility. Such arrangements should be considered when safety or capacity benefits can be achieved.

29. Controlled airspace should be established so as to encompass the climb to cruising level of departing aircraft, the cruising levels on ATS routes normally used by IFR flights and the descent from such levels of
arriving aircraft, except in those cases where the type and density of traffic clearly do not justify the establishment of controlled airspace.

30. The vertical limits and classification of airspace should be as follows:

a) the vertical limits for all control areas established in the AFI Region be:

   1) upper limit — Above FL245 to unlimited; Controlled airspace to be Class A.
   2) lower limit – Below FL245 ATS provided in various airspace volumes should be based on the ICAO classification of airspaces as defined in Annex 11 — *Air Traffic Services* (i.e. Class A to G), and those classifications should be implemented on the basis of a safety assessment, taking into account the volume and nature of the air traffic.

Details of airspace parameters within FIRs should be shown in respective national Aeronautical Information Publications.

31. States should adopt a common division level between upper and lower airspace; airspace classifications above the division level should be harmonised. (GPI-4 refers). Details of AFI Region Airspace Classifications are contained in the FASID/electronic database.

32. ATS routes and organised track structures should be provided to meet ATM requirements. States should to the extent possible coordinate with the ICAO Regional Offices any changes to the airspace structure, the assignment of or changes to compulsory reporting points and ATS routes; route and reporting point designators should be obtained from the ICARD Global Database. Details of ATS Routes and designators within the AFI Region are contained in the FASID/electronic database.

33. Dynamic and flexible ATS route management should be provided when ATM and aircraft capabilities can safely accommodate such arrangements. (GPI-7 refers)

34. Airspace restrictions and/or temporary airspace reservations for specific users or purposes should only be imposed when the intended purpose cannot be met by other arrangements. If established, such restrictions and/or reservations should be kept to the minimum, both in extent and duration consistent with the purpose they serve and should be withdrawn as soon as possible. In addition, any restricted and/or reserved airspace should be made available for general use whenever the activities having led to their establishment are temporarily suspended, e.g. during weekends, at night, etc.

35. Where users have specific requirements in portions of the airspace extending over the territory of a number of States and/or over the high seas, arrangements should be made between States concerned for the coordinated use of airspace, facilities and procedures in order to ensure maximum uniformity.

**Separation**

36. Reduced vertical separation minima between FL290 and FL410, will be used throughout the AFI Region airspace. (GPI-2 refers).

37. The introduction of Performance Based Navigation (PBN) and Required Navigation Performance (RNP) equipped aircraft is expected to enable reductions in separation minima and route spacing. The extent of this improvement has yet to be assessed.
Air Traffic Flow Management (ATFM)

38. Efforts should be made to provide sufficient capacity to cater to both normal and peak traffic levels, without jeopardizing safety levels. ATFM should aim for capacity management and the optimization of the efficiency of the global ATM system, by ensuring that capacity is utilized to the maximum extent possible. (GPI-6 refers)

39. ATFM should be applied for periods when it is expected that the air traffic demand will be close to or will exceed the ATC capacities in the areas concerned.

40. Information concerning the provision of ATFM services applicable in the AFI region are contained in the AFI FASID and the Regional Supplementary Procedures (Doc 7030) — AFI

AIR TRAFFIC SERVICES

Air traffic control service

44. The ATC Service should maintain a safe, orderly and expeditious flow of air traffic by applying separation between aircraft and by issuing clearances to individual flights as close as possible to their preferred profiles, taking into account the actual state of airspace utilization and within the general framework of ATFM measures when applicable. Air traffic control service should be provided on a 24-hour basis in all controlled airspace used by international operations both during the en-route and the terminal phases of their flight.

Flight information service

45. Flight information service should be provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

46. The requirements for flight information services are not expected to change significantly in the near term and the provision of VOLMET would continue to be required. It is, however, expected that data link messages will gradually reduce the requirement for voice VOLMET. The delivery of critical information such as SIGMET messages and other information equally pertinent to the safety of flight should be improved by the existence of data links (AFI FASID Table ATS xx).

Alerting Service

47. Alerting service should be provided for the notification of appropriate organizations regarding aircraft in need of Search and Rescue (SAR) aid and assisting such organizations as required. In addition, data links should be established, where appropriate, between the ATS units and Rescue Coordination Centres to support the SAR function (Part VI — SAR also refers).
SSR CODE MANAGEMENT

Enhanced Originating Region Code Assignment Method (e-ORCAM)/Centralised SSR Code Assignment and Management System (CCAMS)

48. Within the context of ATM and the provision of ATS, SSR code management is a key element of ATM to ensure continuous, unambiguous aircraft identification. SSR codes have a finite limit and without management results in capacity constraints and aircraft delays. The assignment and management of the SSR code management is specified in Part V of the Volume II of Air Navigation Plan (FASID) of AFI Region.

MONITORING
(See also Part VIII – Safety)

Lateral Plane

49. Monitoring of navigation performance is required for two reasons:

a) demonstrated “typical” navigation accuracy provides a basis for determining whether the performance of the ensemble of aircraft operating on the RNAV routes meets the required performance; and

b) the lateral route spacing and separation minima necessary for traffic operating on a given route are determined both by the core performance and upon normally rare system failures.

50. Both lateral performance and failures need to be monitored in order to establish the overall system safety and to confirm that the ATS system meets the required target level of safety.

51. Radar observations of each aircraft’s proximity to track and altitude are typically noted by ATS facilities and aircraft track-keeping capabilities are analyzed.

52. A process should be established allowing pilots and controllers to report incidents where navigation errors are observed. If an observation/analysis indicates that a loss of separation or obstacle clearance has occurred, the reason for the apparent deviation from track or altitude should be determined and steps taken to prevent a recurrence.

53. States should investigate navigation errors which are brought to the attention of operators and/or where necessary the State of Registry of the aircraft concerned with the least possible delay.

Vertical Plane

54. RVSM. System performance monitoring should be undertaken to ensure that the continued operation of RVSM meet the safety objectives. (ICAO Doc 9574 – Manual on Implementation of a 300 m (1000 ft) Vertical Separation Minimum Between FL290 and FL410 Inclusive, Chapter 6).
PERFORMANCE MEASURING

55. The APIRG is in the process of developing initial performance objectives and associated indicators relating to capacity; efficiency and the environment; and cost effectiveness. Performance objectives and indicators will continue to be developed with details provided in the FASID. The initial objectives and indicators are shown below:

Capacity

56. The indicators identified to monitor the achievement of this objective are:

1) En-route ATFM delays a) Average ATFM delay per flight generated by the airspace volume (en-route)

2) Airport ATFM delays a) Average ATFM delay per flight in the main airports (to be identified by States in advance and based on the regional relevance)

Efficiency and Environment

57. The Efficiency and Environment KPAs have been considered together because in this context they are strictly interlinked.

58. The objective for Efficiency is: ensure that users use the most efficient routes – focussing on the horizontal flight-efficiency. The indicator identified to monitor the achievement of this objective is:

1) Average horizontal en route flight efficiency, defined as the difference between the length of the en route part of the actual trajectory (where available) or last flight planned route and the great circle.

59. In this context specificities shall be considered for flights longer than 1000 nm where the optimum could differ from the great circle (wind optimal routes, etc).

60. The objective for Environment is: contribute to the protection of environment – focussing on fuel savings/CO2 emission reductions. The indicator identified for the achievement of this objective is:

1) CO2 emissions deriving from inefficiencies in flight efficiency (conversion of additional distance into CO2 emissions based on standard values formula).

61. Discussion within the APIRG highlighted that future developments of the framework will have to consider the impact of aviation noise on environment.

Cost-effectiveness

62. The objective for cost-effectiveness is: contribute to optimise the costs for air navigation services – focussing on productivity. The indicators identified to monitor the achievement of this objective are:

1) IFR flights (en-route) per ATCO hour on duty;
2) IFR flight hours per ATCO hour on duty; and
3) IFR movements (airport) per ATCO hour on duty.
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PART V — METEOROLOGY (MET)

INTRODUCTION

1. This part of the AFI Basic Air Navigation Plan contains elements of the existing planning system and introduces the basic planning principles; operational requirements and planning criteria related to aeronautical meteorology (MET) as developed for the AFI Region and considered to be the minimum necessary for effective planning of MET facilities and services.

2. As a complement to the Statement of Basic Operational Requirements and Planning Criteria (BORPC) set out in Part I, Part VI constitutes the stable guidance material and considered to be the minimum necessary for effective planning of MET facilities and services in the AFI Region. 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 AFI 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 related requirements. Further, it is expected that some elements of the 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 are
   a) Annex 3 — Meteorological Service for International Air Navigation; and
   b) Regional Supplementary Procedures (Doc 7030).

4. Background information of importance in the understanding and effective application of this part of the plan is contained in the Report of the Seventh Africa-Indian Ocean Regional Air Navigation Meeting (Doc 9702), supplemented by information appropriate to the AFI Region which is contained in the reports of the other regional air navigation (RAN) meetings.

METEOROLOGICAL OFFICES
(FASID Tables MET 1A and MET 1B)

5. Tropical cyclone advisory centre (TCAC) La Réunion, has been designated to prepare advisory information for the AFI Region, as indicated at FASID Table MET 3A.

6. Volcanic ash advisory centre (VAAC) Toulouse has been designated to prepare advisory information for the AFI Region, as indicated at FASID Table MET 3B.
7. Selected State volcano observatories have been designated for direct notification of significant pre-eruption volcanic activity, a volcanic eruption and/or volcanic ash in the atmosphere for the AFI Region to their corresponding ACC, MWO and VAAC, as indicated at FASID Table MET 3C.

8. In the AFI Region, meteorological watch offices have been designated to maintain continuous watch on meteorological conditions affecting flight operations within their area(s) of responsibility, as indicated at FASID Table MET 1B.

9. There is no requirement in the AFI Region for aeronautical meteorological stations to be established on offshore structures or at other points of significance in support of helicopter operations to offshore structures.

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**METEOROLOGICAL OBSERVATIONS AND REPORTS**

[AFI/6, Rec. 9/12]

10. Hourly observations with special reports in the SPECI code form should be made at all aeronautical meteorological stations.

[AFI/6, Rec. 9/12]

11. Observations should be made half-hourly for VOLMET broadcasts at the stations indicated in FASID Tables ATS 2A and 2B.

12. At aerodromes that are not operational throughout 24 hours, METAR should be issued at least two hours prior to the aerodrome resuming operations in the AFI Region.

13. There is no requirement in the AFI Region for information on the sea-surface temperature and the state of the sea from aeronautical meteorological stations established on offshore structures in support of helicopter operations to be included in METAR and SPECI.

14. There is no requirement in the AFI Region for information on the state of the runway to be included in METAR and SPECI at aerodromes.

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**FOREC ASTS**

15. In the AFI Region, an aerodrome forecast, issued as a TAF, should be for the aerodromes indicated in FASID Table MET 1A. [AFI/7, Rec. 7/8]

16. In the AFI Region, the period of validity of a routine TAF should be of 24 or 30
hours to meet the requirements indicated in FASID Table MET 1A.
[AFI/7, Rec. 7/8, APIRG/16 Decision 16/61]

17. In the AFI Region, routine TAF of 24/30 hours validity should be filed for transmission two hours before the commencement of its period of validity.

18. There is no requirement in the AFI Region for the forecast maximum and minimum temperatures to be included in TAF.

19. In the AFI Region, landing forecasts (prepared in the form of a trend forecast) should be provided at aerodromes indicated in FASID Table MET 1A.

20. There is no requirement in the AFI Region for GAMET area forecast and/or area forecasts for low-level flights in chart form prepared in support of the issuance of AIRMET information, and AIRMET information for low-level flights relevant to the whole route, to be supplied to operators or flight crew members.

AIRMET INFORMATION

21. There is no requirement in the AFI Region for AIRMET information to be issued by a MWO for its area of responsibility.

SERVICE FOR OPERATORS AND FLIGHT CREW MEMBERS

22. There is no requirement in the AFI Region for meteorological information for pre-flight planning by operators of helicopters flying to offshore structures.

REQUIREMENTS AND USE OF COMMUNICATIONS
(FASID Tables MET 2A and MET 2C) [AFI/7 Rec. 7/8, APIRG/12 Concl. 12/32]

23. In the AFI Region, WAFC London has been designated as the centre for the operation of aeronautical fixed service satellite distribution system.

24. In the AFI Region, WAFS products in digital form should be disseminated by WAFC London using the satellite distribution system for information relating to air navigation (comprising the SADIS 2G satellite broadcast and the Secure SADIS FTP Service).

25. Operational meteorological information prepared as METAR, SPECI and TAF for aerodromes indicated in FASID Table MET 1A, and SIGMET messages prepared for flight information regions or control areas indicated in FASID Table MET 1B, should be disseminated to the international OPMET databanks designated for the AFI Region and to the centre designated for the operation of the aeronautical fixed service satellite distribution system in the
AFI Region.

26. Special air-reports that do not warrant the issuance of a SIGMET should be disseminated to other meteorological offices in the AFI Region as indicated in FASID Table MET 2B. [APIRG/12 Concl. 12/51]

27. In the AFI Region, meteorological information for use by aircraft in flight should be supplied through VOLMET broadcasts.

28. In the AFI Region, scheduled VOLMET broadcasts should contain TAF and SIGMET.

29. In the AFI Region, the aerodromes for which METAR, SPECI and TAF are to be included in VOLMET broadcasts, the sequence in which they are to be transmitted and the broadcast time, is indicated in FASID Table ATS 2A and ATS 2B.

30. In the AFI Region, the flight information regions for which SIGMET messages are to be included in scheduled VOLMET broadcasts is indicated in FASID Table ATS 2A.

31. There is no requirement in the AFI Region for METAR, SPECI and TAF to be available for uplink to aircraft in flight via D-VOLMET.

ADDITIONAL REGION SPECIFIC REQUIREMENTS
[AFI/7, Rec. 8/6]

30. In the AFI Region, OPMET information additional to that contained in FASID Table MET 2A required by States during the pilgrimage season is indicated in FASID Table MET 2C.

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PART VI - SEARCH AND RESCUE (SAR)

INTRODUCTION

1. ICAO standards require that Contracting States shall, individually or in cooperation with other States, arrange, on a 24-hour basis, for the establishment and prompt provision of search and rescue (SAR) services within their territories to ensure that assistance is rendered to aircraft in distress and to survivors of aircraft accidents, irrespective of nationality, status or the circumstances in which they are found. It also requires that those portions of the high seas or areas of undetermined sovereignty for which search and rescue services will be established shall be determined on the basis of regional air navigation agreements.

2. The Standards, Recommended Practices and Procedures to be applied are contained in:
   a) Annex 10 – Aeronautical Communications;
   b) Annex 12 – Search and Rescue;
   c) Procedures for Air Navigation Services – Air Traffic Management (Doc 4444);
   d) Regional Supplementary Procedures (Doc 7030) – AFI Region; and

AFI REGION RESPONSIBILITIES

3. The ICAO Regional Office will, through the APIRG:
   i) Specify the minimum units and facilities necessary for the provision of search and rescue operations within the AFI Region. Search and Rescue facilities for the AFI Region are listed in Table SAR-1 of the AFI FASID;
   ii) Co-ordinate aeronautical frequencies specified for SAR. See AFI FASID, Supplement Table COM 2; and
   iii) Manage proposed amendments to ICAO SAR documentation.

STATE RESPONSIBILITIES

4. States are encouraged to develop and improve their SAR services, co-operate with neighbouring States and to consider their SAR services to be part of a global system. For example, States should conclude agreements regarding co-operation of their SAR services in border areas and, more especially, over the high seas and in inhospitable areas (deserts, mountainous areas, forests) where speediest possible action is essential to the success of SAR operations.

5. To ensure compatibility between aeronautical and maritime search and rescue regions (SRRs), aeronautical SAR authorities in States should maintain close liaison with their maritime counterparts and the International Maritime Organization (IMO) and consider the possibility of establishing joint aeronautical/maritime rescue coordination centres or equivalent arrangements. Details of such arrangements and any subsequent changes should be notified to the ICAO Regional Offices for incorporation into Table SAR-1 of the AFI FASID.

6. In order to provide a more efficient SAR service and to reduce the costs associated with providing SAR facilities, States should consider establishing joint facilities where possible. Planning for search and rescue services should be based to the maximum practicable extent on existing services and facilities, even if
these are not provided primarily for search and rescue purposes, in order to obtain a reasonable cost-effectiveness relationship in maintaining these services and facilities in the required state of readiness

7. States should take the steps necessary and practicable to ensure the availability of effective aeronautical SAR services throughout the AFI region by:

   a) identifying aeronautical search and rescue authorities in legislation and high-level national SAR plans and committees, and make provisions to support those authorities as necessary;

   b) adopting and implementing, to the fullest extent practicable, the guidance material contained in the three-volume IAMSAR Manual (ICAO Doc 9731) for establishing effective domestic and regional services for aeronautical search and rescue;

   c) establishing domestic and international SAR agreements where such agreements may improve SAR services and to coordinate efforts among entities that provide or support SAR services;

   d) ensuring that a robust communications network, which takes into account any technologies commonly used by aircraft and RCCs, is in place to receive a voice or data distress alert from aircraft via terrestrial and satellite systems that may commonly be used for that purpose, and to enable acknowledgement of that alert and coordination of the SAR response;

   e) ensuring that RCCs know how to obtain data, as appropriate, from the AMVER ship reporting system to identify ships at sea that can provide assistance to aircraft and persons in distress;

   f) ensuring that civil aviation authorities arrange with the appropriate national maritime authorities in order to encourage ships to voluntarily participate in the AMVER system; and

   g) ensuring that all RCC personnel have an effective working knowledge of the English language.

8. Each State should designate a single SAR Point of Contact (SPOC) to facilitate cooperation with the associated mission control centre (MCC) of the COSPAS/SARSAT system in order to ensure the timely distribution of distress data.

Note 1.—A SPOC may be an aeronautical or a maritime Rescue Co-ordination Centre (RCC).

Note 2.—COSPAS = Space System for Search of Vessels in Distress; SARSAT = Search and Rescue Satellite-aided Tracking.

9. States which rely on military authorities and/or other sources for the provision of SAR facilities should ensure that adequate arrangements are in place for coordination of SAR activities between all entities involved.

10. In addition, arrangements should be made to permit a call on any national services likely to be able to render assistance on an ad hoc basis, in those cases when the scope of SAR operations requires such assistance.
11. States should:

   a) take appropriate action to reduce the number of false alarms on emergency frequencies caused by inadvertent activation of emergency locator transmitters (ELTs) and eliminate unauthorized use of those frequencies;

   b) make available information as to how ELT registration information can be obtained rapidly by rescue coordination centres (RCCs) of other States;

   c) when considered feasible, make arrangements for joint SAR exercises between their SAR units and those of other States and with operators, at regular intervals and, if possible, at least once a year;

   d) invite observers from other interested States and organizations to participate in such exercises; and

   e) enable SAR personnel to attend training courses in this field, after provision of adequate information from interested States to ICAO concerning the type of training to be received.
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PART VII - AERONAUTICAL INFORMATION MANAGEMENT (AIM)

1. INTRODUCTION

Regional AIS/AIM Planning

1.1 This part of the Africa-Indian Ocean Region Basic Air Navigation Plan contains basic planning principles, operational requirements, planning criteria and implementation guidelines related to Aeronautical Information Services and Charts (AIS/MAP) considered being the minimum necessary for effective planning of AIS and MAP facilities and services in the AFI Region. It contains also the developing transition path to achieve AFI Region Aeronautical Information Management (AIM) based on the ATM Operational Concept (Doc 9854) and the Global Air Navigation Plan (Doc 9750).

1.2 The dynamic material constituted by the AIS/AIM facilities and services required for international air navigation is contained in the AFI ANP Volume 2 - Facilities and Services Implementation Document (FASID). The FASID includes appropriate additional guidance, particularly with regard to implementation, to complement the material contained in the Basic ANP.

1.3 During the transition to and pending full implementation of AIM, it is expected that the existing requirements will be gradually replaced/complemented by new AIM related requirements. Subsequently, it is expected that the ANP will be subject to regular review and amendment, to reflect progression in the transition towards full implementation of AIM.

Standards, Recommended Practices and Procedures

1.4 The Standards, Recommended Practices and Procedures and related guidance material applicable to the provision of AIS and ultimately AIM are contained in the following ICAO documentation:

a) Annex 4 – Aeronautical Charts;
b) Annex 15 – Aeronautical Information Services;
c) Doc 7030 – Regional Supplementary Procedures, AFI Region;
d) Doc 7383 – Aeronautical Information Services Provided by States;
e) Doc 7910 – Location Indicators;
f) Doc 8126 – Aeronautical Information Services Manual;
h) Doc 8400 – ICAO Abbreviations and Codes (PANS-ABC);
i) Doc 8697 – Aeronautical Charts Manual;
j) Doc 9377 – Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services;
l) Doc 9855 – Guidelines on the Use of the Public Internet for Aeronautical Applications; and
m) Doc 9881– Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information.

2. **GENERAL PROCEDURES/REQUIREMENTS**

**AFI Region Responsibilities**

2.1 The ICAO Regional Offices in Dakar and Nairobi will, through the APIRG:
   i) process endorsed proposals for amendment to ICAO AIS/AIM related documents;
   ii) support the monitoring of AIS/AIM activities in the entire AFI Region; and
   iii) co-ordinate with AFI Region national and international aviation agencies such as EUROCONTROL – Aeronautical Information Management and System Wide Information Management (AIM/SWIM) Team, AIM developments for the ECAC AFCAC area of the EUR AFI Region.

**State Responsibilities**

2.2 Each Contracting State is responsible for the aeronautical information/data published by its aeronautical information service or by another State or a non-governmental agency on its behalf.

2.3 Aeronautical information published for and on behalf of a State should clearly indicate that it is published under the authority of that State.

2.4 The concept of the Centralized AFI Database (AFI-CAD) when implemented, will offer all AIM related tasks including even the classic AIM services to reduce the ANSPs efforts and timeliness needed by the States on their way to the AIS/AIM Transition process.

2.5 Each Contracting State should take all necessary measures to ensure that the aeronautical information/data it provides relating to its own territory, as well as areas in which the State is responsible for providing air traffic services outside its territory, is adequate, of required quality and timely. This should include arrangements for the timely provision of required information/data to the aeronautical information service by each of the State services associated with aircraft operations.

2.6 International NOTAM Offices (NOF) and their areas of responsibility should be established so as to ensure maximum efficiency in the provision of AIS and in the dissemination of aeronautical information.

2.7 The designated International NOTAM Offices for the AFI Region are listed in the AFI ANP Volume 2 - FASID Table AIM-1.

2.8 Coordination/liaison on a permanent basis should be established between AIS/AIM and other technical services responsible for planning and operating air navigation facilities and services.

2.9 Technical services responsible for origination of the raw aeronautical information should be acquainted with the requirements for promulgation and advance notification of changes that are operationally significant as established in Annexes 11 and 14 and other relevant ICAO documentation. They should take due account of the time needed by AIS/AIM for the preparation, production and issue of the relevant material.

2.10 Appropriate AIS/AIM personnel should be included in the air navigation planning processes. This should ensure the timely preparation of appropriate AIS documentation and that the effective dates for changes to the air navigation system and procedures are satisfied.

2.11 Whilst Annex 4 and Annex 15 detail the SARPs for the provision of charts and AIS respectively, the following State responsibilities are highlighted:

Each Contracting State should:
a) Arrange for the implementation of a quality management system for aeronautical information and chart services. The quality management system should include the necessary policies, processes and procedures, including those for the use of metadata, to ensure and verify that aeronautical data is traceable throughout the aeronautical information data chain from origin to distribution to the next intended user. As part of the quality management system, arrangements should be made for the signature of letters of agreement with data originators to manage the aeronautical information data chain;

b) Ensure Human Factors are considered;

c) Ensure adherence to the AIRAC System;

d) Ensure that the aeronautical information/data to be exchanged with States is published as an Integrated Aeronautical Information Package (i.e. Aeronautical Information Publication (AIP), including amendment service, AIP Supplements, NOTAM, pre-flight information bulletins (PIB), Aeronautical Information Circulars (AIC), checklists and list of valid NOTAM) in accordance with the requirements of Annex 15;

e) Arrange for the provision of an electronic AIP (eAIP) in accordance with the requirements of Annex 15;

f) Comply with WGS 84 requirements;

g) Introduce automation enabling digital data exchange with the objective of improving the speed, accuracy, efficiency and cost-effectiveness of aeronautical information services;

h) Ensure that pre-flight information is provided at all aerodromes/heliports normally used for international air operation, in accordance with the requirements of Annex 15, using Automated pre-flight information systems for the supply of aeronautical information/data for self-briefing, flight planning and flight information service;

i) Arrange for the provision of post-flight information;

j) Arrange for the provision of required electronic Terrain and Obstacle Data (eTOD), in accordance with the requirements of Annex 15; and

k) Arrange for the production and publication of necessary aeronautical charts in accordance with Annex 4 provisions and regional agreements.

3. AERONAUTICAL INFORMATION MANAGEMENT

3.1. The Global Air Traffic Management Operational Concept presented in ICAO Doc 9854 depends upon a system wide information management (SWIM). The management, utilization and transmission of data and information are vital to the proper functioning of the ATM system and are at the core of air navigation services.

3.2. As part of SWIM, AIM is required to support evolving requirements for, inter alia, collaborative decision making (CDM), performance-based navigation (PBN), ATM system interoperability, network-centred information exchange, and to take advantage of improved aircraft capabilities.

3.3. The scope of information management includes all types of information and in particular aeronautical information. The relationship diagram below shows a number of the core elements of SWIM:
Aeronautical Information Management (AIM) is considered to be the dynamic, integrated management of aeronautical information services—safely, economically and efficiently—through the provision and exchange of quality-assured digital aeronautical data in collaboration with all parties.

TRANSITION TO AIM

3.4. The transition to AIM requires that all aeronautical information, including that currently held in AIP be stored as individual digital standardized data sets to be accessed by user applications. The distribution of these data sets will both enhance the quality of output and ultimately provide a platform for new applications. This will constitute the future integrated aeronautical information package that will contain the minimum regulatory requirement to ensure the flow of information necessary for the safety, regularity and efficiency of international air navigation. (GPI-18 refers).

Guiding Principles for the Transition to AIM

3.5. The transition from AIS to AIM will have to:

a) support or facilitate the generation and distribution of aeronautical information which serves to improve the safe and cost-effective accessibility of air traffic services in the world;

b) provide a foundation for measuring performance and outcomes linked to the distribution of quality assured aeronautical information and a better understanding of the determinants of ATM, safety and effectiveness not related to the distribution of the information;

c) assist States in making informed choices about their aeronautical information services and the future of AIM;

d) build upon developments in States, international organizations and industry and acknowledge that the transition to AIM is a natural evolution rather than a revolution;
e) provide over-arching and mature Standards that apply to a wide range of aeronautical information products, services and technologies;

f) be guided by the Global Air Navigation Plan (Doc 9750) and ensure that all development is aimed at achieving the ATM system envisaged in the Global Air Traffic Management Operational Concept (Doc 9854); and

g) ensure, to the greatest extent possible, that solutions are internationally harmonized and integrated and do not unnecessarily impose multiple equipment carriage requirements for aircraft or multiple systems on the ground.

The Roadmap to AIM

Source Document: ICAO Road Map for the Transition from AIS to AIM

3.6. The purpose of the roadmap is to develop the AIM concept and associated performance requirements by providing a basis upon which to manage and facilitate, on a worldwide basis, the transition from AIS to AIM. The roadmap is based on what is known today and has been developed with sufficient flexibility to facilitate the new concepts that will emerge from future research.

3.7. Three phases of action are envisaged for States and ICAO to complete the transition to AIM:

Phase 1 — Consolidation

3.8. During Phase 1, steps will be taken to establish a solid base by enhancing the quality of the existing products and improving the status of implementation of current Annex 4 and Annex 15 provisions. This is a pre-requisite before Phase 2 can be achieved.

Phase 2 — Going digital

3.9. Phase 2 of the transition to AIM will mainly focus on the establishment of data-driven processes for the production of the current products in all States. States that have not yet done so will be encouraged “to go digital” by using computer technology or digital communications and through introducing structured digital data from databases into their production processes. The emphasis will, therefore, not be on the introduction of new products or services but will be on the introduction of highly structured databases and tools such as geographic information systems.

Phase 3 — Information management

3.10. Phase 3 will introduce steps to enable future AIM functions in States to address the new requirements that will be needed to implement the Global Air Traffic Management Operational Concept in a net centric information environment. The digital databases introduced in Phase 2 will be used for the transfer of information in the form of digital data. This will require the adoption of a Standard for an aeronautical data exchange model to ensure interoperability between all systems not only for the exchange of full aeronautical data sets, but also for short-term notification of changes.
National Plans for the transition to AIM

3.11. States should be planning for the transition from AIS to AIM. The national plans for the transition from AIS to AIM should be based on the ICAO Roadmap for the transition from AIS to AIM, identifying clearly the associated performance goals and achievable milestones with a view to satisfy the requirements arising from the Global ATM Operational Concept, in particular the management of a seamless information flow ensuring interoperability between the different CNS/ATM systems.

AIM Implementation

3.12. The following provisions/regulatory requirements complement those contained in ICAO Annex 4 and Annex 15 with a view to expedite AIM implementation in the Africa-Indian Ocean (AFI) Region in a harmonized manner. They represent the basis for a number of provisions contained in the FASID tables.

Integrated Aeronautical Information Database (IAID) (FASID Table AIM-2)

3.13. FASID Table AIM-2 sets out the requirements for the Provision of AIM products and services based on the Integrated Aeronautical Information Database (IAID).

3.14. States should designate and implement an authoritative Integrated Aeronautical Information Database (IAID). The designation of authoritative databases should be clearly stated in States’ AIPs.

Electronic Terrain and Obstacle Data and Aerodrome Mapping Data Bases (AMDB) (FASID Table AIM-3)

3.15. FASID Table AIM-3 sets out the requirements for the provision of Terrain and Obstacles Datasets and Aerodrome Mapping Data Bases (AMDB).

3.16. States should take the necessary measures for the provision of required electronic Terrain and Obstacle Data (eTOD), in accordance with Annex 15 provisions.

3.17. States should manage the eTOD implementation as a national programme supported by the necessary resources and detailed planning including priorities and timelines for implementation.

3.18. The implementation of eTOD should involve different Administrations within and outside of the Civil Aviation Authority i.e.: AIS, Aerodromes, Military, National Geographic and Topographic Administrations/Agencies, procedure design services, etc.

3.19. States, while maintaining the responsibility for data quality and availability, should consider to which extent the provision of electronic terrain and obstacle data could be delegated to other approved data providers.

3.20. States should establish formal arrangements to address cross-border issues, to ensure harmonization and more efficient implementation of eTOD.
3.21. States should take the necessary measures to ensure that the obstacle dataset is maintained up-to-date.

3.22. States should endeavour to integrate the acquisition of eTOD and AMDB data to realize efficiency gains and to take into account the complementary nature of AMDB and eTOD datasets.

**Aeronautical Data Quality**  
*(FASID Table AIM-4)*

3.23. FASID Table AIM-4 sets out the requirements for aeronautical data quality.

3.24. States should take the necessary measures to ensure that aeronautical information/data it provides meet the regulatory Aeronautical Data quality requirements.

3.25. The Quality Management System in AIM should define procedures to meet the safety and security management objectives.

3.26. Recognizing the need to maintain or enhance existing safety levels of operations, States should ensure that any changes to the existing systems or the introduction of new systems used for processing aeronautical data/information are preceded by a safety assessment including hazard identification, risk assessment and mitigation.

3.27. States should ensure that the Critical, Essential and Routine aeronautical data/information, as specified in Annexes 4 and 15, is transferred by the data originators to the AIM service provider through direct electronic connection, in accordance with the agreed data exchange format.

**AIM Certification**  
*(FASID Table AIM-9)*

3.28. FASID Table AIM-9 sets out the requirements for AIM Certification.

3.29. States should take necessary measures to ensure that AIM Services are provided by Certified AIM Service Provider(s).

3.30. The Certification of AIM Service Provider(s) should be based on the compliance with all regulatory and ICAO requirements related to the provision of AIM services.
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PART VIII - SAFETY (SAF)

INTRODUCTION

1. This Part has been provided to show the overarching link with safety in the planning and delivery processes associated with air navigation services and associated CNS/ATM systems. This air navigation safety related material is a component element of the wider aviation safety and its associated requirements that aviation stakeholders (includes States, regulators, aircraft and airport operators, air traffic service providers, aircraft manufacturers, approved maintenance organisations, international organizations and safety organizations) should consider when planning and delivering aviation services. It reflects ICAO safety targets and details the Africa-Indian Ocean Region Air Navigation Plan related Safety Objective that will contribute to achieving the ICAO Strategic Safety Objectives. Finally, it highlights the significant safety requirements States should adopt, which will contribute to the safe delivery of air navigation services.

2. ICAO Doc 9859 - Safety Management Manual describes safety as a state in which the possibility of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management.

ICAQ Safety Strategic Objective

3. ICAO’s first Strategic Objective is to ‘enhance global civil aviation safety’. To contribute to this ICAO has committed to enhance global civil aviation safety through the following measures:
   i) Identify and monitor existing types of safety risks to civil aviation and develop and implement an effective and relevant global response to emerging risks;
   ii) Ensure the timely implementation of ICAO provisions by continuously monitoring the progress toward compliance by States;
   iii) Conduct aviation safety oversight audits to identify deficiencies and encourage their resolution by States;
   iv) Develop global remedial plans that target the root causes of deficiencies.
   v) Assist States to resolve deficiencies through regional remedial plans and the establishment of safety oversight organizations at the regional or sub-regional level;
   vi) Encourage the exchange of information between States to promote mutual confidence in the level of aviation safety between States and accelerate the improvement of safety oversight;
   vii) Promote the timely resolution of safety-critical items identified by regional Planning and Implementation Groups (PIRGs);
   viii) Support the implementation of safety management systems across all safety-related disciplines in all States; and
   ix) Assist States to improve safety through technical cooperation programmes and by making critical needs known to donors and financial organizations.
Global Aviation Safety Plan

4. Global Safety Initiatives (GSI), targeted at stakeholders, have been developed to support the implementation of the ICAO Strategic Safety Objective and other safety objectives that might be established by regions. The GSI and their main target groups are as follows:

(To be updated based on A37)

<table>
<thead>
<tr>
<th>GSI</th>
<th>Initiative</th>
<th>Main Stakeholders</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSI-1</td>
<td>Consistent implementation of international standards and industry best practices</td>
<td>States</td>
<td></td>
</tr>
<tr>
<td>GSI-2</td>
<td>Consistent regulatory oversight</td>
<td>States</td>
<td></td>
</tr>
<tr>
<td>GSI-3</td>
<td>Effective errors and incidents reporting</td>
<td>States</td>
<td></td>
</tr>
<tr>
<td>GSI-4</td>
<td>Effective incident and accident investigation</td>
<td>States</td>
<td></td>
</tr>
<tr>
<td>GSI-5</td>
<td>Consistent coordination of regional programmes</td>
<td>ICAO Regional Office</td>
<td>States</td>
</tr>
<tr>
<td>GSI-6</td>
<td>Effective errors and incidents reporting and analysis in the industry</td>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>GSI-7</td>
<td>Consistent use of Safety Management Systems (SMS)</td>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>GSI-8</td>
<td>Consistent compliance with regulatory requirements</td>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>GSI-9</td>
<td>Consistent adoption of industry best practices</td>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>GSI-10</td>
<td>Alignment of industry safety strategies</td>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>GSI-11</td>
<td>Sufficient number of qualified personnel</td>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>GSI-12</td>
<td>Use of technology to enhance safety</td>
<td>Industry</td>
<td></td>
</tr>
</tbody>
</table>

5. Stakeholders should incorporate GSI into their relevant planning processes. The EANPG will monitor the implementation progress of all navigation related GSI.

A Global Strategy for Aviation Safety

6. The attainment of a safe system is the highest priority in aviation. However, safety actions are not only driven by facts and data but also by the perception of safety needs by the public. Acceptable safety risk is related to the trust attributed to the aviation safety system, which is undermined every time an accident occurs. Therefore the challenge is to drive an already low accident rate even lower. To guide its work, ICAO has established the following safety target.

7. ICAO Safety Target for 2008-2011 (check for update - it will be 2012 before this document is published)

1. Reduce the number of fatal accidents and fatalities worldwide irrespective of the volume of air traffic.
2. Achieve a significant decrease in accident rates, particularly in regions where these remain high.
3. No single ICAO region shall have an accident rate* more than twice the worldwide rate by the end of 2011.
*Based on a five-year sliding average*

8. To achieve this safety target, aviation stakeholders should be proactive in ensuring that safety considerations are an inherent element of the development of policies, plans, practices and procedures. Moreover, whilst in the past, Authorities have concentrated on analysing accidents to identify future preventative measures; it is now considered that both regulators and industry must similarly manage safety critical information to both identify gaps in compliance and to develop strategies to rectify these as a means of preventing future accidents.

9. To support ICAO Safety targets, the APIRG will develop Regional Safety Objectives in respect of air navigation related deficiencies.

**AFI Region Safety Objectives**

10. The APIRG will continue in according its highest priority to the identification, reporting and resolution of the safety related air navigation deficiencies based on the Uniform Methodology adopted by the ICAO Council. The APIRG List of Deficiencies should not be regarded as a “name and blame” list, but as an important mechanism aimed at assisting States to resolve deficiencies through a collaborative effort of the APIRG, the ICAO Regional Office, States and the users’ organizations. In order to expedite the resolution of safety related deficiencies, the APIRG, in accordance with its terms of reference, will endeavour to develop further efficient and transparent procedures related to the identification and reporting of deficiencies, in consultation with all stakeholders concerned, and to provide effective assistance to States in developing corrective actions. The process for APIRG management of safety related deficiencies is detailed in the *APIRG Handbook*.

11. Analysis of the ICAO Universal Safety Oversight Audit Program (USOAP)\(^8\) reports of States of the ICAO AFI Region, and safety related deficiencies identified through the APIRG process, provides a sound basis for identifying the main areas where action is required to reduce the potential contributory factors that could lead to accidents. These could also include initiatives to support States in the implementation of new requirements such as the State Safety Programme.

12. Safety Objectives are by their nature dynamic and the detail of these will be shown in the FASID. Examples of expected AFI Region Safety Objectives (AFI-RSO) are shown below:

<table>
<thead>
<tr>
<th>-AFI-RSO</th>
<th>Initiative</th>
<th>Main Stakeholders</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSO-1</td>
<td>Consistent implementation of ICAO amendments to SARPS and other ICAO Documents</td>
<td>States</td>
<td>Example only</td>
</tr>
<tr>
<td>RSO-2</td>
<td>Support the implementation of State Safety Programmes (SSP).</td>
<td>ICAO Regional Office States</td>
<td>Example only</td>
</tr>
<tr>
<td>RSO-3</td>
<td>Develop Safety Key Performance Indicators (KPIs) and associated safety performance objectives.</td>
<td>ICAO Regional Office States</td>
<td>Example only</td>
</tr>
</tbody>
</table>

13. The implementation of AFI RSOs, in addition to addressing navigation related matters, will in some cases also contribute to addressing wider aviation safety related deficiencies.

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\(^8\) USAOP will be replaced by a Continuous Monitoring Approach process.
14. The APIRG will continue to provide oversight of AFI Region deficiencies and will provide assistance on a case-by-case basis. The ICAO Regional Office will continue to provide courses and workshops on safety related topics such as safety management, state safety programme development and language proficiency.

**Performance Management**

15. The APIRG has developed performance indicators, initially aiming to ensure the improvement of safety through the reduction of ATM related safety occurrences and the implementation of uniform safety standards.

15.1 The indicators identified to monitor the achievement of those objectives are:

   a) Effectiveness of Safety Management (measured by a methodology based on ATM safety framework maturity survey);

   b) Level of State Safety/Just Culture (safety culture survey); and

   c) Adoption of a harmonized occurrences severity classification methodology.

15.2 Performance objectives will continue to be developed with details provided in the FASID.

**State Responsibilities**

**Safety Oversight**

16. States should ensure they meet their duties and responsibilities in respect of aviation safety oversight. Detailed description and guidance is contained in *ICAO Doc 9734 - Safety Oversight Manual*.

**Standards and Recommended Practices**

17. Adherence to ICAO Standards and Recommended Practices (SARPS) will significantly contribute to aviation safety. States should therefore ensure that they have the necessary regulatory framework in place to underpin the adoption of ICAO SARPS within their State and its national airspace. States should ensure that any differences to SARPS have been assessed in respect of safety and are notified in accordance with ICAO requirements.

**State Safety Programme**

18. ICAO Standards require States to establish a State Safety Programme (SSP) in order to achieve an Acceptable Level of Safety (ALoS). They also explicitly require States to establish an ALoS to be achieved as a means to verify satisfactory performance of the SSP and service providers’ Safety Management Systems (SMS).

19. The requirement for an SSP recognizes that States as well as service providers have safety responsibilities and provides a framework within which service providers are required to establish an SMS.

20. Detailed guidance on SSP requirements and methodology are contained in *ICAO Doc 9859 – Safety Management Manual*.

21. States are requested to notify the ICAO Regional Office when they publish their national SSP.
Safety Management System

22. ICAO Standards require States to establish a Safety Management System (SMS). The APIRG thus encourages States to:
   a) develop and implement, if they have not already done so, safety programmes requiring air operators, aerodrome operators and air traffic service providers to implement safety management systems;
   b) use relevant ICAO safety management system (SMS) implementation documentation (global or regional);
   c) undertake aggregated safety analysis at a national level;
   d) if appropriate, use applicable certification process to verify if safety management systems met the established requirements and criteria; and
   e) expedite the safety management training of their staff at the regulatory and regulated entities’ levels, taking advantage of the SMS training offered by ICAO.

Safety Reporting

23. ICAO Standards require States to establish a mandatory accident reporting system and an incident reporting system to facilitate collection of information on actual or potential safety deficiencies. ICAO further recommends that States should establish a voluntary incident reporting system to facilitate the collection of information that may not be captured by a mandatory incident reporting system; this latter system should be non-punitive and afford protection to the sources of the information. Guidance related to both mandatory and voluntary incident reporting systems is contained in the Safety Management Manual (SMM) (Doc 9859).

24. The APIRG thus encourages States to:
   a) develop and implement non-punitive reporting mechanisms as part of their safety programme;
   b) adopt the following enabler elements, to make best use of existing mandatory and voluntary data flows whilst, strengthening the “safety culture” within their legal and organizational environments:
      i) );
      ii) a harmonised safety reporting and investigation process; and
      iii) software tools capable to support a systemic analysis and to allow the sharing of safety intelligence.
   c) provide required airspace safety monitoring data to the AFI Regional Monitoring Agency (ARMA).

25. Reported material will contribute to the future development of AFI Region safety objectives.
PART IX – HUMAN RESOURCES AND TRAINING (HR&TNG)

INTRODUCTION

1. This part of the Africa-Indian Ocean Region Basic Air Navigation Plan reflects the planning and training elements that need to be considered by all those responsible for the regulation, supervision and provision of air navigation services within the wider context of planning for future aviation sector personnel.

2. Human Resource planning can be considered the systematic and continuing process of analysing an organisation’s human resource needs under changing conditions and developing personnel policies appropriate to the longer-term effectiveness of the organisation. It is an integral part of corporate planning and budgeting procedures since human resource costs and forecasts both affect and are affected by longer-term corporate plans.

3. Whilst not described in this Chapter, State regulators, supervisory authorities, air transport operators, and air navigation service providers should be aware of the importance of Human Factors considerations when delivering a safe aviation environment. In this respect human resource planning should be cognisant of the varying aptitude and skill sets needed to meet the demands of the increasingly technical environment comprised by the aviation sector.

4. Human resources development and management must strive to continuously improve the competency levels of safety critical personnel, while taking into account the interdependencies for supply and demand of qualified personnel at national, regional and global levels. Estimating current and future requirements for civil aviation personnel and training capacity in each region is essential for human resource planning, institutional capacity building, and related funding and policy measures.

Next Generation of Aviation Professionals

5. Doc 9956 - Global and Regional 20-year Forecasts has been developed to provide the aviation sector with an informed forecast for the period 2010-2030 relating to: air transport development – traffic, movement and fleet growth; pilot; maintenance; and air traffic controller personnel requirements. The forecast shows both global and regional requirements. This study is ICAO’s initial response to the market demand and is the first in a series that will provide data, analyses, and forecasts to all key players of the aviation industry.

6. Air Transport is forecast to grow globally by 4.7% during the period 2010-2030. Within the AFI Region the average growth is forecast to be Doc 9956 provides significantly more detail, however, analyses indicates that the most likely scenario of training needs against training capacity within the ICAO AFI Region results in an annual shortage of over pilots, maintenance personnel and air traffic controllers.

7. It has been recognised that as the aviation industry emerges from a difficult economic situation, changing demographics and new technologies with far reaching potential will intensify human resource challenges. In this context it becomes urgent to review existing regulations and propose a new regulatory environment for the recruitment, education, training, and retention of the next generation of aviation professionals who must be appropriately educated and suitably qualified to staff an increasingly technical aviation environment.

9 Defined by the UK Institute of Personnel and Development
ICAO CIVIL AVIATION TRAINING POLICY

Scope

8. ICAO, recognizing its role in ensuring that the civil aviation community has access to an adequate pool of qualified professionals to support the safe, secure and sustainable development of air transport, has committed to the development of the necessary Standards and Recommended Practices (SARPs), Procedures for Air Navigation Services (PANS), air transport policies, advice and guidance material. The framework for this is elaborated in the ICAO Civil Aviation Training Policy.

9. The training policy is applicable to all training provided by ICAO Bureaus, Regional Offices and training organizations issuing a certificate of completion or a certificate of achievement with an ICAO logo.

10. Seminars and workshops aimed at informing States and other stakeholders of ICAO SARPs, PANS, air transport policies and guidance material and at facilitating their implementation are not considered as aviation training, education or testing for the purpose of this policy.

11. All ICAO training and testing activities shall be designed, developed and offered in accordance with set standards and best practices for that discipline.

12. The ICAO Civil Aviation Training Policy is shown in full at Appendix 1 to this Part.

ICAO TRAINAIR Plus

13. The ICAO TRAINAIR Programme was established to ensure higher training standards for aviation professionals. The civil aviation training needs are evolving rapidly and ICAO is responding by enhancing the TRAINAIR programme into TRAINAIR PLUS.

14. TRAINAIR PLUS is an ICAO programme that provides support for new and existing aviation training centers via technical expertise, resources, and quality oversight. This results in a network of ICAO TRAINAIR PLUS Centres meeting the standards of the programme.

15. The TRAINAIR PLUS programme’s objectives are:
   i) Streamline, and facilitate the implementation and the development of the TRAINAIR methodology used in Standardized Training Packages (STP) courses;
   ii) Coordinate and supply technical support for STP development courses;
   iii) Provide quality control throughout the STP development stage;
   iv) Operate an international STP sharing system and cooperative training network;
   v) Oversee the certification of endorsed training centres.

16. The TRAINAIR PLUS Programme is based on rebuilding three interrelated tools:
   i) The use of standardized training material.
   ii) The development of an international pool of training courses.
   iii) The creation of an international sharing network between public and private Civil Aviation Training Centres.

17. TRAINAIR PLUS addresses all fields of civil aviation activities: from basic equipment and systems training supporting new implementation projects up to graduate level courses for a variety of civil aviation professionals.
18. Details of ICAO accredited training institutions and courses can be found in the Aviation Training Directory of ICAO accessible at http://www.icao.int/anb/peltrg/tl/listall.cfm.

ICAO AFI Region Support

19. The ESAF Regional Office of ICAO provides support to States through provision of workshops and seminars on a range of topical aviation subjects including, *inter alia*, State Safety Implementation Programmes; Safety Management System Implementation; Performance Based Navigation; and States’ Action Plans on CO₂ Emissions Reduction Activities.

20. ICAO also offers internship positions established to support young aviation professionals to obtain experience with ICAO.

State Support

21. States, aviation carriers, maintenance organisations and ANSPs are requested to regularly provide statistical data on human resources and training requirements as shown in Doc 9956 - *Global and Regional 20-year Forecasts* Appendices 1-3.

22. States should:
   i) Adequately resource regulatory bodies (particularly following separation between regulation and service provision). In this respect States may wish to consider secondment arrangements with airlines and ANSPs to provide current operational expertise to inform policy and regulatory development;
   ii) Provide appropriately experienced representatives to APIRG and its Sub-Group and associated working groups/task forces;
   iii) Encourage aviation providers to develop links with higher education providers to foster interest in careers in aviation;
   iv) Develop regulatory frameworks that will enable free movement of aviation professionals;
   v) Provide or facilitate aviation training resources.
Appendix 1
PART IX – HUMAN RESOURCES AND TRAINING (HR&TNG)

ICAO CIVIL AVIATION TRAINING POLICY

Scope

1. ICAO has an important role to play in ensuring that the civil aviation community, and especially States, have access to the pool of qualified professionals they need to support the safe, secure and sustainable development of air transport.

2. ICAO’s role shall essentially be achieved through the facilitation, support and harmonization of efforts made by States and industry; the development of Standards and Recommended Practices (SARPs), Procedures for Air Navigation Services (PANS), and air transport policies; and the provision of advice and guidance material.

3. The training policy is applicable to all training provided by ICAO Bureaus, Regional Offices and training organizations issuing a certificate of completion or a certificate of achievement with an ICAO logo.

4. Seminars and workshops aimed at informing States and other stakeholders of ICAO SARPs, PANS, air transport policies and guidance material and at facilitating their implementation are not considered as aviation training, education or testing for the purpose of this policy.

5. All ICAO training and testing activities shall be designed, developed and offered in accordance with set standards and best practices for that discipline.

Basic principles

6. The training policy shall be in compliance with Assembly Resolution A36-13 Appendix H and all other Assembly Resolutions dealing with training, recognizing that aviation training is the responsibility of the States and that ICAO should not participate in the operation of training facilities but should encourage and advise operators of such facilities.

7. Training delivery is considered as a support function and not as a core function of ICAO. It shall only be undertaken when it is determined that:

   a) it is necessary to support States in the implementation of ICAO SARPs, PANS, air transport policies and guidance, the rectification of identified deficiencies, or another ICAO activity; or

   b) it can promote and foster ICAO’s strategic objectives and produce adequate revenue to ensure self-sustainability without affecting ICAO’s capability to carry out its core functions.

8. Aviation training activities provided by a third party using the ICAO name or logo shall meet the following requirements:

   a) be in direct support of the strategic objectives of ICAO;

   b) be in full compliance with ICAO SARPs, PANS, air transport policies and guidance;

   c) use of the ICAO logo will be in full conformity with the policies concerning the use of the logo; and

   d) be subjected to an appropriate ICAO endorsement mechanism.

9. The intellectual property of ICAO shall be protected.
10. No harm to ICAO’s reputation shall result from training activities provided by a third party using the ICAO name or logo.

11. Training activities provided by ICAO may be charged in accordance with paragraph 7.7 of The ICAO Financial Regulations (Doc 7515). This charge, together with interest earnings or earnings from investments thereon, shall be used to fund training activities or reimburse all, or part, of the costs incurred by ICAO in the generation, promotion and administration of these training and testing services.

12. Training activities provided by ICAO may be funded using either funds provided by Member States or organizations or funds generated by ICAO’s own activities.

Implementing policy

13. Aviation training mentioned in the basic principles above includes any training or related testing activities undertaken directly by ICAO or by a third party using the ICAO name or logo.

14. The use of the ICAO name or logo for training or testing activities undertaken by a training institution shall be subject to an ICAO endorsement mechanism.

Endorsement

15. ICAO may endorse any training activity and/or facility which meet established requirements.

16. ICAO also reserves the right to withdraw endorsement of any training activity and/or facility which fails to meet those established requirements.

17. An ICAO endorsement indicates that the delivered training programmes, facilities and instructors meet the criteria of quality and relevance needed to ensure that the skills and knowledge necessary to implement SARPs are provided.

18. The endorsement indicates that training programmes, facilities and instructors are managed in such a way as to effectively support learning for performance improvement.

19. Endorsement is used to extend ICAO’s ability to implement key activities derived from strategic objectives involving training and testing. Institutions endorsed for a training activity remain responsible for fully meeting ICAO requirements.

20. Endorsement will be granted only after an assessment conducted by ICAO confirms that established requirements are met.

21. The full costs related to endorsement will be borne by the State or institution.
Remarks

The text contains an overview of policy and requirements that States and air navigation service providers should consider in preparing contingency plans to maintain the provision of services in airspaces for which they are responsible.
AFI ANP, VOLUME I, BASIC ANP

PART X - CONTINGENCY PLANNING (CPLN)

(version date: November 2012)

INTRODUCTION

1. ICAO Annex 11 states that “Air traffic services authorities shall develop and promulgate contingency plans for implementation in the event of disruption, or potential disruption, of air traffic services and related supporting services in the airspace for which they are responsible for the provision of such services. Such contingency plans shall be developed with the assistance of ICAO as necessary, in close coordination with the air traffic services authorities responsible for the provision of services in adjacent portions of airspace and with airspace users concerned.”

2. ICAO Annex 17 states that “Each Contracting State shall ensure that contingency plans are developed and resources made available to safeguard civil aviation against acts of unlawful interference. The contingency plans shall be tested on a regular basis.”

Note. State Aviation Security (AVSEC) planning is outside of the scope of the Air Navigation Plan. Detailed security contingency arrangements should be undertaken through a State’s AVSEC arrangements and appropriately coordinated where such plans have an impact on the provision of air navigation service or availability of airspace.

3. This Part provides an overview of the main ICAO requirements and guidance that States and air navigation service providers (ANSPs) should consider in preparing contingency plans to maintain the provision of services in airspaces for which they are responsible. The Chapter does not provide guidance on Business Continuity planning, which is anticipated to be aligned, at least in part, with State and ANSP contingency planning considerations.

4. The Standards, Recommended Practices and Procedures to be applied are contained in:

   a) Annex 11 — Air Traffic Services;
   b) Annex 17 – Security;
   c) Air Traffic Management (PANS-ATM) – ICAO Doc 4444;
   d) Regional Supplementary Procedures – ICAO Doc 7030;
   e) Air Traffic Services Planning Manual – ICAO Doc 9426;
   g) International Airways Volcano Watch - ICAO Doc 9766;
   h) Volcanic Ash Contingency Plan for the AFI Region;

Note. APIRG has developed comprehensive guidance and reference material in respect of Contingency Planning. The guidelines aim to provide information and processes to help States and ANSPs identify and decide on the contingency strategies and concept of operation best suited to meet their needs in certain circumstances.

5. Contingency plans may constitute a temporary deviation from the approved regional air navigation plans; such deviations are approved, as necessary, by the President of the ICAO Council on behalf of the Council.

6. The effects of disruption of services in particular portions of airspace are likely to affect significantly the services in adjacent airspace. In this respect States should co-ordinate with neighbouring States in the
development and implementation of contingency plans, which in some cases may be developed on a sub-regional basis.

7. Examples of events of disruption, or potential disruption, of air traffic services and related supporting services or unavailability of airspace for civil air operations, that should be covered in general contingency plans or initial development of special contingency plans are:

   a) Natural disasters such as earthquakes resulting in loss of support facilities;
   b) Volcanic ash events requiring closure or restrictions to airspace;
   c) Industrial action necessitating accommodation of international traffic or humanitarian access to airports;
   d) Armed conflict or acts of unlawful interference with civil aviation resulting in closure of national airspace; and
   e) Catastrophic loss of air traffic services or supporting services.

**AFI REGION RESPONSIBILITIES**

8. ICAO will initiate and coordinate appropriate contingency action in the event of disruption of air traffic services and related supporting services affecting international civil aviation operations provided by a State in the event that the authorities cannot adequately discharge their responsibility for the provision of such services to ensure the safety of international civil aviation operations. In such circumstances, ICAO will work in coordination with States responsible for airspace adjacent to that affected by the disruption and in close consultation with international organizations concerned.

9. Regional contingency plans (e.g. Volcanic Ash Contingency Plan) will be developed, approved and maintained by APIRG with the support of ICAO and other institutions.

10. ICAO will initiate and coordinate appropriate guidance to contingency action at the request of States.

11. ICAO is available to assist States in the development and co-ordination of State or sub-regional contingency plans affecting adjacent AFI and other region airspaces.

12. ICAO will be available for monitoring developments that might lead to events requiring contingency arrangements to be developed and applied and will, as necessary, assist in the development and application of such arrangements.

13. During the emergence of a potential crisis, a coordinating team will be established in the Regional Office(s) concerned and at ICAO Headquarters in Montreal, and arrangements will be made for competent staff to be available or reachable 24 hours a day.

**GENERAL CONSIDERATIONS**

14. Safety. Contingency Plans should be developed using the same safety management system approach utilised for normal operations.

*Note. Within the AFI Region air navigation service providers are required to develop, update and maintain contingency plans for all the services they provide in the case of events which result in significant degradation or interruption of their services.*

16. Human Resources. Contingency planning may require the relocation of personnel or disruption to established working patterns. Human Resource personnel should be involved in Contingency Planning throughout the process.
17. Training, testing and exercising. By their very nature it is not expected that contingency plans will be activated on a routine basis. In this respect, the strict adherence to the safety management system process during the development of a contingency plan should ensure that ATS contingency procedures are inherently safe to activate. State Authorities and ANSPs are recommended to ensure that relevant staffs are familiar with contingency plan procedures. Whilst large scale exercises of such plans may be impractical, States/ANSPs should consider running desk-top exercises to ensure that the management of a contingency activation can be effectively conducted. Testing of equipment that is planned to be used should be undertaken on a planned basis to ensure that it meets the envisaged operational requirement.

STATE RESPONSIBILITIES

18. States should establish a contingency plan covering all possible situations that would cause disruption to air traffic flow in the airspace of its responsibility. It is the State’s responsibility to coordinate with other States who are expected to provide the support services in the event of a contingency situation.

19. The Contingency Plan should be prepared in advance and submitted to ICAO Headquarters as necessary through the ESAF and WACAF Regional Offices for review and approval by the President of the ICAO Council on behalf of the Council. In this respect, contingency plans that affect regional arrangements detailed in the AFI ANP or adjacent States should be submitted for approval. Contingency plans developed to cater for a local outage such as a failure of facilities causing localised disruption not affecting the Regional ANP need not be submitted for ICAO Approval; States may, however, provide details of such plans to the ESAF and WACAF Regional Offices.

20. The contingency plan should be updated at regular intervals as required.

21. It is recognized that in some cases the short time required for approval of implementation of a contingency plan may be insufficient, e.g. in case of natural disasters. Implementation of a contingency plan (without changes) prior to approval of that implementation may be necessary. However, in such cases ICAO should be informed immediately.

22. States should register with ICAO any aeronautical agreements between a Contracting State and any other State.
**Remarks**

This part highlights areas where PIRGS can directly influence the adoption of measures to improve the efficiency of air navigation including adoption of *performance based navigation* and improved *civil/military co-ordination* thus facilitating the flexible use of airspace.

It also reflects the performance objective(s) and associated metric(s) developed by the APIRG.

Further action to be taken:

1. Table of environmental tools and modeling techniques in the Appendix may be considered to be part of the FASID as work progresses.
AFI ANP, VOLUME I, BASIC ANP

PART XI - ENVIRONMENT (ENV)

INTRODUCTION

1. The need to minimise the environmental impact of aviation in the Africa-Indian Ocean Region is well recognized. Environmental challenges are present in every aspect of civil aviation and they need to be tackled in order to mitigate adverse impacts that can limit aviation growth.

2. Each State should have an appropriate basis for the development of an aviation *environmental policy and strategy* and the environmental issues which have to be considered in any planning activities. The environment related material provided in this chapter, and its associated requirements, should be considered by aviation stakeholders (including States, regulators, aircraft and airport operators, air traffic service providers, aircraft manufacturers, approved maintenance organisations, international organizations and environment organizations) when planning and delivering aviation services. This chapter is intended as a useful tool for States. It reflects the ICAO environment goals and targets elaborated in the ICAO Action Programme on climate protection and details the Africa-Indian Ocean Region Air Navigation Plan related environment initiatives that will contribute to achieving the ICAO Strategic *Environmental Protection and Sustainable Development* Objective. Finally, it highlights the significant environment requirements States should adopt in their delivery of navigation services.

**ICAO Strategic Objective Environmental Protection and Sustainable Development**

3. ICAO’s third Strategic Objective is related to *Environmental Protection and Sustainable Development of Air Transport*. Thus, ICAO fosters harmonized and economically viable development of international civil aviation that does not unduly harm the environment.

4. To contribute to this vision ICAO has committed to minimize the adverse environmental effects of global civil aviation activity, notably aircraft noise and aircraft engine emissions, through the following means:

   a. Providing measures to:
      
      i) limit or reduce the number of people affected by significant aircraft noise;
      
      ii) limit or reduce the impact of aircraft engine emissions on local air quality; and
      
      iii) limit or reduce the impact of aviation greenhouse gas emissions on the global climate.

   b. Working with other international bodies, in particular the UN Framework Convention on Climate Change (UNFCCC) to address aviation’s contribution to global climate change.

**ICAO: Environmental Mandate and Activities**

5. In matters of environmental protection, ICAO establishes Standards and Recommended Practices (SARPS), and policies and guidance for international civil aviation.

6. The **CAEP (Committee on Aviation Environmental Protection)**, a technical committee of ICAO, is charged with developing and establishing rules and recommending measures to reduce the environmental impact of aviation. CAEP supports ICAO in the development of environmental standards for the certification of aircraft as well as guidance material on airport planning and management, operational procedures and market-based measures to reduce aviation’s impact on the environment. The existing state of scientific knowledge and realistic approaches on noise, air quality and climate impacts of aviation may be used to facilitate informed policy decisions. Actions to address environmental impact may also take account of the interdependency between aircraft noise and emissions. CAEP also promotes the use and further development of harmonised tools and best practices. The practical information provided by CAEP can be used by States to
estimate the environmental impact of aviation and identify measures to mitigate it. The ICAO Secretariat which supervises CAEP work also coordinates environmental activities with other UN bodies such as the United Nations Environment Programme (UNEP), UNFCCC and the World Meteorological Organisation (WMO).

**ICAO related Environmental Fields and Activities:**

a) **Certification:** SARPs development related to aircraft noise certification and aircraft engine emissions certification.

b) **Noise:** Noise abatement operational procedures; Land-use planning and management; Operation restrictions to minimize aircraft noise; Aircraft noise scenarios; Aircraft noise modelling: Aircraft noise charges policies.

c) **Fuel:** Fuel efficiency; Alternative fuels.

d) **Air quality:** Local air quality; Local air quality emissions charges.

e) **Emissions /Climate change:** Aircraft emissions scenarios; Aircraft emissions modelling; Market-based measures to reduce emissions; Emissions trading; Voluntary agreements; Aviation’s impact on the upper atmosphere; Climate change; Ozone depletion.

**ICAO Global Strategy for Aviation Environment/Targets**

7. The global strategy of the aviation industry is focused on reducing the contribution of aviation to climate change; this strategy is translated as fuel management and emissions cuts. Industry’s ambitious goals can only be achieved through collective efforts. Accordingly, the global aviation strategy to reduce carbon emissions was confirmed by the 37th ICAO Assembly. This historic agreement formalized strategy targets to continuously improve CO\(_2\) efficiency by an average of 2 % per annum from 2009 until 2020, to achieve carbon neutral growth from 2020 and reduce its carbon emissions by 50% by 2050 compared to 2005 levels.

**The Environment Roadmap**

8. The ICAO Environmental Roadmap provides a framework to better understand aviation environmental priorities, including performance indicators and long-term targets. Steps to achieve the emissions reduction target(s) are related to investments in new technology, the building and use of an efficient infrastructure; operating aircraft effectively and economic measures (i.e. Emissions Trading Scheme; voluntary measures).

9. The ICAO Council was asked to regularly assess the present and future impact of aircraft noise and aircraft engine emissions and to continue the development of tools for this purpose. Knowledge of the interdependencies and trade-offs related to measures to mitigate the impact of aviation on the environment are continuously maintained and updated. In 2009, an ICAO Global Framework for Aviation Alternative Fuels (GFAAF) was established.

**States and International Organisations Involvement**

10. States and international organizations are invited to provide the necessary scientific information and data to enable ICAO to validate its work related to environment.

11. The Global Framework on International Aviation and Climate Change and ICAO Assembly Resolution A37-19: *Consolidated statement of continuing ICAO policies and practices related to environmental protection - Climate Change* specify that addressing greenhouse gas (GHG) emissions from international aviation requires the active engagement and cooperation of States and industry. States are requested to support ICAO on measuring progress through the reporting of annual data on traffic and fuel consumption.

12. States are advised to refrain from environmental measures that would adversely affect the orderly and sustainable development of international civil aviation.
Action Plans on CO2 Emissions Reduction

13. According to the ICAO Assembly Resolution A37-19, States are encouraged to submit to ICAO their Action Plans outlining their respective policies and actions, and annual reporting on international aviation CO2 emissions. Those States that choose to prepare their Action Plans are invited to submit them as soon as possible, preferably by the end of June 2012, in order that ICAO can compile information related to achieving the global aspirational goals. The Action Plans should include information on measures considered by States and information on any specific assistance needs. Where emissions reductions are achieved through Market Based Measures (MBMs), they should be identified in States’ emissions reporting. ICAO Regional offices can provide additional assistance on this matter.

14. In order to achieve the goals related to climate change, States should put an emphasis on increasing fuel efficiency through all aspects of the ICAO Global Air Navigation Plan (Doc 9574), and all stakeholders are encouraged to develop an air traffic management system that maximises environmental benefits. States are also encouraged to promote and share best practices applied at airports to reduce the adverse effects of GHG emissions produced by civil aviation operations.

ICAO AFI Region Environmental Objectives/Goals

15. The AFI Planning and Implementation Regional Group (APIRG) expects States to ensure environmental factors are taken into consideration when developing CNS/ATM systems implementation plans.

16. States in the AFI region are encouraged to adopt best practices from other States and international organisations (UNFCCC; WMO; IATA, ACI).

17. The APIRG will promote implementation measures for CO2 reduction, with a focus on fuel efficiency and new operational practices. Appropriate Performance Indicators will be developed.

18. States are urged to adopt a balanced approach to noise management, taking full account of ICAO guidance (Doc 9829 – Guidance on the Balanced Approach to Aircraft Noise Management), relevant legal obligations, existing agreements, current laws and established policies, when addressing noise problems at their international airports.

Current Practices

19. Current practices include the development and implementation of fuel efficient routings and procedures to reduce aviation emissions. Investments in research and development should be accelerated to bring to market more efficient technology by 2020. Aviation stakeholders should accelerate their efforts to achieve environmental benefits through the implementation of performance based navigation that would improve the efficiency of air navigation.

Performance Based Navigation (PBN) Implementation

20. PBN environmental benefits are significant, and can be quantified case-by case. Airlines that take full advantage of PBN routinely accumulate benefits from reduced fuel burn and greenhouse gas emissions, improved schedule reliability and increased safety. It should be noted that 3.15 kg of CO2 emissions are eliminated for every 1 kg of fuel saved through shorter and vertically optimized flight paths. IATA estimates that globally, shorter PBN routes could cut CO2 emissions by 13 million tonnes per year.

21. In the approach phase, obstacle clearance and environmental constraints can be better accommodated by creating optimized tracks based on PBN. PBN also offers environmental benefits by saving fuel and reducing CO2 emissions. Flying down the middle of a defined flight path means less throttle activity and better avoidance of noise-sensitive areas.
22. The 37th ICAO Assembly (Resolution 37-11 refers) urged States to complete a PBN implementation plan as a matter of urgency. APIRG/17 and APIRG/18 meetings agreed that a reminder to the ICAO AFI States to continue their PBN planning and implementation activities in accordance with the ICAO PBN concept as detailed ICAO Doc 9613 and provide information on the status of implementation to the ESAF and WACAF Regional Offices of ICAO, would be timely and helpful to foster implementation. Implementation of PBN is considered a significant enabler to deliver environmental benefits.

23. States are requested to continue to develop civil/military co-ordination to enhance the Flexible Use of Airspace, which will contribute to more direct routing with a commensurate saving in fuel and associated emissions.

Global and Regional Initiatives

NextGen

24. A strategic approach to proactively manage environmental issues is a central element of the United States’ Federal Aviation Administration (FAA) NextGen programme. The FAA expects environmental benefits from NextGen systems and procedures to help offset the environmental impact from the expected growth of flight operations. The programme is focusing on minimising delays and carbon emissions, while maximising safety and savings. The target is that by 2018 delays will be reduced by 35% and fuel use by 5.7 billion litters cumulative. CO2 emissions are expected to be reduced by 14.1 million tons cumulative through the implementation of NextGen’s five pillar approach which includes the use of alternative fuels, accelerated ATM improvements and operational efficiencies.

SESAR

25. Single European Sky ATM Research (SESAR) is the operational and technological dimension of the Single European Sky initiative. SESAR seeks to reduce the environmental impact per flight by 10% without compromising safety and with clear capacity and cost efficiency targets in mind.

26. The efficiency gains made possible by the implementation of SESAR will enable the reduction of the environmental impact of every movement in European airspace and at European airports. The enhancements in air traffic management through the optimisation of flight trajectories have the potential to trim down the cumulative in-flight CO2 emissions up to 2020 by around 50 million tons.

27. SESAR is focused on showing tangible results every year. In many airports in Europe, initiatives such as ‘green’ approaches are already being introduced – especially in densely populated areas where the reduction of noise and the improvement of local air quality are highly appreciated.

28. SESAR will introduce the so-called ‘4D trajectory’ when developing new and more efficient air- and ground systems as well as procedures. Optimised air traffic management will lead to emissions savings in all phases of flight.

AIRE

29. The Atlantic Interoperability Initiative to Reduce Emissions (AIRE) is an example of how the SESAR and NextGen programmes work collaboratively on an international basis to substantially accelerate the pace of change in reducing the environmental impact of air transport. A total of 1152 trials lead to savings of an amount of 390 tons of CO2 per flight. The two first complete (gate-to-gate) green transatlantic flights from Charles de Gaulle to Miami included enhanced procedures to improve the aircraft’s energy efficiency.

ALTERNATIVE AVIATION FUEL

30. One means to accelerate the reduction of aviation CO2 emissions is the development of sustainable aviation alternative fuels. This sector is supported by research and development, followed by investments in
new feedstock cultivations and production facilities, as well as incentives to stimulate commercialisation and use of sustainable alternative fuels for aviation. Therefore, the use of alternative fuels is also one aspect to be considered in planning activities.

**Environment Guidance and Existing Tools**

31. The ICAO Council was tasked to establish a set of aviation environmental tools which States could use to implement their policies and evaluate the performance of aviation operations and the effectiveness of standards, policies and measures to mitigate aviation’s impacts on the environment. This work progresses and a number of tools and models have been introduced. Additionally, some States and international organisations have developed their own environmental tools and models. Consequently, several options are available for States and their aviation stakeholders to assess or predict the environmental impact due to aircraft operations. Some examples are illustrated below:

- **Noise**: AEDT/MAGENTA; AEDT/NIRS; STAPES; SONDEO.
- **Air Quality**: ADMS; AEDT/EDMS; ALAQS; LASPORT; PEGAS.
- **Climate Change**: AEDT/SAGE; AEM III; AERO2K; FAST; ICAO carbon calculator; IFSET.
- **Cost benefit analysis (economics)**: APMT Economics; NOx-CSM.
- **Performance**: BADA.
- **Forecasting air traffic growth**: FOM; FESG traffic forecast.

32. A list of available and developing tools and models with a short explanation of their purpose/capability is shown at Appendix 1 to this Chapter.

33. **Market-Based Measures** are among the elements of a comprehensive mitigation strategy to address greenhouse gas emissions from international aviation that are being considered by ICAO. Market-Based Measures include: *emissions trading*, emission related levies - charges and taxes, and emissions offsetting; all of which aim to contribute to the achievement of specific environmental goals, at a lower cost, and in a more flexible manner, than traditional command and control regulatory measures. States are invited to use the *Guidance on the Use of Emissions Trading for Aviation* (Doc 9885). This material supports the incorporation of international aviation emissions into States emissions trading schemes, consistent with the United Nations Framework Convention on Climate Change process. It focuses on aviation-specific issues, identifies options and offers potential solutions. A global CO2 Standard for aircraft (aiming for 2013) is under development at present.

34. On the noise side, the *Balanced Approach to Aircraft Noise Management* (Doc 9829) aims to provide States with advice and practical information on managing the noise impact and achieve maximum environmental benefit in the most cost-effective manner. Its implementation relies on four principle elements: reduction of noise at source, land-use planning and management, noise abatement operational procedures and operating restrictions on aircraft. They are linked to tools and procedures useful to assess the noise situation: noise contours, noise index, baseline, management plans, etc.

35. Assembly Resolutions A37-18 – “Consolidated statement of continuing ICAO policies and practices related to environmental protection — General provisions, noise and local air quality” and A37-19 – “Consolidated statement of continuing ICAO policies and practices related to environmental protection - Climate change” constitute the consolidated statement of continuing ICAO policies and practices related to environmental protection and illustrate, *inter-alia*, new guidance on operational measures to reduce international aviation emissions.

36. Other relevant ICAO Documents:

- *Report of the Seventh Meeting of the Committee on Aviation Environmental Protection (CAEP)* (Doc 9886);
- *Report of the Independent Experts on the LTTG NOx Review and Medium and Long Term Technology Goals for NOx* (Doc 9887);
37. Aviation stakeholders will measure their performance through environmental key performance indicators (EPI). EPIs are linked to safety and capacity key performance indicators (KPI) and most of them are under development. Three types of EPI are recognised at present:

- **Management Performance Indicators (MPI)**, which provide management information on how efforts to improve environmental performance are working;
- **Operational Performance Indicators (OPI)**, which provide information about operational performance; and
- **Environmental Condition Indicators (ECI)**, which provide information on environmental impact, and can be used to help an organisation understand its actual or potential environmental impacts (ISO 2000).

38. For airlines and airports, there is a large number of published EPIs, although there is little consensus on a common suite for benchmarking and subsequent use across Europe.

39. In their present form the EPIs produced in airline and airport environmental reports do not provide a means of comparing relative environmental (or social) performance. Co-ordinated action at an industry level is required to develop consistent interpretations of agreed KPIs and EPIs. Information on KPIs can be found in the *Global Air Traffic Management Operational Concept* (Doc9854), in EUROCONTROL’s work on SES II Performance Scheme, and in the Performance Framework of the SES ATM Master Plan.

40. The 37th Assembly, Resolution A37-19 called upon States to develop and implement procedures to reduce aviation emissions. The implementation of operational improvements will generally have benefits in areas such as improved airport and airspace capacity, shorter cruise, climb and descend times through the use of more optimized routes, and an increase of unimpeded taxi times. The importance of such information on the savings, which reflects the efforts made by the whole aviation industry in reducing fuel consumption, flight time, mileage and its impact on the environment (CO$_2$ emissions), have been already identified by States at various regional meetings.

41. The APIRG has endorsed ICAO’s request that all States/ANSPs in the AFI Region start reporting the benefits to ICAO as they plan or implement any type of operational improvement. States will be notified by ICAO of the mechanism of reporting fuel savings benefits.

42. Whilst ICAO has developed the IFSET Tool to provide a means of capturing fuel savings stemming from operational improvements, States may use other advanced model or measurement capabilities to fulfil the reporting requirement.

43. The APIRG has developed initial performance objectives and associated indicators relating to efficiency and the environment. Performance objectives and indicators will continue to be developed with details provided in the FASID. The initial objectives and indicators are shown below:
Efficiency and Environment

44. The Efficiency and Environment KPAs have been considered together because in this context they are strictly interlinked.

45. The objective for Efficiency is: ensure that users use the most efficient routes – focussing on the horizontal flight-efficiency.

46. The indicator identified to monitor the achievement of this objective is:

   1) Average horizontal en route flight efficiency, defined as the difference between the length of the en route part of the actual trajectory (where available) or last flight planned route and the great circle.

47. In this context specificities shall be considered for flights longer than 1000 nm where the optimum could differ from the great circle (wind optimal routes, etc).

48. The objective for Environment is: contribute to the protection of environment – focussing on fuel savings/CO$_2$ emission reductions.

49. The indicator identified for the achievement of this objective is:

   1) CO$_2$ emissions deriving from inefficiencies in flight efficiency (conversion of additional distance into CO$_2$ emissions based on standard values formula).

50. Discussion within the Group highlighted that future developments of the framework will have to consider the impact of aviation noise on environment.
### TABLE OF ENVIRONMENTAL TOOLS AND MODELLING TECHNIQUES

#### ICAO Tools/Models

<table>
<thead>
<tr>
<th>Tool/Model</th>
<th>Source</th>
<th>Modelling Area</th>
<th>Implementation status</th>
<th>Comments /recommendation</th>
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<tbody>
<tr>
<td>1 Balanced Approach to Aircraft Noise Management</td>
<td>ICAO</td>
<td>Noise</td>
<td>Ready and in use globally</td>
<td>This guidance (Doc 9829) relates to a concept involving several inter-related tools comprising 4 pillars: technological development; operational practices; operating restrictions; &amp; land use planning. Helps assess the management of noise impact using noise contours, noise index, and management plans. Implemented gradually at airport(s) level; States may already have noise regulations and policies in place.</td>
</tr>
<tr>
<td>2 FESG Traffic Forecast</td>
<td>ICAO</td>
<td>Forecasting</td>
<td>Used globally</td>
<td>This provides traffic and fleet forecasts developed for passenger and cargo services over the period 2006 to 2036. It also outlines the methodology, the assumptions and the inputs used to develop the forecasts. Develops the aircraft retirement curves and conducts the sensitivity analyses around the forecasts.</td>
</tr>
<tr>
<td>3 ICAO carbon emissions calculator</td>
<td>ICAO</td>
<td>Climate Change</td>
<td>Ready &amp; in use globally</td>
<td>ICAO has developed a methodology to calculate the carbon dioxide emissions from air travel for use in offset programmes. The ICAO Carbon Emissions Calculator allows passengers to estimate the emissions attributed to their air travel. It is simple to use and requires only a limited amount of information from the user. The methodology applies the best publicly available industry data to account for various factors such as aircraft types, route specific data, passenger load factors and cargo carried.</td>
</tr>
<tr>
<td>4 IFSET</td>
<td>ICAO</td>
<td>Climate Change</td>
<td>Ready to be implemented</td>
<td>ICAO Fuel Savings Estimation Tool (IFSET) has been developed to measure the benefits from operational improvements. It is applicable globally with the ability to capture the differences in flight trajectory performance in terms of fuel consumption before and after implementation of operational improvements at local, regional or global level.</td>
</tr>
<tr>
<td>5 NOx –CSM</td>
<td>ICAO</td>
<td>Economics</td>
<td>Used by experts</td>
<td>This is a Cost Spreadsheet Model (CSM) and is the principal tool used for calculating costs for selected scenarios based on NOx stringency analysis.</td>
</tr>
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</table>
### State/International Organisation Tools/Model

<table>
<thead>
<tr>
<th>Tool</th>
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<th>Modelling Area</th>
<th>Implementation status</th>
<th>Comments / recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMS - Airport</td>
<td>UK DfT</td>
<td>Air Quality</td>
<td>Ready, in use</td>
<td>ADMS-Airport is a comprehensive tool for managing air quality at airports. It is an extension of the ADMS-Urban model, designed to model the concentration of pollutants at airports in rural or complex urban environments. ADMS-Airport is also one of the participating models in the ICAO CAEP (Committee on Aviation Environmental Protection) model exercises.</td>
</tr>
<tr>
<td>AEDT - NIRS</td>
<td>US FAA</td>
<td>Noise</td>
<td>Ready, in use</td>
<td>Aviation Environment Design Tool -Noise Integrated Routing System (NIRS) – regional noise analysis; based on US data. Use of this model is by request to the US FAA.</td>
</tr>
<tr>
<td>AEDT - EDMS</td>
<td>US FAA</td>
<td>Air Quality</td>
<td>Partially used; Under development for public release</td>
<td>AEDT is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions and noise. Full flight gate-to-gate analyses are possible for study sizes ranging from a single flight at an airport to scenarios at the regional, national, and global levels. AEDT is currently used by the U.S. government to consider the interdependencies between aircraft-related fuel burn, noise and emissions. AEDT is being developed for public release, and will become the next generation aviation environmental consequence tool, replacing the current public-use aviation air quality and noise analysis tools such as the Integrated Noise Model (INM – single airport noise analysis), the Emissions and Dispersion Modelling System (EDMS) – single airport emissions analysis), and the Noise Integrated Routing System (NIRS – regional noise analysis).</td>
</tr>
<tr>
<td>AEDT - MAGENTA</td>
<td>US FAA</td>
<td>Noise</td>
<td>Ready, in use at global level</td>
<td>MAGENTA is a computer based Aviation Environmental Design Tool used to estimate the number of people exposed to significant aircraft noise worldwide. The original MAGENTA model was developed with ICAO - CAEP to assess the worldwide aviation noise climate. The computational core of MAGENTA is FAA’s Integrated Noise Model (INM) and is the most widely used computer program to calculate aircraft noise around airports.</td>
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<tr>
<td>Tool</td>
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<td>Implementation status</td>
<td>Comments /recommendation</td>
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<tr>
<td>AEDT - SAGE</td>
<td>US FAA</td>
<td>Climate Change</td>
<td>Partially ready and in use (fuel burn)</td>
<td>System for Assessing Aviation's Global Emissions (SAGE) is a high fidelity model incorporated into the Aviation Environmental Design Tool (AEDT). It is used to predict aircraft fuel burn and emissions for all commercial (civil) flights globally. The model is used to analyze scenarios from a single flight to airport, country, regional, and global levels. In addition, SAGE dynamically models aircraft performance, fuel burn and emissions. Its purpose is to provide the FAA, and indirectly the international aviation community, with a tool to evaluate the effects of various policies, technology, and operational scenarios on aircraft fuel use and emissions. SAGE is also used to develop global inventories of fuel burn and emissions.</td>
</tr>
<tr>
<td>AEM III</td>
<td>EUROCONTROL</td>
<td>Climate Change</td>
<td>Used partially</td>
<td>Advanced Emission Model (AEM) is an aircraft stand-alone system developed and maintained by EUROCONTROL. AEM uses several underlying system databases (aircraft, aircraft engines, fuel burn rates and emission indices) provided by external data agencies in order to assure the quality of the information provided. This system information is combined with dynamic input data, represented by the air traffic flight profiles. References for fuel burn calculation: Above 3000 ft: based on BADA 3.7 (Base of Aircraft Data) Below 3000ft: based on ICAO (International Civil Aviation Organisation); Access is under licence from EUROCONTROL.</td>
</tr>
<tr>
<td>AERO 2K</td>
<td>UK DfT</td>
<td>Climate change</td>
<td>Ready &amp; in use</td>
<td>This is a global aircraft emissions data project for the evaluation of climate change impacts and airport local air quality; AERO2K establishes a new inventory of aircraft emissions of pollutants (CO2, NOx, HCs, CO) important for assessing aviation impacts on climate change. Contributes to the global aviation emissions inventory study.</td>
</tr>
<tr>
<td>ALAQS</td>
<td>EUROCONTROL</td>
<td>Air Quality</td>
<td>Used by some European airports</td>
<td>The ALAQS project is designed to promote best practice methods for airport LAQ analysis concerning issues such as emissions inventory, dispersion, and the data required for the calculations, including emission factors, operational data, and aircraft landing and take-off profiles. The ALAQS-AV toolset is a GIS based research tool. It is a test bed that can be used to investigate the sensitivity of different inventory and dispersion methodologies. The choice of a GIS as a test bench simplifies the process of defining the various airport elements (runways, taxiways, buildings, etc.) and allows the spatial distribution of emissions to be visualized. The ALAQS emissions factors and operations profiles will provide this for use by airport authorities and planners.</td>
</tr>
<tr>
<td>ANCON2</td>
<td>UK DfT</td>
<td>Noise</td>
<td>Ready and in use</td>
<td>ANCON-2 calculates noise exposure. The tool determines the sound exposure level from an aircraft flight segment derived from Noise-Power-Distance tables as a</td>
</tr>
<tr>
<td>Tool</td>
<td>Source</td>
<td>Modelling Area</td>
<td>Implementation status</td>
<td>Comments _recommendation</td>
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<tr>
<td>ANP</td>
<td>EUROCONTROL</td>
<td>Noise</td>
<td>Ready and in use</td>
<td>The Aircraft Noise and Performance Database (ANP) is an international data resource for aircraft noise modellers. This database is an online data resource accompanying the ECAC Doc 29 3rd Edition and ICAO Doc 9911 guidance documents on airport noise contour modelling.</td>
</tr>
<tr>
<td>APMT</td>
<td>US FAA</td>
<td>Interdependencies &amp; Economics</td>
<td>Economics &amp; Operations modules are available for use</td>
<td>The Aviation Environmental Portfolio Management Tool (APMT) computes the environmental impacts of aircraft operations, their interrelationships and economic consequences using the following elements: APMT-Impacts, APMT-Cost Benefit, and APMT-Economics. Cost benefit analyses with the APMT-Cost Benefit combines output from multiple Tools Suite elements to facilitate weighing total expected costs against total expected benefits for aviation's environmental effects under different policy, technology, operational and market scenarios. Access to this tool is by request to the FAA.</td>
</tr>
<tr>
<td>BADA</td>
<td>EUROCONTROL</td>
<td>Aircraft Performance Model</td>
<td>Ready and in use</td>
<td>Base of Aircraft Data (BADA) is an Aircraft Performance Model (APM) with corresponding database. The main application of BADA is trajectory simulation and prediction within the domain of ATM (Air Traffic Management).</td>
</tr>
<tr>
<td>FAST</td>
<td>UK DfT</td>
<td>Climate Change</td>
<td>Ready and in use</td>
<td>Future Aviation Scenario Tool (FAST) is a model for climate change/GHG emission calculation.</td>
</tr>
<tr>
<td>FOM</td>
<td>US FAA</td>
<td>Forecasting</td>
<td>Ready and in use</td>
<td>Forecasting and Operations Module (FOM) is a fleet and operation model. This provides access to historical traffic counts, forecasts of aviation activity, and delay statistics: mainly fleet &amp; operations activity. Access on request to the FAA.</td>
</tr>
<tr>
<td>LASPORT</td>
<td>German Ministry of Transport (BMVBS)</td>
<td>Air Quality</td>
<td>Ready and in use</td>
<td>LASPORT is a programme system for the calculation of airport-induced pollutant emissions and concentrations in the atmosphere. Calculations can be carried out in conformance with the ICAO Airport Air Quality Guidance Manual (ICAO Document 9889). Aircraft movements are accounted for either individually based on a movement journal or in a more generalized form based on aircraft groups. Other source groups explicitly accounted for are: auxiliary power units (APU), ground power units (GPU), ground support equipment (GSE), engine start emissions, motor traffic (airside and landside).</td>
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<td>Tool</td>
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<tr>
<td>PEGAS</td>
<td>Russian Federation Civil Aviation Environmental Safety Centre</td>
<td>Air Quality</td>
<td>Ready and in use</td>
<td>PEGAS calculates the pollutants concentration in the airport area, so it is a LAQ Tool. It provides comparative analysis of measurement and computational results. Used in some eastern European States: e.g. Russia &amp; Ukraine.</td>
</tr>
<tr>
<td>SONDEO</td>
<td>European Union Model developed by Spain (ANOTEC)</td>
<td>Noise</td>
<td>Ready and in use</td>
<td>Study on noise exposure around European airports. Developed around a noise contour engine database. It calculates Lden and Lnight noise contours based on the ANP noise and performance database managed by EUROCONTROL.</td>
</tr>
<tr>
<td>STAPES</td>
<td>EUROCONTROL</td>
<td>Noise</td>
<td>Ready and in use</td>
<td>The System for Airport Noise Exposure Studies (STAPES) is a multi-airport noise model capable of providing valuable input into both European and international policy-making analyses. The STAPES project has identified the European Environment Agency’s population database as an appropriate single source of data for use in relation to EU airports dealing with issues such as noise exposure. STAPES has successfully contributed to the assessments of CAEP/8 policies on the European region.</td>
</tr>
</tbody>
</table>
Data Sources:

- Airports Database; US FAA, EUROCONTROL;
  - Common Operations Database; US FAA, EUROCONTROL
  - 2006 Campbell-Hill Fleet Database
- ICAO/CAEP: WG1 noise & WG3 emissions
- Population Database
- ICAO aircraft engine emissions databank (EDB)

List of Acronyms

<table>
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<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACI</td>
<td>Airport Council International</td>
</tr>
<tr>
<td>ADMS</td>
<td>Atmospheric Dispersion Modelling System</td>
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<tr>
<td>AEDT</td>
<td>Aviation Environment Design Tool</td>
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<tr>
<td>AEM III</td>
<td>Advanced Emission Model</td>
</tr>
<tr>
<td>AERO2K</td>
<td>Model Name</td>
</tr>
<tr>
<td>AI</td>
<td>Atlantic Interoperability Initiative to Reduce Emissions</td>
</tr>
<tr>
<td>ALAQS</td>
<td>Airport Local Air Quality Studies</td>
</tr>
<tr>
<td>ANCON</td>
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<tr>
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<tr>
<td>APMT</td>
<td>Aviation Environmental Portfolio Management Tool</td>
</tr>
<tr>
<td>APU</td>
<td>Auxiliary Power Unit</td>
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<tr>
<td>BADA</td>
<td>Base of Aircraft Data</td>
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<td>BMVBS</td>
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<tr>
<td>CAEP</td>
<td>ICAO Committee on Aviation Environmental Protection</td>
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<tr>
<td>CO</td>
<td>Carbon Oxide</td>
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<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
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<td>ECI</td>
<td>Environmental Condition Indicator</td>
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<td>GHG</td>
<td>Green House Gas (emissions)</td>
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<td>Geographic Information System</td>
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<tr>
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<td>Lden</td>
<td>Index; is A-weighted average sound level used to assess disturbance over day-</td>
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<tr>
<td>Acronym</td>
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<td>evening-night period (24 hr)</td>
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