International Civil Aviation Organization
CAR/SAM Regional Planning Implementation Group (GREPECAS)
First Meeting of the Communications, Navigation and Surveillance / Air Traffic Management Subgroup (CNS/ATM/SG/1)
(Lima, Peru, 15 to 19 March 2010)

Agenda Item 2: Review of global and CAR/SAM CNS/ATM developments

TRANSITION PLAN TOWARDS ATM OPERATIONAL CONCEPT

(Presented by the Secretariat)

SUMMARY

This working paper describes the Transition Plan towards the ATM Operational Concept, document presented at GREPECAS/14 meeting and originated by the ATM/CNS/SG/5 meeting. The mentioned transition plan was mainly based on the Global Plan Initiatives that were approved for use in the CAR/SAM Regions during the AP/ATM/12 Meeting. In addition, it proposes the drafting of a CAR/SAM regional ATM performance-based implementation plan, on the basis of the Transition Plan towards an ATM Operational Concept and the NAM/CAR Regional Performance-based Air Navigation Implementation Plan.

References:

- CAR/SAM Air Navigation Plan (Doc 8733);
- Air Navigation Global Plan;
- AP/ATM/12 Meeting Report; and
- ATM/CNS/SG/5 Meeting Report.

Strategic Objectives:	*This working paper is related to Strategic objectives A and D.*

1. Introduction

1.1. Taking into account the progress reached in the implementation of the CNS/ATM System, achieved by States and Planning and Implementation Regional Groups, within the framework of the Global Air Navigation Plan for CNS/ATM Systems (Doc. 9750), it was acknowledged that technology was not an end in itself and that a complete global integrated ATM system concept, based on clearly established operational requirements, was needed. This concept, in turn, would serve as the foundation for the coordinated implementation of CNS/ATM technologies, also based on clearly established requirements. In order to develop the concept, the ICAO Air Navigation Commission established the Air Traffic Management Operational Concept Panel (ATMCP).

1.2. In order to adequate global planning to the Conclusions of the Eleventh Air Navigation Conference, mainly with regard to the Global ATM Operational Concept, as well as to the Industry Roadmap, ICAO initiated the development of the new Air Navigation Global Plan. In addition to including the Global ATM Operational Concept, the Global Air Navigation Plan is centred in a group of Global Plan Initiatives (GPI), providing the necessary conditions for implementations aimed at reaching benefits for the ATM Community at short and mid term.

1.3. During the AP/ATM/12 Meeting, and taking into account the working projects already initiated in the CAR and SAM Regions, *Conclusion AP/ATM/12/02 Implementation of Work Programmes in support of Strategic Performance Objectives* was formulated, where seven projects were established for the CAR/SAM Regions, with a view to support the transition from a systems based approach to a performance based approach. These projects contemplate the ATS routes structure optimisation, Improve the balance between demand and capacity, Align the classification of the upper airspace (CAR Region), Implement RNP approaches, Improve data communications between ATS facilities, Improve situational awareness and Implement the flexible use of the airspace.

1.4. In view of the above, the ATM Committee presented to the ATM/CNS/SG/5 Meeting an initial proposal to the Transition Plan towards ATM Operational Concept in the CAR/SAM Regions, which was developed keeping in mind the Air Navigation Global Plan and had the objective to apply the Global Plan Initiatives (GPI), in order to initiate the transition towards the ATM Operational Concept.

1.5. Also, this plan was addressed to establish an implementation strategy aimed to achieving benefits for the ATM community at short and mid term, based in the infrastructure related to the ATM and available and foreseen aircraft capabilities.

1.6. The document presented contained duly developed the Chapters related with the ATM field, leaving pending of detailed preparation the air navigation infrastructure (CNS, AIS, MET, AGA/AOP) and Institutional Aspects involved, necessary to accompany such evolution.

2. **Analysis**

CAR/SAM transition plan towards the ATM system

2.1. The ATM/COMM/5 analysed the CAR/SAM Transition Plan towards the ATM System, and proposed some amendments, and approved chapters 1, 3 and 4, corresponding to the ATM Committee. Also, it considered that the document should be sent to the GREPECAS ACG through fast track procedure to the AGA/AOP, AIS, HRT and MET Subgroups, to the CNS Committee and to the Institutional Aspects Task Force, to develop the remaining chapters of the document.

2.2. The meeting considered that it should be an evolving and dynamic document, in order that changes generated at a global level may be reflected, as well as in the regional environment. Taking the above in consideration, the ATM/CNS/SG/5 Meeting formulated a draft decision and a decision:

a) Through Draft Decision ATM/5/12 *Approval of the CAR/SAM ATM System Transition Plan*, it was requested that the transition plan be approved through the GREPECAS Administration and Coordination Group (ACG), using the fast track procedure; and

b) Decision ATM/5/13 *Development of chapters 2, 5 to 12 of the CAR/SAM Transition Plan towards the ATM System*, requesting that the ATM/CNS Subgroup Secretariat, once approved the above decision, submit the Transition Plan towards the ATM System in the CAR/SAM Regions for consideration of the CNS Committee, the AGA/AOP, AIS, HRT and MET Subgroups, Institutional Aspects and Air Traffic Forecasts Task Forces, to develop the chapters corresponding to their area of responsibility of the mentioned document.

2.3. This matter was examined during GREPECAS/14, and note was taken on the decisions adopted, it took note that the Subgroup had considered that the effort in developing a base document for the updating of the CAR/SAM ANP had been of great value, keeping in mind the changes being carried out to the Air Navigation Global Plan, which also contemplated ICAO Strategic Objectives and the elements of the route plan coordinated with the industry.

2.4. GREPECAS/14 Meeting finally was informed that the Subgroup, after analysing the documents, had considered it convenient that the ATM Committee continue with the revision and updating of the same, as well as the submission to the other GREPECAS Subgroups to make their contributions, understanding that the approval of the final document could be made until the reception of the complementary parts, providing time to complete final changes to the Global Plan and the resulting electronic documentation of the updating work by ICAO Headquarters, as per the information presented.

2.5. The Transition Plan towards the ATM System in the CAR/SAM Regions, as approved by the ATM/CNS/SG/5 is presented as **Appendix** to this working paper.

2.6. The Eleventh Meeting of Civil Aviation Authorities for the South American Region (RAAC/11) in analysing the status of the regional air navigation plan, agreed on the need to update the regional planning documentation, based on the Global ATM Operational Concept, requesting ICAO to take pertinent actions in order to continue developing the Transition Plan towards the ATM Operational Concept in the South American Region, which was initially presented at the ATM/CNS Subgroup.

Performance-based framework

2.7. GREPECAS/15, in reviewing the performance framework at a regional and national level, observed that the ICAO planning objective seeks to achieve a performance-based global air traffic management (ATM) system, through the implementation of air navigation systems and procedures in a gradual and effective manner, in terms of cost and collaboration.

2.8. In order to facilitate the implementation of performance based ATM global system, the Meeting took note that ICAO had achieved significant progress in the preparation of pertinent guidance material. Among the documents, there are: a) the Global Air Traffic Management Operational Concept (Doc 9854), b) Air Traffic Management Systems Requirements (Doc 9882), c) Manual on Global Performance of the Air Navigation System, and d) Global Air Navigation Plan (Doc 9750).

2.9. As regards performance regional planning, the work will be based on the Global Air Navigation Plan and on the Global Performance Manual. The result of this process shall be a management form entitled: “Performance Framework Form (PFF) or performance objectives” to serve as guidelines in implementation tasks.

2.10. The Transition Plan towards the ATM System in the CAR/SAM Regions, initially developed these forms, which where further used to describe the ATM Committee tasks, and was also used as reference for the work carried out by ICAO regarding PFF.

NAM/CAR Regional Performance-based Air Navigation Implementation Plan (NAM/CAR RPBANIP)

2.11. In follow-up to GREPECAS Conclusions 14/51 and 15/1 del GREPECAS, a performance-based air navigation implementation plan was developed in the NAM/CAR Regions, which included in its development the seven projects formulated by AP/ATM/12 meeting (*Conclusion AP/ATM/12/02 - Implementation of Work Programmes in support of the Performance Strategic Objectives).* Details of same are found in this meeting's working paper 5 (WP/05).

2.12. The NAM/CAR Regional Performance-based Air Navigation Implementation Plan was approved by the Directors of Civil Aviation of the NAM/CAR Regions, and its updating is carried out by the Caribbean working groups (C/CAR/WG, E/CAR/WG and CA/ANE/WG). On the basis of Conclusion NACC/DCA/3/3, the plan will serve as a regional implementation guide, supported by a technical cooperation project currently under coordination with ICAO Headquarters.

2.13. In the identification of regional performance objectives and of performance framework forms, the NAM/CAR plan examines the ATM performance objectives specified in the transition plan towards the ATM system in the CAR/SAM Regions and introduces new performance objectives in the CNS, AIM, MET and AGA/AOP fields. Some of these updatings correspond to agreements reached within the AGA/AOP and AIM Subgroups.

Drafting of a CAR/SAM regional ATM performance-based implementation plan

2.14. Taking into account the CAR/SAM Transition Plan towards the ATM Operational Concept and the NAM/CAR RPBANIP, and further to GREPECAS Conclusion 15/1, the Subgroup should draft a CAR/SAM regional ATM performance-based implementation plan, under the following premises:

a) The revised ATM performance objectives, as well as the new CNS, AIS, MET and AGA/AOP performance objectives outlined in the NAM/CAR RPBANIP would serve as a starting point, respectively;

b) Appendix 1 to Chapter 4 (CAR/SAM ATM performance objectives) can be updated, as well as Chapters 5 to 10 of the CAR/SAM Transition Plan towards the ATM System (Appendix to this working paper);

c) The Meeting should start updating the transition plan in the ATM and CNS areas and urge GREPECAS in order that the remaining GREPECAS contributory bodies proceed in the updating of their respective fields;

d) Among the updating work in the ATM and CNS areas, the Meeting should examine the tasks taken under consideration to achieve the respective performance objectives, the dates for the starting and ending of tasks, and their status of compliance, with the aim that they are in harmony with the plans approved in each of the regions. Information on the plans approved in each of the Regions is provided in WP/05 and WP/07 of this Meeting;

e) In addition, the Meeting could analyze changing the title of the CAR/SAM Transition Plan towards the ATM System to CAR/SAM Regional Performance-based Implementation Plan, which will serve as a guidance implementation plan towards the ATM system; and

f) For the review to the transition document, the Meeting could establish an ad-hoc group with representatives from the CAR and SAM Region, which could deliver an initial CAR/SAM transition plan, harmonized on the basis of the plans approved in each of the Regions.

3. **Suggested action**

3.1. The Meeting is invited to:

a) Take note of the information presented in this working paper,

b) Draft a CAR/SAM regional ATM performance-based implementation plan proposal, taking into account the CAR/SAM Transition Plan towards an ATM Operational Concept and the NAM/CAM RPBANIP Plan, as per paragraph 2.14; and

c) Analyze other topics in this regard, which the Meeting might deem necessary.

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APPENDIX

INTERNATIONAL CIVIL AVIATION ORGANIZATION

PLAN FOR THE TRANSITION TO THE ATM SYSTEM IN THE CAR/SAM REGIONS

Version 1.1

November 2006

TABLE OF CONTENTS

Chapter 1: Introduction

1.1 Objective

1.1.1 The Plan for the Transition to the ATM System in the CAR/SAM Regions has been developed taking into account the Global Air Navigation Plan. Its objective is to apply the Global Plan Initiatives (GPIs) in order to start the transition to the ATM System.

1.1.2 This Plan also aims to establish an implementation strategy that will yield benefits for the ATM community in the short and long term, based on the ATM-related infrastructure and existing and foreseeable aircraft capabilities. The document contains the air navigation infrastructure (CNS, AIS, MET, AGA/AOP) and considers the institutional aspects needed for that evolution.

1.2 Scope

1.2.1 This transition plan extends to the boundaries of the CAR/SAM Regions and in the short and medium term, respectively, will last up to 2010 and from 2011 to 2015, as indicated in the guidelines of the Global Air Navigation Plan. As they are gradually developed and approved, the long-term initiatives required for the evolution to a global ATM system, as shown in the global ATM operational concept, will be added to this Plan.

1.3 Background

1.3.1 It was recognised, after the progress made in the implementation of the CNS/ATM System by States and Regional Planning and Implementation Groups within the framework of the Global Navigation Plan for CNS/ATM Systems (Doc. 9750), that technology does not constitute an end in itself and that a complete, integrated global ATM system concept was needed, based on clearly-established operational requirements. This concept, in turn, was to constitute the grounding for the coordinated implementation of CNS/ATM technologies, also based on clearly-established requirements. The ICAO Air Navigation Commission set up the Air Traffic Management operational concept Panel (ATMCP) to develop the concept.

1.3.2 The global ATM operational concept developed by the above-cited panel was approved by the Eleventh Air Navigation Conference published as Doc. 9854 AN/458 through recommendation 1/1, which stipulates the following:

a) ICAO, the States and the planning and regional implementation groups (PIRGs) should consider the concept as the common global framework to guide ATM system implementation and concentrate ATM development efforts;

b) The global ATM concept should be used as high-level guidance for the development of ICAO CNS/ATM provisions;

c) States, with the support of other members of the ATM community, should undertake the task of validating the seven components of the global ATM operational concept;

d) ICAO, the States and the PIRGs should develop transition strategies for ATM systems implementation based on the global ATM operational concept; and

e) ICAO should align its technical programme to facilitate future efforts regarding the ATM operational concept.

1.3.3 The sixth consultation meeting between the Air Navigation Commission and the industry took place in Montreal after the AN-Conf/11, on the topic of "Promoting the implementation of the recommendations of the 11th Air Navigation Conference". Among the issues addressed, "The global ATM – from concept to reality" produced the following conclusion:

"That all partners that are in a position to do so, work together to prepare a common road map or a global action plan, in order to generate operational benefits in the short and medium term, and that the said document be made available to ICAO in mid October 2004 for presentation to the Air Navigation Commission and so that its inclusion in the Global Plan may be considered."

1.3.4 The industry road map included CNS/ATM implementation activities for the short and medium term, while the long-term objectives are considered in the operational concept. As a result, the Commission declared that the road map was perfectly in line with the operational concept and that continued positive results would ensure its convergence with the ATM system envisaged in the operational concept and the formation of a complete planning structure, together with the Global Plan and that concept.

1.3.5 ICAO started developing the new Global Air Navigation Plan to adjust global planning to the conclusions of the Eleventh Air Navigation Conference, particularly insofar as the Global ATM Operational Concept and the Industry Road Map were concerned. The Global Air Navigation Plan not only includes the global ATM operational concept, but focuses on a series of "Global Plan Initiatives (GPIs)" that offer the necessary conditions for the implementations aimed at benefiting the ATM community in the short and medium term.

1.4 Deficiencies of the current System in the CAR/SAM Regions

1.4.1 Air Traffic Management (ATM)

1.4.1.1 The ATM currently available in the CAR/SAM Regions suffers from some inconveniences, including the following:

a) The lack of a harmonized airspace operations concept with broad use of performance-based navigation through an RNAV and/or RNP navigation specification for en-route and TMA flights, hinders airspace design and management, by not permitting the implementation of an optimum airspace structure.

b) Failure to use the navigation capability of currently available aircraft creates an unfavourable cost-benefit ratio for aircraft operators.

c) Lack of systemic use cost-benefit analyses for the implementation of new airspace structures creates problems for the establishment of air navigation infrastructure implementation priorities and impedes the measurement of the benefits obtained by the ATM community.

d) Lack of a policy and procedures for flexible airspace use makes airspace design and management difficult by not allowing for the application of an optimum airspace structure and use of optimum flight trajectories.

e) Lack of air traffic flow management services in most airspaces in the CAR/SAM Regions causes congestion in some airspaces and airports and does not permit to maximise the use of ATC and airport capacities, to the detriment of their users.

f) Lack of coordination in the provision of current CNS/ATM services can occasionally result in a duplication of resources and services.

g) Inadequate quality of means of communication and language problems create problems in the provision of Air Traffic Services.

h) The lack of ATS surveillance in some parts of the airspace of the Regions does not permit a harmonised reduction of aircraft separation due to application of different separation criteria in FIR boundaries , and limiting the use of optimum flight profiles.

i) Lack of interfacing of ATM automation systems in the CAR/SAM Regions and the little sharing of ATS surveillance data create discontinuity in ATS services.

1.5 Evolution and Transition

1.5.1 In considering the overall system concept, the questions of evolution and transition are most important. It will be necessary to ensure inter- and intra-regional CNS/ATM system harmonisation in order to optimise investments in airborne systems and ensure that aircraft are not unnecessarily required to carry a multiplicity of equipment and operators are not obliged to request multiple operational approvals. Furthermore, there is a need to ensure that differences in the pace of development around the world do not lead to incompatibility between elements of the ATM operational concept among the ICAO Regions. Particularly because of the wide scope of these components, , the above considerations call for judicious coordination of regional and worldwide planning and implementation if such systems are to be optimised.

Chapter 2: Air Traffic in the CAR/SAM Regions

2.1 Traffic Forecasts in the CAR/SAM Regions

TBD

Chapter 3: Planning Considerations

3.1 Introduction

3.1.1 As traffic volumes grow worldwide, the demands made on air navigation service providers in a given airspace increase, as do the complexities of air traffic management. With the increase in traffic density, the number of flights unable to follow optimum flight trajectories rises.

3.1.2 Implementation of the components of the ATM operational concept is expected to provide sufficient capacity to meet the growing demand, while generating additional benefits in the way of more efficient flight profiles and increased levels of safety. The potential of new technologies to significantly reduce service costs, however, calls for the establishment of clearly-defined operational requirements.

3.1.3 Considering the benefits to be derived from the ATM operational concept, many timely decisions are required for its implementation. There will be a need for unprecedented global and regional cooperation.

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

3.1.5 In its most elementary way, the output from the regional planning process is a listing of air navigation facilities, together with their achievable time frames. This data is essential for implementation of the Global Plan Initiatives that will guide the gradual transition to the ATM operational concept. These lists will be incorporated into the CAR/SAM Regional Air Navigation Plan (ANP) and kept up to date by the CAR/SAM Regional Planning and Implementation Group (GREPECAS), with the assistance of ICAO Regional Offices.

3.1.6 This Plan calls for the gradual, coordinated, timely and cost-effective global implementation of the ATM operational concept components, bearing in mind the Global Plan Initiatives (GPIs) that could be implemented in the short and medium term. The Plan fulfils two important functions in this connection:

a) It offers regional planning institutions, States/Territories, service providers and users guidelines for the transition to the ATM operational concept.

b) It operates as a measuring stick to gauge progress.

3.1.7 Planning the implementation of ATM operational concept components, as well as the elaboration of orientation guidelines to ensure a harmonious and integrated implementation, should be basically a regional responsibility, while the implementation is the responsibility of the States/Territories or groups of States/Territories and International Organisations, working together within the framework of the concept and implementation strategy developed by GREPECAS for the two Regions. However, it is imperative for each State in the CAR and SAM Regions to develop and publish its own plan for the transition to the ATM operational concept.

3.1.8 Regional planning should take into consideration the features intrinsic to the components of the ATM operational concept, the scope of whose facilities may transcend national boundaries, making it necessary to implement multinational facilities to avoid duplicating resources and services. In establishing multinational facilities, the institutional aspects involved, which generically encompass all technical, operational, administrative, financial and legal matters, should be taken into account.

3.1.9 The establishment of Regional Multinational Organisations is to be expected, given the aspects cited in the previous paragraph and the need to develop a suitable structure for the planning and implementation of multinational facilities. These bodies, made up of groups of States, would guarantee that optimum use is made of the investments needed to implement and maintain air navigation services.

3.2 ATM **Homogeneous areas and main international traffic flows**

ATM Homogeneous area

3.2.1 A homogeneous ATM area is an airspace with a common ATM interest, based on similar characteristics of traffic density, complexity, air navigation system infrastructure requirements or other specified considerations wherein a common detailed plan will foster the implementation of interoperable ATM systems. Homogeneous ATM areas may extend over States, specific portions of States or groups of States. They may also extend over large oceanic and continental areas. They are considered areas of common interests and requirements.

3.2.2 According to the ATM operational concept, homogeneous ATM and/or routing areas should be reduced to a minimum and consideration should be given to merging adjacent areas.

Main traffic flows

3.2.3 A main traffic flow refers to the concentration of a significant volume of air traffic on the same or proximate flight paths. Main traffic flows may cross several homogeneous ATM areas with different characteristics.

3.2.4 Homogeneous ATM areas and main traffic flows are related primarily to en-route airspace. However, addressing capacity and efficiency improvements in the terminal control area (TMA) and at aerodromes and working on the basis of a set of common initiatives will serve as an important building block toward achieving a homogeneous ATM system. Therefore, several of the Global Plan Initiatives were developed specifically to improve aerodrome and TMA operations.

3.2.5 The most significant air traffic flows in the CAR/SAM Regions extend over both Regions and many of them reach the boundaries of the CAR/SAM Regions with the AFI, EUR, NAM, NAT and PAC Regions. **Appendix 1** to this chapter shows the Main Traffic Flows identified in Homogeneous Areas.

3.3 Planning methodology

3.3.1 After identifying the homogeneous ATM areas and main traffic flows, a task in which the CAR/SAM Regions have already progressed significantly, GREPECAS conducted a survey of the current and foreseen aircraft population and its capabilities, predicted traffic figures, and also the ATM infrastructure, including human resource availability and requirements, among other things. An analysis of the data collected made it possible to identify performance "gaps". The Global Plan Initiatives were then evaluated against those gaps to identify those that would most appropriately provide the operational improvements necessary to meet performance objectives in the CAR/SAM Regions and will be described in further detail in the following chapters.

3.3.2 This planning process would continue with development of scenarios for the implementation of initiatives, a cost-benefit analysis of the various scenarios and preliminary development of infrastructure support requirements. Additional steps would include development of implementation plans and funding profiles, further review of human resource requirements to support the identified initiatives, followed by further cost-benefit analyses. Finally, national and regional implementation plans would be developed or amended based on the selected initiatives. This is an iterative process, which may require repetition of several steps until a final choice of initiatives is made. Once available, the planning tools will assist planners in carrying out the above steps. Figure 1 is an illustration of a planning flow chart.

3.3.3 The work for the CAR and SAM Regions should evolve based on the new project management techniques described and performance objectives clearly defined in support to strategic objectives of the Global Plan, aligned with ICAO strategic plan. The work programmes must be common for both regions, taking into consideration the progress, characteristics and needs of each CAR and SAM Region. The strategies agreed shall serve as CAR and SAM inter-regional work programmes; each Region will be able to adapt them to their own characteristics and needs for implementation.

3.3.4 All the activities indicated in the performance objectives will be designed through strategies, concepts, action plan models and roadmaps which could be shared to align the interregional work with the fundamental objective to achieve interoperability and seamlessness to the highest level.

3.3.5 In the activities planning, it should be ensured that the resources will be efficiently used avoiding in the planning activities, duplicated or unnecessary work, so that the work/activities could easily be adapted to each CAR and SAM Regions. The planning activities should encourage optimizing human resources, savings as well as dynamic use of electronic communication means between States such as the Internet, videoconferences, teleconferences, e-mail, telephone and facsimile.

3.3.6 The new work process and methods should ensure that the performance objectives could be measure with time lines and the regional work progress achieved be easily reported to the ICAO Council and to the Air Navigation Commission.

3.3.7 In the basis to this Transition Plan, States, Territories and International Organizations should develop their own implementation strategy or action plan that reflects work programme, date lines, individual parties responsible and status to monitor progress and to report advances of those activities. Additionally, they should consider detailed information on required activities to complete implementation, means to provide feedback on progress of work through annual report process, which will help administrations to prioritize activities and support needed, and also help to detect annual needs and assistance in each ICAO Region.

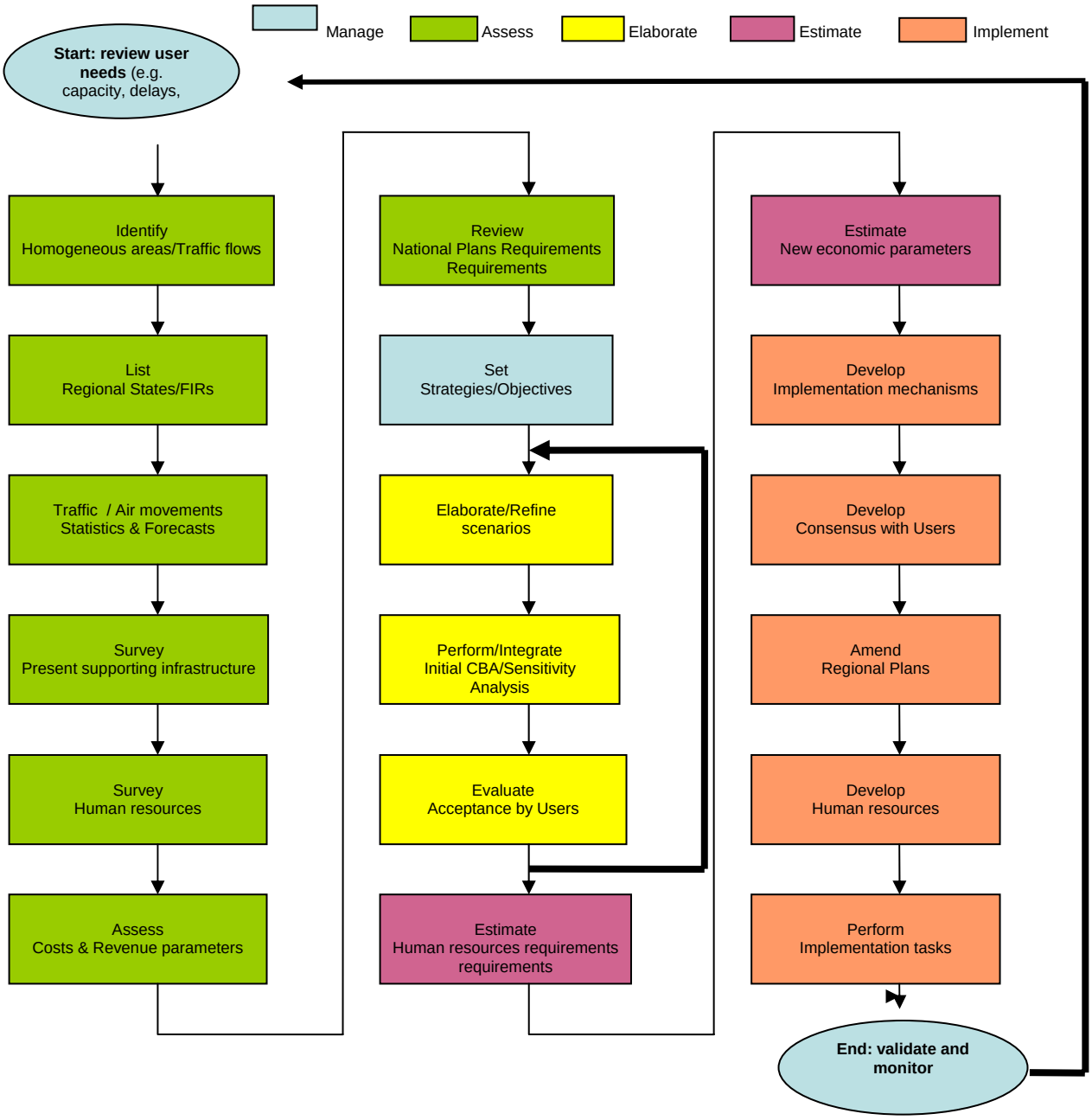

Figure 1. Planning Flow Chart

3.3.8 Development of work programmes is based on the experience and lessons learned in the previous cycle of the CNS/ATM implementation process. This Plan therefore, focuses efforts toward maintaining consistent regional harmonisation and improving implementation efficiencies by drawing on the existing infrastructure capabilities and regional implementations.

3.4 Planning tools

3.4.1 This Transition Plan will be supported by planning tools of the Global Plan which will provide various electronic formats (*e.g.*, software applications, planning documentation, web-based reporting forms, project management tools, etc.), with a view toward following up on and ensuring the coordination of performance objectives and implementation timelines, together with the resulting timetables and action plans. As States consider the implementation of initiatives, they will be able to use common templates of programmes as a basis to establish performance objectives and timelines for implementation, and also develop exhaustive schedules and planning activities to comply with the work programme associated with the global initiatives (GPIs).

3.5 Evolution

3.5.1 Achieving the global ATM system sought after will be accomplished through the implementation of many initiatives over several years on an evolutionary basis. These initiatives were established to support planning and implementation of performance objectives in the CAR/SAM Regions. The set of initiatives contained in this Transition Plan are meant to facilitate and harmonise the work already underway within the CAR/SAM Regions and to bring needed benefits to aircraft operators over the near and medium term. ICAO will continue to develop new initiatives on the basis of the operational concept that will be included in the Global Plan and, which will be included also in this Transition Plan.

3.5.2 The ATM System in the CAR/SAM Regions shall be based on the provision of integrated services. In order to describe how these services shall be provided, seven components of the ATM operational concept, jointly with key concept services are described in Doc 9854. The performance objectives were logically linked to the components of the ATM operational concept, in order to ensure that the work has as a goal to reach the ATM system described in the operational concept. Thus, the term Components of the ATM Operational Concept used in the current plan are referred to the seven components described in the ATM operational concept. These are: Airspace Organization and Management (AOM), Demand and Capacity Balancing (DCB), Aerodrome Operations (AO), Traffic Synchronization (TS), Conflict Management (CM), Airspace User Operations (AUO) and ATM Service Delivery Management (ATMSDM).

3.5.3 In all cases, initiatives must meet global objectives based on the operational concept. On this basis, planning and implementation activities begin with the application of available procedures, processes and capabilities. The evolution would progress to application of emerging procedures, processes and capabilities and ultimately, migrate to the ATM system based on the operational concept. Figure 2 depicts the Global Plan evolution.

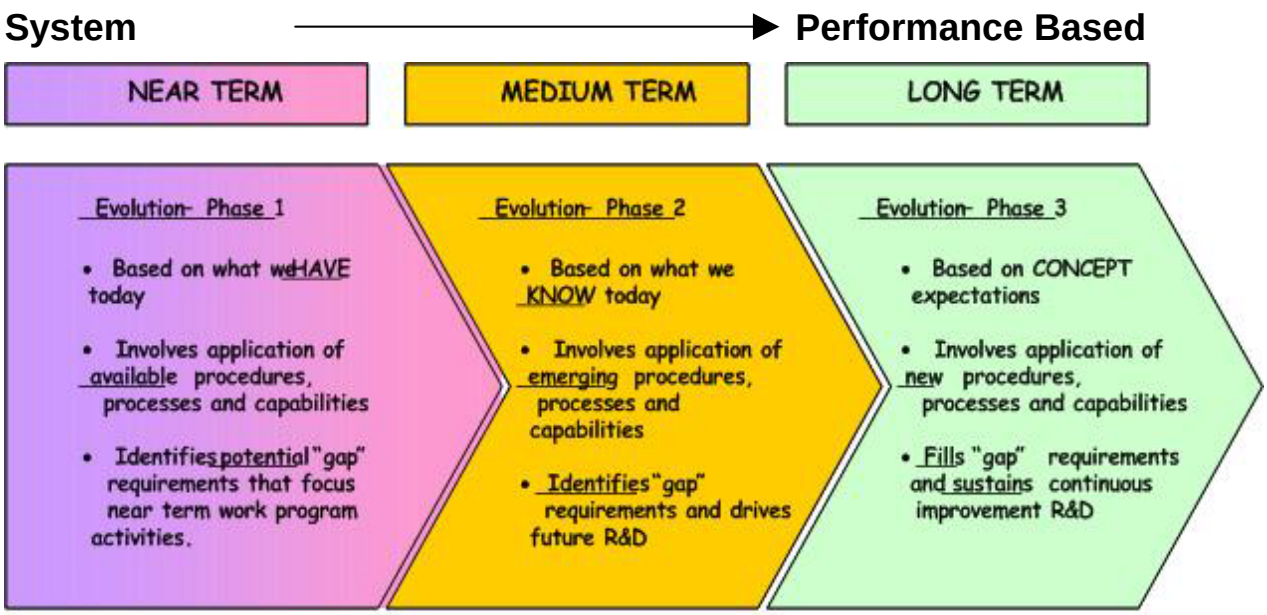

Figure 2. Global Plan Evolution

3.6 Global Plan Initiatives

3.6.1 Table 3-1 sets out the Global Plan Initiatives (GPIs) that can be considered by GREPECAS and by States, Territories and International Organisations. The initiatives in this Transition Plan will be inserted into each of the following chapters, broken down by ATM, CNS, AGA, MET, AIS, and other areas of operation. Planning and implementation of performance objectives should be started in the near term and progressed in an evolutionary manner. Long-term initiatives, necessary to guide the evolution of the global ATM system as envisioned in the operational concept, will be added to the Global Plan and, therefore, to this Transition Plan, as they are developed and agreed to.

Note: The Global Plan contains the objective and relevant implementation strategy for each initiative.

3.7 Integration of initiatives

3.7.1 The GPIs are provided to facilitate the planning process and should not be viewed as stand-alone tasks, but rather, in many cases, as interrelated. Therefore, initiatives are quite capable of integrating with and supporting each other. In fact, integration is a sought after goal of a global ATM system.

GPI		En-route	Terminal area	Aerodrome	Supporting infrastructure	Related Operational Concept Components
GPI-1	Flexible use of airspace	X	X			AOM, AUO
GPI-2	Reduced vertical separation minima	X				AOM, CM
GPI-3	Harmonise level	X				AOM, CM,

GPI		En-route	Terminal area	Aerodrome	Supporting infrastructure	Related Operational Concept Components
	systems					AUO
GPI-4	Uniform upper airspace classifications	X				AOM, CM, AUO
GPI-5	RNAV and RNP (Performance based navigation)	X	X	X		AOM, AO, TS, CM, AUO
GPI-6	Air traffic flow management	X	X	X		AOM, AO, DCB, TS, CM, AUO
GPI-7	Dynamic and flexible ATS route management	X	X			AOM, AUO
GPI-8	Collaborative airspace design and management	X	X			AOM, AUO
GPI-9	Situational awareness	X	X	X	X	AO, TS, CM, AUO
GPI-10	Terminal area design and management		X			AOM, AO, TS, CM, AUO
GPI-11	SIDs and STARs with RNP and RNAV		X			AOM, AO, TS, CM, AUO
GPI-12	Functional integration of ground systems with airborne systems		X		X	AOM, AO, TS, CM, AUO
GPI-13	Aerodrome design and management			X		AO, CM, AUO
GPI-14	Runway operations			X		AO, TS, CM, AUO
GPI-15	Match IMC and VMC operating capacity		X	X	X	AO, CM, AUO
GPI-16	Decision support systems	X	X	X	X	DCB, TS, CM, AUO

GPI		En-route	Terminal area	Aerodrome	Supporting infrastructure	Related Operational Concept Components
GPI-17	Implementation of data link applications	X	X	X	X	DCB, AO, TS, CM, AUO, ATMSDM
GPI-18	Aeronautical information	X	X	X	X	AOM, DCB, AO, TS, CM, AUO, ATMSDM
GPI-19	Meteorological systems	X	X	X	X	AOM, DCB, AO, AUO
GPI-20	WGS-84	X	X	X	X	AO, CM, AUO
GPI-21	Navigation systems	X	X	X	X	AO, TS, CM, AUO
GPI-22	Communication infrastructure	X	X	X	X	AO, TS, CM, AUO
GPI-23	Aeronautical radio spectrum	X	X	X	X	AO, TS, CM, AUO, ATMSDM

Table 3-1 Global Plan Initiatives and their links to the main groups

Appendix 1 to Chapter 3

Homogeneous Areas and Main Traffic Flows Identified

-1- Routing area (RA)	-2- Traffic flows	-3- FIRs involved	-4- Type of area covered	-5- Remarks
Caribbean/South American (CAR/SAM) Regions				
AR 1	Buenos Aires-Santiago, Chile	Ezeiza, Mendoza, Santiago	Low-density continental	SAM intra-regional traffic flow
	Buenos Aires-Sao Paulo/Rio de Janeiro	Ezeiza, Montevideo, Curitiba, Brasilia	High-density continental	SAM intra-regional traffic flow
	Santiago, Chile-Sao Paulo/Rio de Janeiro	Santiago, Mendoza, Córdoba, Resistencia, Asunción, Curitiba, Brasilia	Low-density continental	SAM intra-regional traffic flow
	Sao Paulo/Rio de Janeiro-Europe	Brasilia, Recife, Atlantic	Low-density continental / oceanic	SAM/AFI/EUR inter-regional major traffic flow
AR 2	Sao Paulo/Rio de Janeiro-Miami	Brasilia, Amazónica, Maiquetía, Curacao, Kingston, Santo Domingo, Port au Prince, Havana, Miami	Low-density continental / oceanic	CAR/SAM/NAM inter- and intra-regional traffic flow
	Sao Paulo/Rio de Janeiro- New York	Brasilia, Amazónica, Paramaribo, Georgetown, Piarco, Rochambeau, San Juan (New York)	Low-density continental / oceanic	CAR/SAM/NAM /NAT inter- and intra-regional traffic flow
AR 3	Sao Paulo/Rio de Janeiro - Lima	Brasilia, Curitiba, La Paz, Lima	Low-density continental	SAM intra-regional traffic
	Sao Paulo/Rio de Janeiro - Los Angeles	Brasilia, Amazónica, Bogotá, Barranquilla, Panama, Central America, Mexico, Mazatlán Oceanic (Los Angeles)	Low-density continental	CAR/SAM/NAM inter- and intra-regional traffic flow
AR 4	Santiago - Lima - Miami	Santiago, Antofagasta, Lima, Guayaquil, Bogotá, Barranquilla, Panama, Kingston, Havana, Miami	Low-density continental / oceanic	CAR/SAM/NAM inter- and intra-regional traffic flow
	Buenos Aires - New York	Ezeiza, Resistencia, Asunción, La Paz, Amazónica, Maiquetía, Curacao, Santo Domingo, Miami (New York)	Low-density continental / oceanic	CAR/SAM/NAM /NAT inter- and intra-regional traffic flow
	Buenos Aires - Miami	Ezeza, Resistencia, Córdoba, La Paz, Amazónica, Bogotá, Barranquilla, Kingston, Havana, Miami	Low-density continental / oceanic	CAR/SAM/NAM inter- and intra-regional traffic flow

-1- Routing area (RA)	-2- Traffic flows	-3- FIRs involved	-4- Type of area covered	-5- Remarks
AR 5	Northern South America - Europe	Guayaquil, Bogotá, Maiquetía, Piarco (NAT-EUR)	High-density continental / oceanic	SAM/CAR/NAT/ EUR inter-regional traffic flow
AR 6	Santiago - Lima - Los Angeles	Santiago, Antofagasta Lima, Guayaquil, Central America, Mexico, Mazatlán Oceanic	Low-density oceanic	CAR/SAM/NAM inter- and intra-regional traffic flow
AR 7	South America – South Africa	Ezeiza, Montevideo, Brasilia, Atlantic Johannesburg (AFI)	Low-density oceanic	SAM/AFI inter-regional traffic flow
	Santiago, Chile – Easter Island - Papeete (PAC)	Santiago, Pascua, Tahiti	Low-density oceanic	SAM/PAC inter-regional traffic flow
G-1	Mexico, Toluca, Guadalajara, Monterrey, Mazatlán, La Paz, Acapulco, Puerto Vallarta, Huatulco, Cancún Gulf of Mexico — North America	Mexico, Houston, Miami; Albuquerque; Los Angeles	High-density continental/oceanic	CAR/NAM inter-regional main traffic flow
	Cancún, Guatemala, El Salvador, Nicaragua, Honduras, Costa Rica - Miami	Mexico, Central America, Havana, Miami	High-density continental/ oceanic	CAR/NAM inter-regional traffic flow
GM-2	Mexico, Cancun, Havana, Nassau — Europe	Mexico, Havana, Miami –(NAT-EUR)	High-density continental/ oceanic Main traffic flow	CAR/NAM/NAT /EUR inter-regional traffic flow
GM-3	Costa Rica, Panama, Honduras, Kingston, Haiti, Santo Domingo, San Juan, Caribbean — Europe	Central America, Panama, Kingston, Port-au-Prince, Curacao, Santo Domingo, San Juan – EUR	High-density oceanic	CAR/ NAT/EUR intra- and inter-regional main traffic flow
	North America – Eastern Caribbean	New York, Miami, Havana, San Juan, Santo Domingo, Piarco	High-density oceanic	West Atlantic Route System CAR/NAM inter-regional traffic flow

Chapter 4: Air Traffic Management (ATM)

4.1 Introduction

4.1.1 The general purpose of ATM, according to the Global ATM Operational Concept, is to achieve an inter-functional global air traffic management system for users during all flight phases that meets agreed operational safety levels, provides optimum operations, is environmentally sustainable and fulfils national security requirements.

4.1.2 The future system should evolve from the current system in such a way that user requirements are met as fully as possible, according to clearly-established operational requirements. The fact is that the most difficult problems ATM system designers must resolve are transition and integration. It is virtually impracticable to evolve from one system to another over a period of less than several years.

4.1.3 The design of the airspace structure should not be restricted by airspace boundaries and divisions. Planning should be coordinated between adjacent areas in order to achieve a continuous airspace in which the user will not perceive any divisions. That airspace should be free from operational discontinuities and inconsistencies and should be organised to meet the needs of different types of users when the time comes. Transition between areas should be seamless to users at all times.

4.1.4 Planning and implementation of ATM Operational Concept components should include study of their impact on and requirement for human resources.

4.1.5 Some benefits to be expected from implementation of these components are enhanced safety, fuel savings for users, less delays and gas emissions and an increase in system capacity.

4.1.6 Air traffic management evolution in the CAR/SAM Regions has been carefully planned to avoid degradation of current system performance. It is necessary, as progressive improvements are made in air navigation efficiency throughout the transition period, to ensure at least the present operational safety level. Aircraft should not be unnecessarily burdened with the need to carry a multiplicity of CNS equipment, both existing and new, over the lengthy transition cycle.

4.2 General principles

4.2.1 All States, Territories and International Organisations in the CAR/SAM Regions should be guaranteed unrestricted access to the air navigation services covered by this document.

4.2.2 It is recognised that CAR/SAM States/Territories and International Organizations need to comply fully with national plans and with standards governing use of the new systems.

4.2.3 States/Territories and International Organizations should accept the global nature of the ATM operational concept and have the firm intention to facilitate the integration mechanisms needed for its timely implementation.

4.2.4 Depending on the requirements identified for an adequate air traffic management level in the CAR/SAM Regions, CNS infrastructure should be carefully planned.

4.2.5 CNS elements should be introduced progressively in the light of the benefits they will provide to the ATM community.

4.3 Implementation strategy

4.3.1 ATM evolution for the CAR/SAM Regions has been planned taking into account the GPIs that could be implemented in the short and medium term. These Initiatives will be applied to the main international traffic flows identified in homogeneous areas as well as in the main terminal areas and will produce operational benefits for the ATM community. The ATM performance objectives not only set forth the necessary requirements for ATM improvements, but also specify the implementation dates for planned improvements, together with performance goals and the main GPI implementation tasks.

4.4 ATM evolution in the CAR/SAM Regions

4.4.1 General

4.4.1.1 ATM evolution is based on Global Plan Initiatives applied to:

a) Air operations in general

b) En-route operations; and

c) TMA operations

4.4.2 Air operations in general

4.4.2.1 This portion of the Plan includes Global Plan Initiatives that are applied to air operations in general that cannot be considered en-route and/or TMA operations.

4.4.2.2 Flexible use of airspace (FUA)

4.4.2.2.1 Strategic coordination and dynamic interaction will facilitate an optimum, balanced and equitable civil/military use of airspace, which, in turn will permit the establishment of optimum flight paths, while reducing operational costs for airspace users.

4.4.2.2.2 CAR/SAM States, Territories and International Organisations should establish policies on the use of temporary or permanent restricted airspace in order to avoid, as much as possible, the adoption of airspace restrictions, particularly on a permanent basis.

4.4.2.2.3 The first step in the process of implementing the Flexible Use of Airspace should be to evaluate dangerous, restricted and prohibited airspaces that impede or that could prevent aircraft flow.

4.4.2.2.4 The establishment of letters of agreement between ATS units and military units or other users for the dynamic and flexible use of airspace should eliminate restrictions on airspace use, thus making it possible to accommodate the needs of all airspace users.

4.4.2.2.5 Where airspace restriction is unavoidable, the letters of agreement should stipulate that the blockage will last no longer than necessary. In such cases, other paths should be developed for the dynamic re-routing of aircraft to enable them to avoid those airspaces.

4.4.2.2.6 Those paths should then be published in the AIPs to warn users of the need to consider said deviations in their flight planning.

4.4.2.2.7 FUA implementation involves convincing military authorities of the States involved that their needs will be met, independently of the application of airspace restrictions. It will, therefore, be necessary to hold seminars/meetings with those authorities to demonstrate the importance of optimised airspace use.

4.4.2.3 **Air traffic flow management**

4.4.2.3.1 The application of timely demand and capacity balancing measures will avoid overburdening the ATM system and provide the necessary conditions for maximising the use of airport and ATC capacity. This will significantly increase airspace capacity and enhance operational efficiency.

4.4.2.3.2 Inasmuch as air traffic congestion and saturation problems in the CAR/SAM Regions are still very specific, the application of air traffic flow management measures should start gradually to allow States, Territories and International Organisations to gain experience, particularly in calculating and maximising ATC and airport capacities.

4.4.2.3.3 The implementation of ATFM in the CAR/SAM Regions should take into account the objective and principles established in Appendix AL to Item 3 of GREPECAS/13, stressing that ATFM measures should foster maximum use of existing capacity without jeopardising safety. Furthermore, it is important to emphasise that AFTM measures should not be used to resolve the occasional deficiencies intrinsic to the ATM system.

4.4.2.3.4 The CAR and SAM ATFM Operational Concept, establishes a simple implementation strategy which should be developed in stages, in such a way to ensure the maximum utilisation of the available capacity and permit all parties concerned to obtain sufficient experience.

4.4.2.3.5 The experience acquired in other Regions and by some States/Territories and International Organizations of the CAR/SAM Regions, permits the application of ATFM basic procedures in airports, without the immediate need for a Centralised ATFM. A Centralised ATFM shall demand ample studies to define operational concepts, requirements of the systems and institutional aspects for ATFM implementation in the CAR/SAM Regions.

4.4.2.3.6 In this way, ATFM will be implemented by stages in the CAR/SAM Regions, in response to established operational requirements, as foreseen in the ATFM Operational concept for the CAR/SAM Regions.

Centralised ATFM

4.4.2.3.7 The implementation of the Centralised ATFM should take into account two scenarios, CAR and SAM but which could be modified as progress is made in the development of implementation plans. The strategy is to develop harmonised planning in an ATFM inter-regional CAR and SAM System.

4.4.2.3.8 In order to maximise its efficiency, a Centralised ATFM should have the responsibility to provide service on the maximum extension of possible airspace, provided that it is homogeneous. According to ATFM planning in the CAR and SAM Regions, at least two Centralised ATFMs will be available, one for each Region.

4.4.2.3.9 It is necessary that procedures during all the process of implementation be developed in a harmonious manner between ATFM units to avoid risks in safety. This implies to establish a regional and inter-regional strategy which facilitates and harmonises all the implementation process. Each phase should be implemented, based on operational configurations, descriptive documents of the systems and operational models, as per the established strategy.

4.4.2.3.10 In order to harmonise National Plans with the CAR/SAM ATFM Regional Plan, it is necessary that civil aviation administrations take measures required and make a closer follow-up of the ATFM regional development and prepare an ATFM Implementation Programme, where the needs for implementation are determined analysed, and the impact is analysed as regards ATC national system, airspace, air traffic services, operations, and airport services.

4.4.2.3.11 Most States, Territories and International Organisations are expected, when centralised ATFM becomes available, to implement tactical airspace ATFM by making the relevant institutional arrangements and considering the most favourable cost-benefit ratio.

4.4.2.3.12 In order to provide Air Traffic Flow Management (ATFM) service, the centralised ATFM in the CAR and SAM Regions should perform the following activities:

a) Set up and maintain a database in the region where it operates, regarding:

- ✓ air navigation infrastructure, air traffic service (ATS) units and registered aerodromes
- ✓ relevant ATC and airport capacity; and
- ✓ data on foreseen flights

b) Establish a coherent table of predicted traffic demand, its comparison with available capacity and determination of critical traffic overload zones and durations foreseen;

c) Coordinate as needed to increase the available capacity where necessary;

d) When deficiencies in available capacity cannot be eliminated, determine and duly implement ATFM measures where needed, coordinated beforehand with interested aircraft operators and aerodromes;

e) Monitor the outcome of the measures implemented;

f) Coordinate ATFM service with the other centralised ATFM units where needed.

4.4.3 En-route operations

4.4.3.1 ATM evolution for en-route operations took into account the main GPIs applicable to the CAR/SAM Regions and was planned in such a way as to permit optimum airspace management and organisation.

4.4.3.2 Homogeneous areas and main continental and oceanic traffic flows were taken into account and an ATM evolution table was prepared.

4.4.3.3 Implementation of performance-based navigation

4.4.3.3.1 Implementation of PBN will foster use of advanced aircraft navigation capabilities which, when combined with air navigation infrastructure, will make it possible to optimise the airspace, including the route network. This, in turn, will contribute to the establishment of an ATS routing environment that meets the needs of airspace users and reduces controller and pilot workload and aircraft concentration in portions of the airspace.

4.4.3.3.2 PBN implementation for en-route operations will require establishing exclusionary airspaces because they offer the conditions for making the necessary changes in airspace structure. The vertical boundaries of the airspace where PBN is to be implemented should be thoroughly analysed, in order not to exclude a large number of users.

Short term

4.4.3.3.3 No major changes are expected in the existing airspace structure, given the low density of air traffic in the oceanic airspaces. The sole exception will be the application of RNP-10 in the region known as WATRS, which will provide significant benefits in the CAR Region. No changes are expected in the short term in airspaces where RNP-10 (EUR/SAM Corridor, Lima-Santiago de Chile routes and South Atlantic Random Route System) is applied.

4.4.3.3.4 It is expected that RNAV-5 will be implemented in selected continental airspaces where operational benefits can be obtained and the existing CNS infrastructure is capable of supporting its use.

Medium term

4.4.3.3.5 It is expected that RNP-4 will be applied in the EUR/SAM Corridor and in the Santiago de Chile/Lima route segment, with the utilisation of ADS/CPDLC to permit a 30 NM lateral and longitudinal separation. Materialisation of this application will depend upon the evolution of the aircraft fleet operating in these airspaces.

4.4.3.3.6 It is expected that in this phase RNP-2 will be applied in selected continental airspaces, with the exclusive use of GNSS, since the ground infrastructure will not support RNAV. It will be necessary to establish a GNSS back-up system and develop contingency procedures for the possible failure of the GNSS. RNP-2 implementation will facilitate PBN application in airspaces without ATS surveillance service. Exclusive GNSS use will mean that the GNSS signal will need to broadcast more information.

4.4.3.4 ATM Situational awareness and implementation of data link applications

4.4.3.4.1 ADS-C and CPDLC application in oceanic airspaces will promote the necessary conditions for use of 30 NM horizontal separation minima in the EUR/SAM Corridor and in the Santiago de Chile/Lima route segment. Furthermore, in other oceanic airspaces with less air traffic density, ADS-C and CPDLC will provide reliable means of surveillance and communication, thereby reducing controller and pilot workload.

4.4.3.4.2 Application of improved surveillance techniques (ADS-B and/or multilateration) in continental airspace will make it possible to reduce horizontal separation minima, improve safety, increase capacity and improve flight efficiency profitably. Use of other data link applications instead of voice communications offers significant advantages in terms of safety and pilot and controller workload.

4.4.3.4.3 These benefits can be obtained by providing surveillance in areas not equipped with primary or secondary radars, when justified by cost-benefit analysis. In airspaces where radar is used, improved surveillance can enhance the quality and reliability of surveillance information both on the ground and in the air. States, Territories and International Organisations should make a consistent cost-benefit analysis to determine whether when the time comes for PSR and/or SSR systems to be replaced, it would be desirable to replace them with ADS-B systems or multilateration.

4.4.3.4.4 CPDLC use in continental airspace with high traffic density should be evaluated, considering that the characteristics of ATC interventions could make it unviable.

4.4.3.4.5 Gradual implementation of ATS inter-facility data communication (AIDC) will improve airspace safety and reduce coordination errors between ATS units.

4.4.3.4.6 In implementing ATS surveillance systems and data link applications, consideration should be given to the corresponding aspects of automation, particularly the need to harmonise the systems applied in order to ensure their interoperability.

4.4.3.4.7 Furthermore, ATM automation tools (minimum safe altitude warning; conflict prediction; conflict alert; conflict resolution advisory; path conformance control; functional integration of ground systems with aircraft systems, etc.) should also be considered when implementing ATS surveillance systems and data link applications.

4.4.4 **TMA operations**

4.4.4.1 Evolution of air traffic management in terminal areas should be harmonised with ATM evolution for en-route operations, making it possible to obtain a harmonious and integrated ATM system.

4.4.4.2 ATM evolution for TMA operations took account of the combination of different GPIs applicable to the CAR/SAM Regions and was planned to allow for optimum airspace management and organisation.

4.4.4.3 The table on the Optimisation of TMA structure combined GPIs 5, 10, 11 and 12, all of which concern the optimisation of TMA airspace structure, using SIDs and STARs based on RNAV-, RNP- and/or FMS based approach procedures, as well as application of TMA design and management techniques and the functional integration of ground and on board systems.

4.4.4.4 The table referring to situational awareness and data link application combined GPIs 9 and 17 in view of the close relationship between the application of improved surveillance techniques (ADS-B and/or multilateration) and the use of data link applications.

4.4.4.5 Many elements must be taken into account in planning the requirements for an air navigation service infrastructure in a TMA. In addition to traffic volume, other factors to be considered include, *inter alia*, the number and location of aerodromes, traffic characteristics, topography, meteorological conditions, etc. Consequently, States, Territories and International Organisations should be responsible for studying each TMA in particular and determining, in coordination with users, the requirements for implementing the corresponding air navigation services.

4.4.4.6 Optimisation of TMA structure

4.4.4.6.1 The following measures will optimise TMA airspace structure:

a) Implementing PBN, including SIDs and STARs with RNP and RNAV, and RNP approach procedures.

b) Functional integration of ground and on board systems.

c) Using improved design and management techniques.

4.4.4.6.2 Implementation of performance-based navigation

4.4.4.6.2.1 TMA operations have unique features because of the separation minima applicable between aircraft and between aircraft and obstacles. All aircraft are involved, including low-performance aircraft and use the same or nearby paths for their arrival and departure procedures as those of high-performance aircraft.

4.4.4.6.2.2 In this sense, States/Territories and International Organisations need to develop their own national plans for implementing PBN in TMAs, based on the CAR/SAM PBN Road Map. An effort will be made to harmonise aircraft separation criteria and applicable RNAV and/or RNP criteria, to avoid the need to obtain multiple approvals for intra- and inter-regional operations.

4.4.4.6.2.3 The efficiency with which TMA operations are carried out in a PBN environment will depend upon Aerodrome Design and Management (GPI 13) and Runway Operations (GPI 14), inasmuch as the airport infrastructure will have to absorb any increase in air traffic flow in TMA operations.

Short term

4.4.4.6.2.4 RNAV-1 is expected in TMAs selected by States/Territories and International Organizations in environments equipped with ATS surveillance and appropriate ground navigation infrastructure that will permit the performance of DME/DME and DME/DME/INS operations. Both equipped and non-equipped aircraft will be allowed to operate during this phase and once a suitable percentage of approved air operations have been reached, RNAV-1 operations should be started.

4.4.4.6.2.5 RNP-1 application is expected in TMAs selected by, States/Territories and International Organizations, where there is no ATS surveillance service and/or appropriate ground navigation infrastructure, with exclusive application of GNSS, provided that there are a suitable percentage of approved air operations. Even so, when the corresponding operational benefits are confirmed, both approved and not approved aircraft will be allowed to operate. Whether overlay or exclusive RNP procedures are applied will depend upon air traffic complexity and density.

4.4.4.6.2.6 RNP 0.3 (basic GNSS) approach procedures are expected in as many airports as possible, particularly those where international flight operations are conducted, while not-equipped aircraft will continue to use conventional approach procedures.

4.4.4.6.2.7 RNP AR approach procedures are also expected in airports where their operational benefits are evident because of the existence of significant obstacles.

Medium term

4.4.4.6.2.8 During this phase, the expansion of RNAV or RNP 1 application is expected in TMAs selected by States/Territories and International Organizations, depending upon the ground infrastructure and aircraft navigation capabilities. RNAV or RNP 1 equipment will be mandatory in the more complex TMAs (exclusionary airspace), while in the less complex TMAs the operations of equipped and non-equipped aircraft will still be allowed.

4.4.4.6.2.9 The expanded application of RNP 0.3 and RNP AR procedures is expected in selected airports during this phase. The application of the GLS procedure is also expected to start, which will improve the transition from the TMA to the approach phase, basically using the GNSS for both phases.

4.4.4.6.3 Functional integration of ground and on board systems

4.4.4.6.3.1 States, Territories and International Organisations are expected to study the feasibility of using functional integration of ground and on board systems, with a view to apply flight procedures that provide the most efficient trajectory during approach of an aircraft to the destination aerodrome. These procedures shall enable an un-interrupted flight trajectory from the beginning of the descent until the aircraft is stabilized for the landing.

4.4.4.6.3.2 The optimization of efficiency in TMAs shall depend of the major possible use of automation. Also, in addition to the application of the continuous descent capacities, aircraft shall be each time more equipped with calculation in arrival time. This capacity shall be integrated with ground automated systems, in order to identify specific flight schedules. These schedules should assist in the landing sequence process enabling aircraft to stay near their 4D preferred trajectories.

4.4.4.6.4 The use of improved design and management techniques

4.4.4.6.4.1 Airspace planners should apply design techniques to TMA restructuring, in order to:

a) Validate the proposed airspace structure.

b) Evaluate the impact of implementing PBN, including RNAV and/or RNP SID and STAR procedures, RNP approach procedures and FMS-based arrival procedures, using ATC simulations where necessary.

c) Ensure a favourable cost-benefit ratio.

d) Optimise sectorisation to make it seamless to users and balanced in terms of workload.

4.4.4.6.4.2 To improve TMA management, consideration should be given to implementing the WGS-84 and taking measures to optimise air traffic management and capacity, including a collaborative decision-making process involving the tower, TMA and en-route sectors, while strategically encompassing airspace users.

4.4.4.7 ATM Situational awareness and implementation of data link applications

4.4.4.7.1 In addition to the considerations set out in paragraph 4.4.3.4, which are also applicable to TMA operations, the States, Territories and International Organisations should consider the following aspects when implementing ATS surveillance services and data link applications in the TMA:

4.4.4.7.2 The implementation of improved surveillance techniques (ADS-B and/or multilateration) in TMAs will permit the integration of en-route and TMA operations.

4.4.4.7.3 The use of ATS surveillance systems (SSR, ADS-B and/or multilateration), it will be possible to apply RNAV-based navigation techniques without having to rely on RNP because that surveillance will allow the monitoring of flights in order to detect any possible deviation from their path. Thus, users that would not be approved for RNP operations could be included in TMA operations.

4.4.4.7.4 Implementation of improved surveillance techniques would facilitate the operation of aircraft without RNAV/RNP approval because it would allow controllers to route them through vectors up to their final approach.

4.4.4.7.5 CPDLC is not expected in TMAs, given the characteristics of ATC intervention in these airspaces. Data link applications, such as D-ATIS and digital flight plan clearances (DCL), however, will reduce the workload of controllers and pilots.

4.4.4.7.6 The fact that TMA users may not be equipped with data link systems must be considered, given that a large number of low-performance aircraft fly in this airspace and may not have the capacity to be properly equipped. In that case, procedures should be developed to permit the flight of unequipped aircraft, unless the air traffic density justifies use of exclusionary airspaces.

Appendix 1 to Chapter 4

ATM PERFORMANCE OBJECTIVES

<table>
<tr><th colspan="4">OPTIMIZE THE ATS ROUTE STRUCTURE IN BOTH
TERMINAL AND EN-ROUTE AIRSPACE</th></tr>
<tr><td colspan="4">Benefits</td></tr>
<tr><td>Environment
Efficiency</td><td colspan="3">• reductions in fuel consumption;
• ability of aircraft to conduct flight more closely to preferred trajectories;
• increase in airspace capacity;
• facilitate utilization of advanced technologies (e.g., FMS based arrivals) and ATC decision support tools (e.g., metering and sequencing), thereby increasing efficiency.</td></tr>
<tr><td colspan="4">Strategy
Short term (2010)
Medium term (2011 - 20015)</td></tr>
<tr><th>TASK</th><th>DESCRIPTION</th><th>START-END</th><th>STATUS</th></tr>
<tr><td>AOM</td><td>En-route airspace
• analyze the en-route ATS route structure and implement all identifiable improvements;
• implement all remaining regional requirements (e.g. RNP 10 routes); and
• finalize implementation of WGS-84
• monitor implementation progress
• develop a strategy and work programme to design and implement a trunk route network, connecting major city pairs in the upper airspace and for transit to/from aerodromes, on the basis of PBN and, in particular, RNAV/5, taking into account interregional harmonization;
In terminal airspace
• develop a regional strategy and work programme for implementation of optimized standard instrument departures (SIDs), standard instrument arrivals (STARs), instrument flight procedures, holding, approach and associated procedures, on the basis of PBN and, in particular RNAV/1 and 2; and
• monitor implementation progress</td><td>2005-2008

2008-2011</td><td></td></tr>
<tr><td>References</td><td colspan="3">GPI/5: performance-based navigation, GPI/7: dynamic and flexible ATS route management, GPI/8: collaborative airspace design and management, GPI/10: terminal area design and management, GPI/11: RNP and RNAV SIDs and STARs and GPI/12: FMS-based arrival procedures.</td></tr>
</table>

IMPLEMENT RNP APPROACHES			
Benefits			
Efficiency **Safety**	• Improvements in capacity and efficiency at aerodromes. • Improvements in safety at aerodromes.		
Strategy **(2008-2015)**			
TASK	**DESCRIPTION**	**START-END**	**STATUS**
AOM	• development of a regional strategy and work programme for implementation of RNP approaches at aerodromes where aircraft weighing 5700 kg or more are operated, on the basis of the transition plan as follows: **Stage 1** – Evaluate existing procedures, determine compatibility of use with RNAV overlay routes **Stage 2** – Carry out cost benefit analysis and safety assessments of RNAV procedures **Stage 3** – Use existing radar vectoring patterns as the basis for RNAV departure and arrival tracks **Stage 4** – Evaluation and simulation of procedures **Stage 5** – Design stand-alone RNAV procedures **Stage 6** – Training phase **Stage 7** – Publish new procedures and introduce into new service, meet AIRAC dates **Stage 8** – Operational review **Stage 9** – Removal of conventional procedures • monitor implementation progress		
References	GPI/5: performance-based navigation, GPI/7: dynamic and flexible ATS route management, GPI/8: collaborative airspace design and management, GPI/10: terminal area design and management, GPI/11: RNP and RNAV SIDs and STARs and GPI/12: FMS-based arrival procedures.		

ENHANCE CIVIL/MILITARY COORDINATION AND CO-OPERATION			
Benefits			
Efficiency	• increase airspace capacity;		
Continuity	• allow a more efficient ATS route structure • ensure safe and efficient action in the event of unlawful interference; • make available military restricted airspace more hours of the day so that aircraft can fly on their preferred trajectories; and • improve search and rescue services.		
Strategy (2008-2012)			
TASK	**DESCRIPTION**	**START-END**	**STATUS**
AOM	• develop guidance material on civil/military coordination and co-operation to be used by States/Territories to develop national policies, procedures and rules; • establish civil/military coordination bodies; • arrange for permanent liaison and close cooperation between civil ATS units and appropriate air defense units; • conduct a regional review of special use airspace; • develop a regional strategy and work programme for implementation of flexible use of airspace in a phased approach beginning with more dynamic sharing of restricted airspace while working towards full integration of civil and military aviation activities by **2012**; and • monitor implementation progress		
References	GPI/1: flexible use of airspace.		

ALIGN UPPER AIRSPACE CLASSIFICATION			
Benefits			
Efficiency **Continuity**	• better utilization of data link communication; • optimize use of flight plan data processing systems; • enhance airspace management coordination, message exchange capabilities and utilization of flexible and dynamic airspace management techniques; • harmonization of interregional coordination processes; • improvement of airspace interoperability and seamlessness; and • ensure the provision of positive air traffic control services to all aircraft operations.		
Strategy ***(Target: 2008)***			
TASK	**DESCRIPTION**	**START-END**	**STATUS**
AOM	• Develop a regional implementation strategy and work programme for the implementation of ICAO Annex 11 airspace Class A above FL 195. • identify key stakeholders, ATCOs, pilots, and relevant international organisations for coordination and cooperation on changes for new airspace organization, using a CDM process; • develop new national airspace organization in accordance with ICAO provisions, as needed; • Coordinate changes for regional and national documents; • Doc 8733, CAR/SAM ANP; • AIP; and, • ATS letters of agreement • carry out improvements in ground systems to support new airspace organization configurations, as necessary; • publish national regulatory material for implementation of new rules and procedures to reflect airspace organizational changes; • train ATCOs and pilots in new procedures, including all civil and military airspace users, as required; • monitor implementation progress.		
References	GPI/4: align upper airspace classification.		

IMPROVE DEMAND AND CAPACITY BALANCING			
Benefits			
Environment	• reduction in weather- and traffic-induced holding, leading to reduced fuel consumption and emissions;		
Efficiency	• improved and smoother traffic flows; • improved predictability; • improved management of excess demand for service in ATC sectors and aerodromes; • improved operational efficiency; • enhanced airport capacity; • enhanced airspace capacity; and		
Safety	• improved safety management.		
Strategy ***Near term (2008)***			
TASK	**DESCRIPTION**	**START-END**	**STATUS**
DCB	• identify key stakeholders (ATC service providers and users, military authorities, airport authorities, aircraft operators and relevant international organisations) for purposes of coordination and cooperation, using a CDM process; • identify and analyse traffic flow problems and develop methods for improving efficiencies on a gradual basis, as needed, through enhancements in current: o airspace organization and management (AOM) and ATS routes structure (unidirectional routes) and SID and STARS, o communication, navigation and surveillance systems, o aerodrome capacity, o ATS capacity, o training for pilots and Controllers; and o ATS letters of agreement; • define common elements of situational awareness between FMUs; o common traffic displays, o common weather displays (Internet), o communications (teleconferences, web), and o daily teleconference/messages methodology advisories; • develop methods to establish demand/capacity forecasting; • develop a regional strategy and work programme for harmonized implementation of ATFM service; and,		

Medium term (2010)			
	• develop a regional strategy for the implementation of flexible use of airspace (FUA); o assess use of airspace management processes; o improve current national airspace management to adjust dynamic changes in tactical stage to traffic flows; o introduce improvements in ground support systems and associated procedures for the extension of FUA with dynamic airspace management processes; o implement dynamic ATC sectorization in order to provide the best balance between demand and capacity to respond in real-time to changing situations in traffic flows, and to accommodate in short-term the preferred routes of users; • define common electronic information and minimum databases required for decision support and alerting systems for interoperable situational awareness between Centralized ATFM units; • develop regional procedures for efficient and optimum use of aerodrome and runway capacity; • develop a regional ATFM procedural manual to manage demand/capacity balancing; • develop a regional strategy and framework for the implementation of a Centralized ATFM unit; • develop operational agreements between Centralized ATFM units for interregional demand/capacity balancing; and, • monitor implementation progress.		
References	GPI/1: flexible use of airspace; GPI/6: air traffic flow management; GPI/7: dynamic and flexible ATS route management; GPI/9: Situational awareness; GPI/13: aerodrome design and management; GPI/14: runway operations; and GPI/16: decision support and alerting systems.		

IMPROVE ATM SITUATIONAL AWARENESS			
Benefits			
Efficiency	• enhanced traffic surveillance; • enhanced collaboration between flight crew and the ATM system; • improved collaborative decision-making through sharing electronic aeronautical data information; • reduced of workload for both pilots and controllers; • improved operational efficiency; • enhanced airspace capacity; • improved implementation on a cost-effective basis;		
Safety	• improved available electronic terrain and obstacle data in the cockpit; • reduced of the number of controlled flight into terrain related accidents; and • improved safety management.		
Strategy ***Near term (2010)***			
TASK	**DESCRIPTION**	**START-END**	**STATUS**
SDM	• identify parties concerned • identify the automation level required according to the ATM service provided in airspace and international aerodromes, assessing o operational architecture design, o characteristics and attributes for interoperability, o data bases and software, and o technical requirements; • improve ATS interfacility communication • implement flight plan data processing system and electronic transmission tools • implement radar data sharing programs where benefits can be obtained • develop situational awareness training programmes for pilots and controllers • implement ATM surveillance systems for situational traffic information and associated procedures • implement ATS automated message exchanges, as required o FPL, CPL, CNL, DLA, etc. • implement automated radar handovers, where able; • implement ground and air electronic warnings, as needed o Conflict prediction o Terrain proximity o MSAW o DAIW o Surveillance system for surface movement • implement data link surveillance technologies and applications: ADS, CPDLC, AIDC, as required.		

Medium term (2015)			
	• implement additional/advanced automation support tools to increase sharing of aeronautical information o ETMS or similar o MET information o AIS/NOTAM dissemination o Surveillance tools to identify airspace sector constraints o A-SMGC in specific aerodromes, as required • implement teleconferences with ATM stakeholders • monitor implementation progress		
References	GPI/1: flexible use of airspace; GPI/6: air traffic flow management; and GPI/7: dynamic and flexible ATS route management; GPI/9: Situational awareness; GPI/13: aerodrome design and management; GPI/14: runway operations; and GPI/16: decision support and alerting systems; GPI/17: implementation of data link applications; GPI/18: aeronautical Information; GPI/19: meteorological systems.		

- END -

Chapter 5: Communications

5.1 Introduction

5.1.1 CAR/SAM States, Territories and International Organisations should, when implementing communications systems, consider the operational requirements set out in Chapter 4 of this Plan.

5.1.2 Implementation of communications systems in the CAR/SAM Regions should be planned considering GPIs 22 and 23 and bearing in mind the functionalities that could be implemented in the short and medium term.

5.1.3 Consideration should be given, in the evolution of the aeronautical mobile and fixed communications infrastructure, to applying voice and data communications so that that infrastructure can adapt to the new functions and offer the appropriate service capacity and quality to support ATM requirements.

5.1.4 Communications systems should be implemented based on the results of cost-benefit analyses of the different scenarios available, by comparing the existing structure with the improvements to be obtained if the new systems are implemented. Two or more technologies that meet the same operational requirement should also be studied.

5.1.5 Implementation of the communication systems in the short and medium term should give consideration to the established operational requirements that would meet future ATM expectations, using the following tools, among others:

a) Aeronautical message handling system (AMHS).

b) Very high frequency digital link (VDL).

c) Satellite digital link.

d) Air traffic services interfacility data communications (AIDC).

e) Controller-pilot data link communication (CPDLC).

5.1.6 Communications systems planning should still take into consideration the necessary communications required to effectively support centralised air traffic flow management as regards:

a) Other centralised ATFM systems

b) FMUs, FMPs and/or ATS units involved

c) Operators and users

d) Airport authorities

e) Meteorological authorities

f) Aeronautical information services

g) Radar and ADS data transmission for ATFMC

5.1.7 Implementation of communications systems should be based on a harmonised strategy for the CAR/SAM Regions, taking into account operational requirements and relevant cost-benefit analyses. It should, furthermore, be based on Action Plans to ensure that CAR/SAM States, Territories and International Organisations implement the necessary systems in keeping with consistent timescales.

Planning details for the implementation of communication systems – CNS COMMITTEE

Chapter 6: Navigation

6.1 Introduction

6.1.1 CAR/SAM States, Territories and International Organizations should, when implementing navigation systems, consider the operational requirements set out in Chapter 4 of this Plan.

6.1.2 Implementation of navigation systems in the CAR/SAM Regions should be planned considering GPI 21 and take into account the functionalities that could be implemented in the short and medium term.

6.1.3 Consideration should be given, in the evolution of navigation infrastructure, to technologies that provide the appropriate service capacity and quality for supporting ATM requirements.

6.1.4 Navigation systems should be implemented based on the results of cost-benefit analyses of the different scenarios available, by comparing the existing structure with the improvements to be made if the new systems are implemented. Two or more technologies that meet the same operational requirement should also be studied.

6.1.5 Implementation of the navigation systems in the short and medium term should give consideration to the established operational requirements that would meet future ATM expectations, taking into account, *inter alia*, the following aspects:

a) The ground navigation infrastructure needed for the operations envisioned in the CAR/SAM PBN Road Map.

b) Application of the GNSS for en-route operations without the use of precision values, together with RNAV-5 (continental airspaces) and RNP-4 (oceanic airspaces).

c) Application of the GNSS for TMA operations (RNAV 1).

d) Application of the GNSS for approach operations (RNP 0.3, RNP AR and GLS).

e) The need to apply the SBAS to meet the requirements of the CAR/SAM PBN Road Map.

f) The cost-benefit analysis of SBAS use, bearing in mind the effects of the implementation of GALILEO and of frequency L5 in the GPS.

6.1.6 Implementation of navigation systems should be based on a harmonised strategy for the CAR/SAM Regions that would take into account the operational requirements and relevant cost-benefit analyses. It should, furthermore, be based on Action Plans to ensure that CAR/SAM States, Territories and International Organisations implement the necessary systems in keeping with consistent timescales.

Planning details for the implementation of navigation systems – CNS COMMITTEE

Chapter 7: Surveillance

7.1 Introduction

7.1.1 CAR/SAM States, Territories and International Organisations should, when implementing surveillance systems, consider the operational requirements set out in Chapter 4 of this Plan.

7.1.2 Implementation of surveillance systems in the CAR/SAM Regions should be planned considering GPIs 9 and 17 and bearing in mind the functionalities that could be implemented in the short and medium term.

7.1.3 Consideration should be given, in the evolution of surveillance infrastructure, to technologies that provide the appropriate service capacity and quality for supporting ATM requirements.

7.1.4 Surveillance systems should be implemented based on the results of cost-benefit analyses of the different scenarios available, by comparing the existing structure with the improvements to be made if the new systems are implemented. Two or more technologies that meet the same operational requirement (*e.g.* ADS/B or multilateralism) should also be studied.

7.1.5 Implementation of surveillance systems in the short and medium term should give consideration to the established operational requirements that would meet future ATM expectations, using the following tools, among others:

a) ADS-B

b) ADS-C

c) Multilateralism

d) SSR

e) The combination of the cited tools.

7.1.6 Implementation of surveillance systems should be based on a harmonised strategy for the CAR/SAM Regions that would take into account the operational requirements and relevant cost-benefit analyses. It should, furthermore, be based on Action Plans to ensure that CAR/SAM States, Territories and International Organisations implement the necessary systems in keeping with consistent timescales.

Planning details of the implementation of surveillance systems – CNS COMMITTEE

Chapter 8: Meteorology

8.1 Introduction

8.1.1 CAR/SAM States, Territories and International Organizations should, when implementing meteorological systems, consider the operational requirements set out in Chapter 4 of this Plan.

8.1.2 Implementation of meteorological systems in the CAR/SAM Regions should be planned considering GPI 19 and bearing in mind the functionalities that could be implemented in the short and medium term.

8.1.3 The improvement of the world area forecasting system (WAFS), the international airways volcano watch (IAVW) and the ICAO tropical cyclone warning system will contribute to airspace optimisation by improving the precision, timely distribution and usefulness of the information developed by those systems. At the same time, by increasing the use of data links for transmitting meteorological information through uplinks and downlinks to help in the automatic sequencing of aircraft for their approach procedure, capacity will be maximised.

8.1.4 The global ATM system requires immediate access to world meteorological information in real time. These strict requirements will demand the automation of most meteorological systems. The automatic downloading, by means of downlinks, of MET data included in ADS messages will provide precise information about upper wind fields and wind profiles in real time. Increasing use should be made of data links to transmit information about meteorological conditions to aircraft by means of uplinks during approach and departure procedures, including the application of the data link-automatic terminal information service (D-ATIS) and D-VOLMET.

8.1.5 These improvements will give ATC units display access to precise upper wind fields both in the form of WAFS world upper wind forecasts and wind fields and wind profiles “in real time,” derived from wind information automatically transmitted by aircraft through the automatic dependent surveillance (ADS) system and reports and forecasts of hazardous meteorological conditions, particularly volcanic ash, tropical cyclones, storms, clear air turbulence, icing and wind shear. This information will help ATM make tactical decisions for aircraft surveillance, air traffic flow management and flexible and dynamic aircraft routing and will contribute to the optimisation of airspace use.

Planning details of the implementation of meteorological systems – MET Subgroup

Chapter 9: Aeronautical Information Services

9.1 Introduction

9.1.1 CAR/SAM States, Territories and International Organisations should, when implementing Aeronautical Information Services, consider the operational requirements set out in Chapter 4 of this Plan.

9.1.2 Implementation of Aeronautical Information Services in the CAR/SAM Regions should be planned considering GPI 18, taking into account the functionalities that could be implemented in the short and medium term.

9.1.3 ATM, RNAV, RNP and FMS requirements introduced the need for corresponding new AIS requirements to ensure the quality and timely distribution of the information. In order to be able to provide information and meet these new requirements, the traditional aeronautical information service function will become an information management service, modifying its obligations and responsibilities.

9.1.4 Real-time quality electronic data (aeronautical information about the terrain and obstacles) is needed to facilitate coordination, enhance efficiency and safety and ensure that the different members of the ATM community possess the same information when they make collaborative decisions. By equipping aircraft with geographical reference data sets containing information for the en-route, terminal and aerodrome phases, pilots will have enhanced situational awareness during those operations, thanks to electronic data. The same information can be provided at different ATC positions and pre-flight planning units, and airline flight planning departments or general or private aviation users can have access to it. Electronic data can be adapted and their format modified to meet the requirements of ATM users and adjust to its applications. Standard data formats will be used to create databases into which data sets of an assured quality will be entered.

Planning details of the implementation of aeronautical information services – AIS/MAP Subgroup

Chapter 10: Aerodromes and Ground aids / Aerodrome Operational Planning

10.1 Introduction

10.1.1 CAR/SAM States, Territories and International Organisations should consider the operational requirements set out in Chapter 4 of this Plan when undertaking Aerodrome Operational Planning, including Ground Aids.

10.1.2 Aerodrome operational planning in the CAR/SAM Regions should be undertaken considering GPIs 13 and 14, taking into account the functionalities that could be implemented in the short and medium term.

10.1.3 The efficiency of TMA operations in a PBN environment will depend upon aerodrome design and management (GPI 13) and runway operations (GPI 14), inasmuch as aerodromes will have to absorb any increases in TMA air traffic flow.

10.1.4 Aerodrome operational planning should consider use of simulation tools to ensure the efficiency of runway and apron operations. To foster integrated design and management, it is also necessary to consider the use of combined airport and airspace simulations.

10.1.5 Activities to improve design and management, including coordination and collaboration among ATM service providers, vehicle operators and aircraft operators, can have an important impact on safety and aerodrome capacity.

10.1.6 Local collaborative decision-making should seek the sharing of key data on flight scheduling, so that all participants (aerodromes, ATC, ATFM, aircraft operators, and ground service providers) will have a more precise knowledge of aircraft status throughout the entire process. This would permit the adoption of minimum and precise ATFM measures and make flight scheduling more predictable. Some of the benefits to be obtained include a more efficient use of aerodrome and ground service resources, reduction of delays and greater predictability of flight schedules.

10.1.7 As an integral part of the air navigation system, the aerodrome must provide ground infrastructure including, among others, lights, taxiways, landing and departure runways and surface precision orientation systems, in order to improve safety and maximise the airport capacity in any weather condition. The ATM system must permit the efficient use of the airport infrastructure, in order to ensure the optimum use of airports, through the following actions:

a) runway occupation time must be reduced, where efficiency and capacity benefits may be obtained

b) ensure the execution of safe manoeuvres in any weather condition, in order to maintain VMC and IMC capacity

c) where necessary, surface precision orientation systems from/to the runway shall improve capacity and efficiency.

d) The position (with the appropriate precision level) and intentions of all vehicles and aircraft operating in the movement and manoeuvring areas must be known and available for the ATM community members in those aerodromes where it is possible to obtain a cost-benefit relationship showing a significant increase in the capacity and efficiency.

10.1.8 The first step in improving runway operation performance is to establish runway capacity reference values, which are usually defined as the maximum number of flights for which an aerodrome can provide routine services in one hour of operations with meteorological minima superior to Category I. These reference values are calculations that vary according to the runway configurations and combination of aircraft types involved. The goal should be the most appropriate use of aircraft capabilities and available runways to bring the number of all-weather operations as close as possible to the number of operations under visual meteorological conditions.

10.1.9 Reaching optimum capacity for each runway is a complex task that encompasses many factors, both tactical and strategic. In order to perform this task effectively, it is essential to gauge the effects of the changes and to monitor the performance of airspace users and ATM providers. Pilot and controller performance analysis would be applied in the latter case, recognising the need to maintain the trust of users and to work within the existing safety culture. A system of performance indicators should be designed to serve as the basis for taking the measurements and performing the analyses. Flight operations and ATM factors are among the tactical elements that affect runway occupancy. The aspects relating to flight operations include operator performance, effects of company procedures, use of airport infrastructure and issues of aircraft performance.

10.1.10 Limitations in runway capacity are defined by the procedures, the design of the surface area, aircraft performance capabilities, surveillance capability, aircraft spacing and meteorological limitations. Application of improved procedures to minimise spacing, such as the application of reduced runway separation minima, precision runway monitoring (PRM) and RNP and RNAV approaches for parallel runways not far from one another, will optimise spacing capacity.

Details of Aerodrome Operational Planning – AGA/AOP Subgroup

Chapter 11: Development of Human Resource Training requirements

11.1 Adequate provision of Air Navigation Services will depend upon the training of technical and operational personnel, together with their availability in large enough numbers to handle the different services.

11.2 Introducing ATM Operational Concept components will have a major impact on aeronautical personnel, both ground personnel and flight crews. For that reason, training is one of the key elements for a successful transition.

11.3 In the past, aeronautical technologies evolved gradually and instructors were generally able to meet the challenges created by change, even though they did not always have refined training methodologies and instruments available. The new CNS/ATM systems, however, are based on many new concepts that affect all areas of air navigation services and for that reason their implementation poses an even more serious challenge for instructors.

11.4 Many aeronautical disciplines will be modified as a result of the introduction of ATM Operational Concept components and it is likely that new training will be needed for several of these disciplines. The most important changes appear to have resulted form the need for a greater use of computers, data communications and automation.

11.5 New aeronautical disciplines will emerge with the introduction of ATM Operational Concept components. It will be necessary, from the viewpoint of human resource planning, to redistribute and train personnel.

11.6 The plans to study and complexity of the different disciplines has increased in such a manner that it deserves implementation of a professional status within the educational framework of States.

11.7 The need for training and course preparation will be especially strong during the transition stage. Not only will a large number of personnel have to be recycled or trained in new technologies, equipment and procedures, but a large enough number of skilled personnel will have to maintain their competence in the necessary skills to keep the older systems running and in good repair.

11.8 In planning the training of human resources for the implementation of the ATM Operational Concept components, it will be necessary to keep the specific requirements of each of the implementation activities in mind. An example that can be used are the PBN training requirements that involve airspace planning activities, design of air navigation procedures, airspace safety assessment, aircraft and operator approval and controller and pilot training.

11.9 Training planning in the CAR/SAM Regions should be handled at two duly coordinated levels. The first is GREPECAS, through the Human Resources and Training Subgroup (HRT/SG) and the second are the Civil Aviation Training Centres, where the necessary courses would be taught in a coordinated manner to avoid duplicating efforts.

Planning details of the implementation of communication systems – Human Resources and Training Subgroup (HRT/SG)

Chapter 12: Institutional Aspects

12.1 Introduction

12.1.1 CAR/SAM States, Territories and International Organisations should, when analysing the institutional aspects involved in implementing the ATM Operational Concept components, consider the operational requirements set out in Chapter 4 of this Plan.

12.1.2 In analysing those institutional aspects, consideration should be given to the information set forth in appendices C, D, E, F, G and H of the Global Air Navigation Plan.

12.1.3 Regional planning should take into consideration the characteristics intrinsic to ATM Operational Concept components, the impact of whose facilities may transcend national boundaries, making it necessary to implement multinational facilities to avoid duplication of resources and services. In establishing multinational facilities, the institutional aspects involved, which generically encompass all technical, operational, administrative, financial and legal matters, should be taken into account.

12.1.4 In view of the aspects cited in the previous paragraph and the need to develop a suitable structure for the planning and implementation of multinational facilities, the establishment of Regional Multinational Organisations is to be expected. These bodies, made up of groups of States, would guarantee optimum use of the investments needed to implement and maintain air navigation services.

Details of the institutional aspects involved in the implementation of the ATM operational concept components – Institutional Aspects Task Force

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